

Lecture starts at 1:10pm

Do the quiz on Canvas while you wait

# Interaction

SI 649 W20: Information visualization

Matthew Kay, Assistant Professor, School of Information

& Computer Science and Engineering

University of Michigan

Portions of slides adapted from Eytan Adar

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**(quiz)**

# This week

## Lecture

Changes due to COVID-19  
Interaction

## Lab

Design jam: Group projects

# Lectures and office hours

Now via BlueJeans

Link on Canvas: [https://umich.instructure.com/  
courses/349673/external\\_tools/4352](https://umich.instructure.com/courses/349673/external_tools/4352)

# Lectures

Please mute your audio/video initially

If you have a question write “question” in the chat

No more attendance, quizzes still happening

# **Lab reading responses**

None this week (because of the disruption)

Going forward will ask to present **via BlueJeans**

# Labs

Design Jams: **individually** (or in groups via video). Either way **submit individually**.

Group project labs: **via BlueJeans**

# Labs

- 3/18: Design Jam for Group Project (no BlueJeans)
- 3/25: Group mockup presentation (BlueJeans)
- 4/1: Design Jam for Hierarchical Vis (no BlueJeans)
- 4/8: Group demo presentation (BlueJeans)
- 4/13: Design Jam for Network Vis (no BlueJeans)

# Design jam: Group project

Design jam for group projects in “lab” this week

Find a time to meet with your group (likely **over video**)

See the lab instructions here: <https://si649w20.slack.com/archives/CSMTRGKPH/p1583936946000300>

# Design jam: Group project

You'll make several sketches + a **consensus sketch**

Refine consensus sketch to make **detailed mockup**

Paper or digital is fine for detailed mockup

# **Mockups (due Tue Mar 24; present Mar 25)**

**From the Design Lab**, submit your sketches and detailed mockups

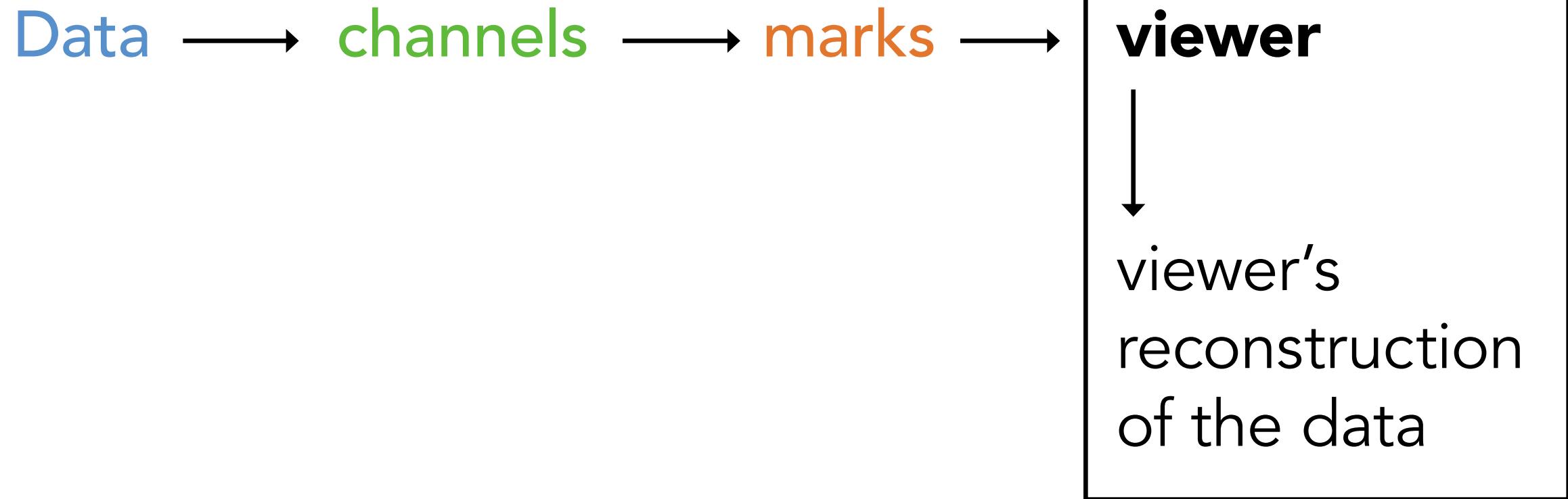
Then **present in the lab (on BlueJeans)**

For more info see here: [https://docs.google.com/document/d/1x\\_eJnHJm2bqBX4Nzn-ueYgK7Q4LIMSUhuZdt1V3w2K0/edit](https://docs.google.com/document/d/1x_eJnHJm2bqBX4Nzn-ueYgK7Q4LIMSUhuZdt1V3w2K0/edit)

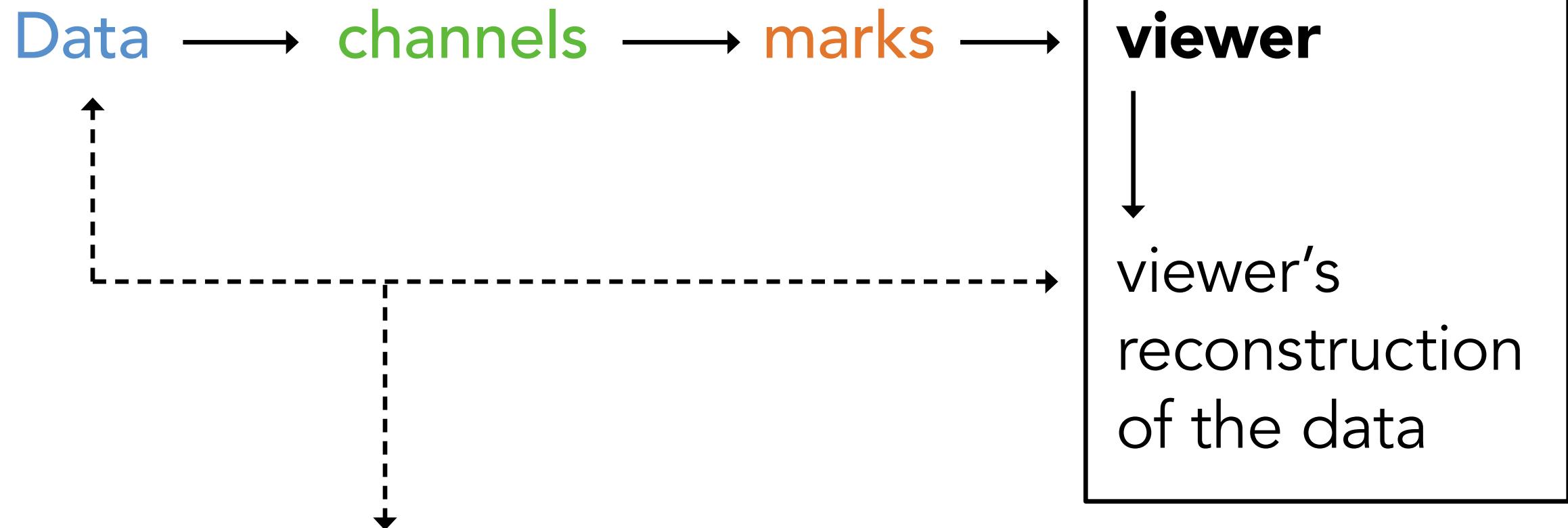
# Questions?

# Interaction

# Our view of chart construction so far...



# Our view of chart construction so far...

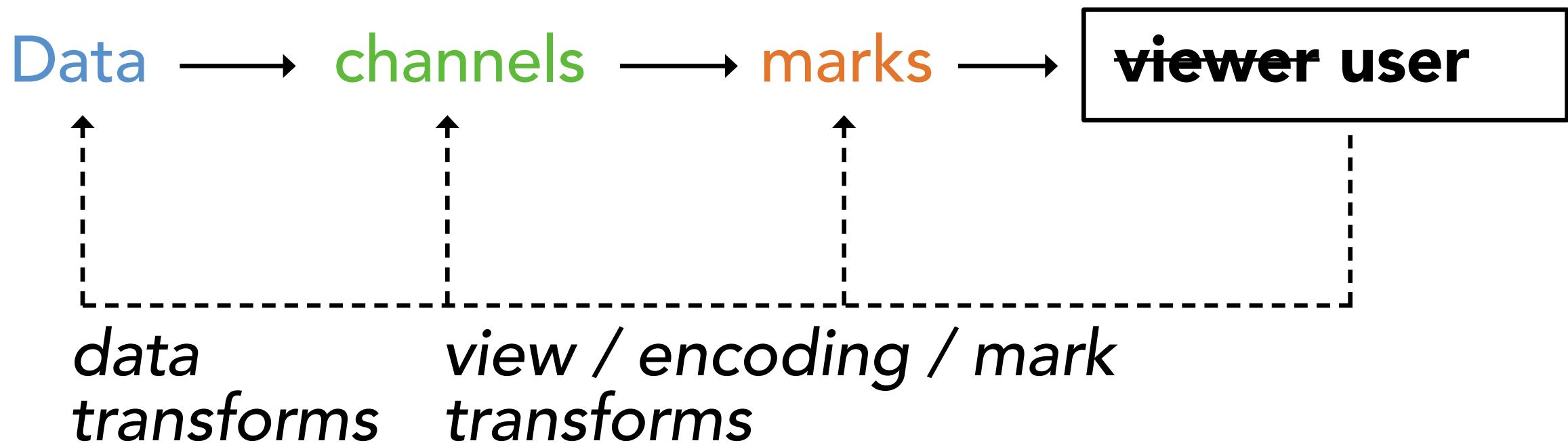


*How well do these match, given the **channel** used?*

# The user can take a more active role...

Data → channels → marks → **viewer**

# The user can take a more active role...



Systematizing “interaction” in vis...

# Systematizing “interaction” in vis...

...is complex: we'll go with some **heuristic categories**

You should notice some similar concepts (**selections**, **brushes**, etc) as in Vega-Lite/Altair

# Rough categories of vis interation (Segel/Heer)

Select

Explore

Reconfigure

Encode

Abstract/Elaborate

Connect

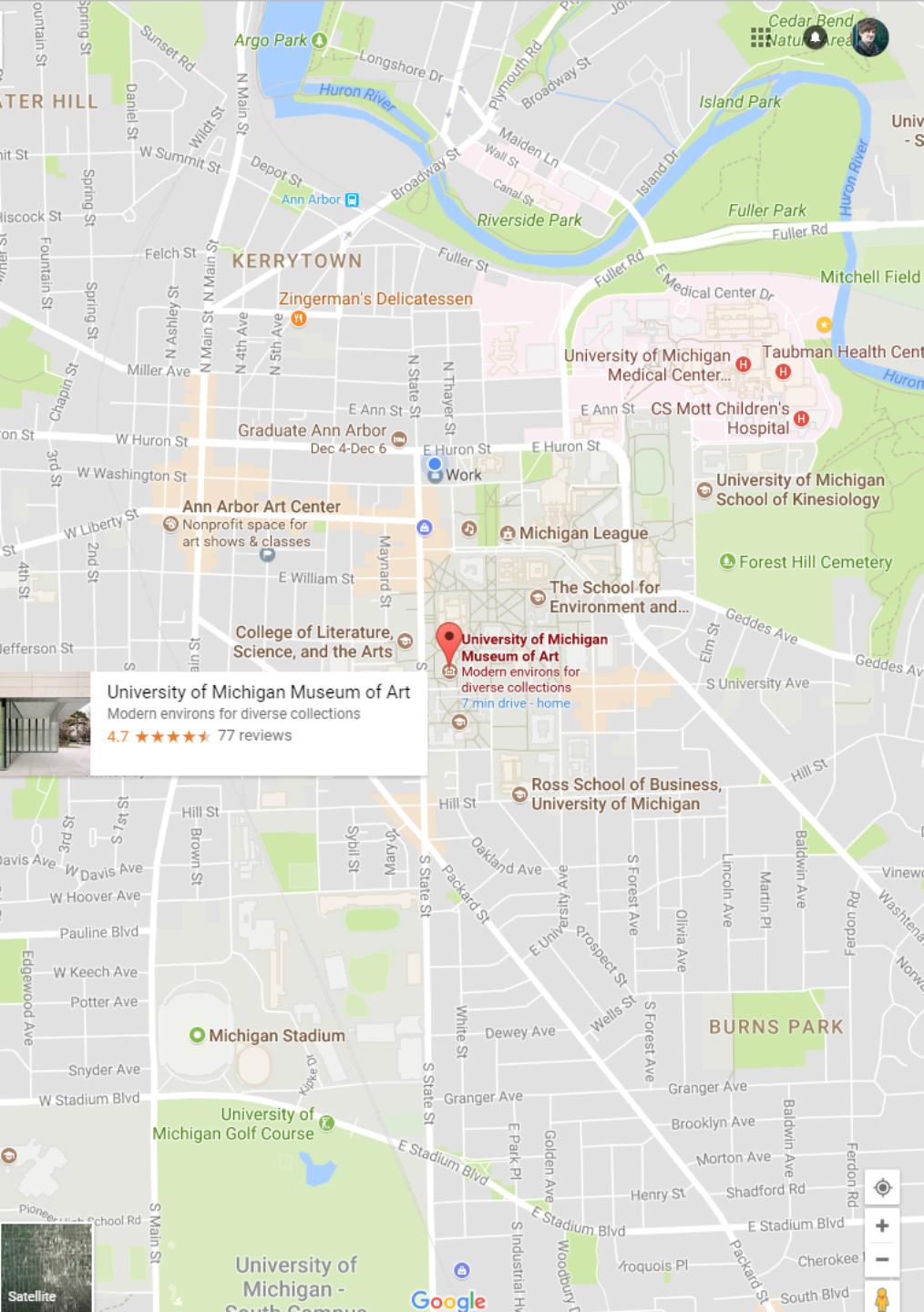
Filter

# Select

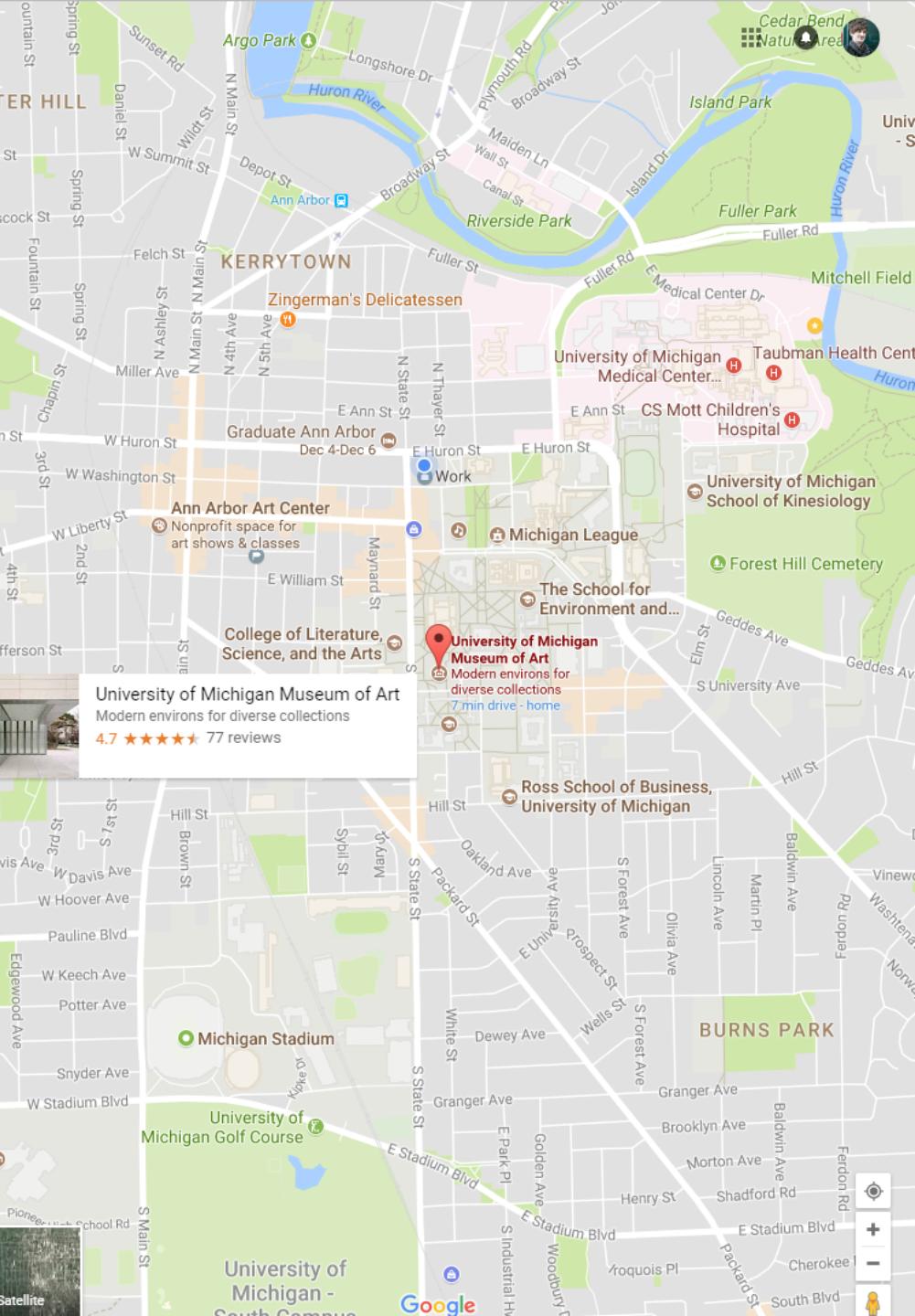
Mark something as interesting to keep track of it

Often precedes other operations

E.g., selecting a placemark in Google Maps



# (Elaborate)



# (Elaborate)

University of Michigan Museum

University of Michigan Museum of Art

4.7 ★★★★☆ • 77 reviews

Art Museum

SAVE NEARBY SEND TO YOUR PHONE SHARE

Spacious galleries house a sizable collection of rotating artworks that span centuries & the globe.

525 S State St, Ann Arbor, MI 48109

umma.umich.edu

(734) 764-0395

Closed today

Suggest an edit

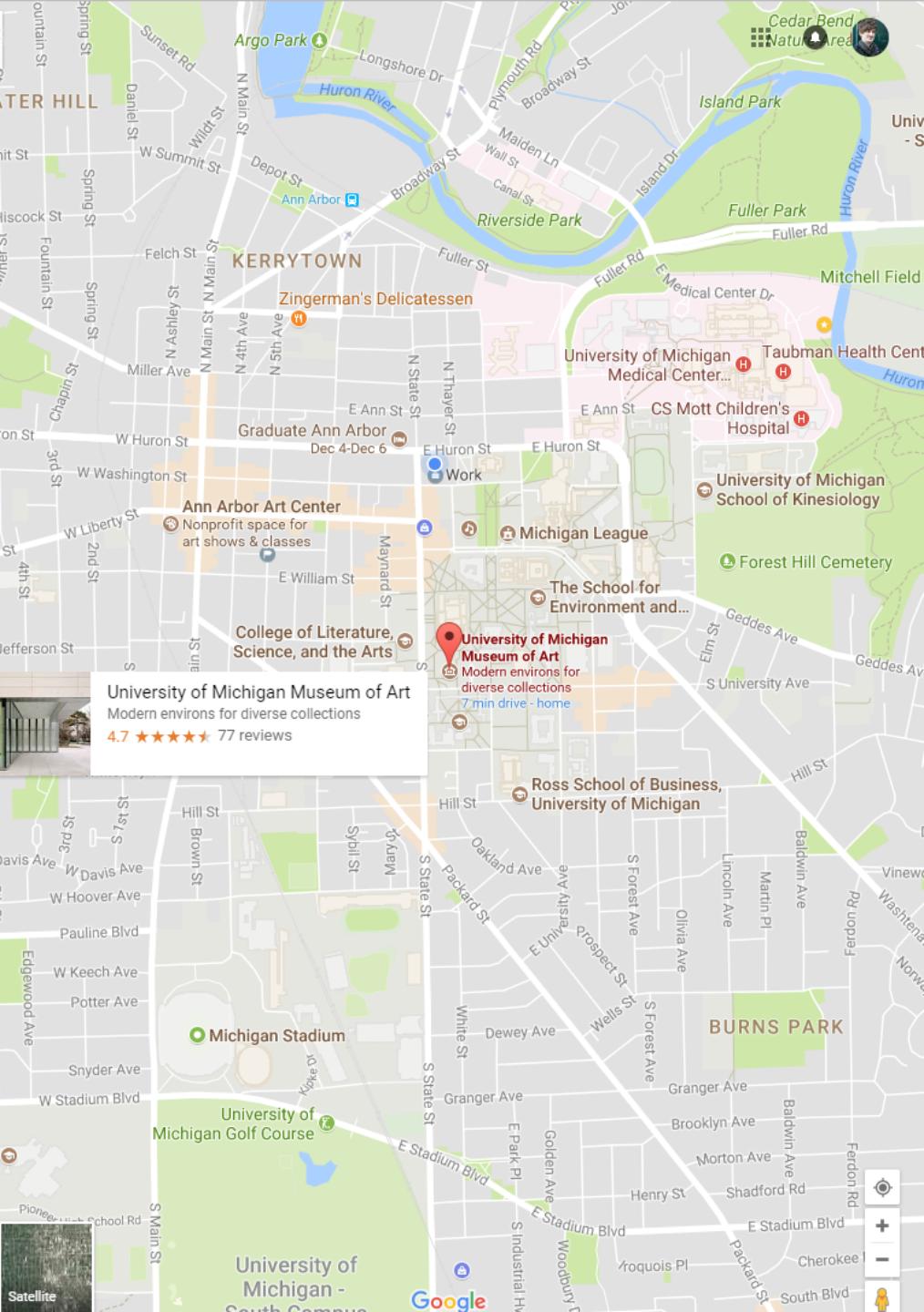
Add a label

Popular times Mondays ▾

Closed Mondays—pick another day

195+ Photos

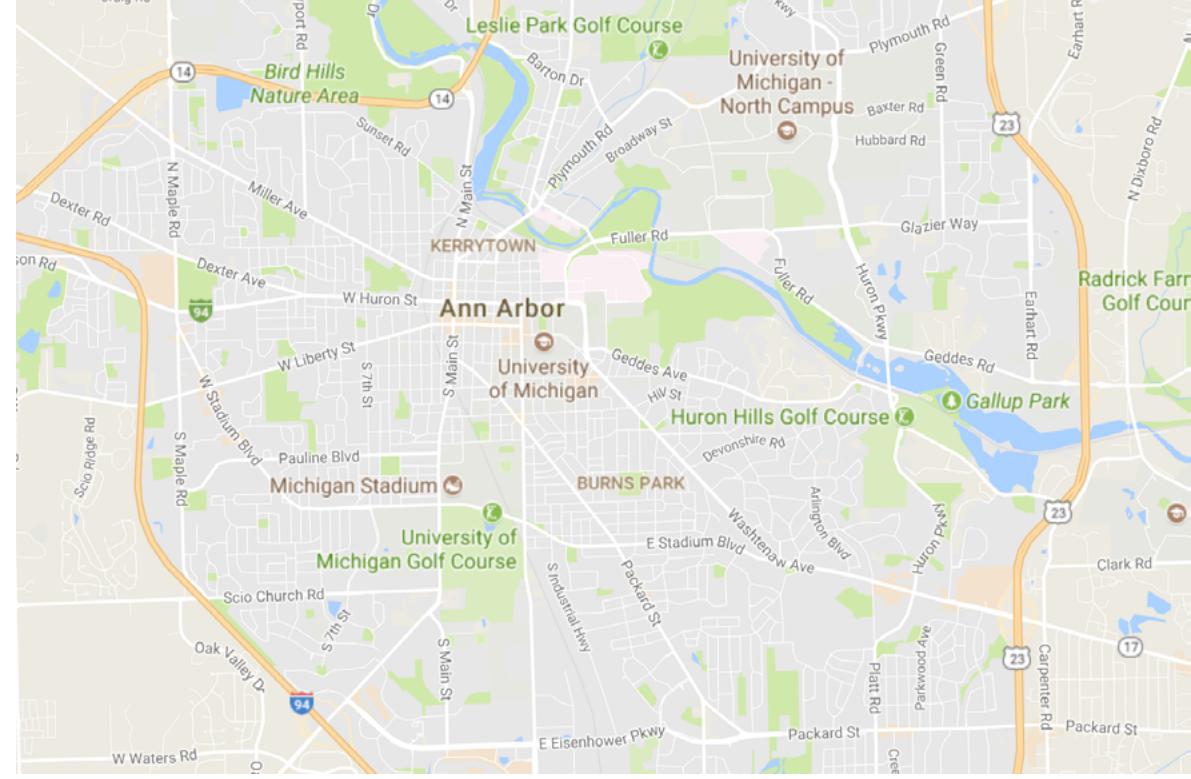
Add a photo



# Explore

Show something different

- examine different subset
- overcome display size limits



Examples:

- Panning in Google Maps
- Walking in Visual Thesaurus

[http://www.youtube.com/watch?v=HGUD45\\_k5y0](http://www.youtube.com/watch?v=HGUD45_k5y0)



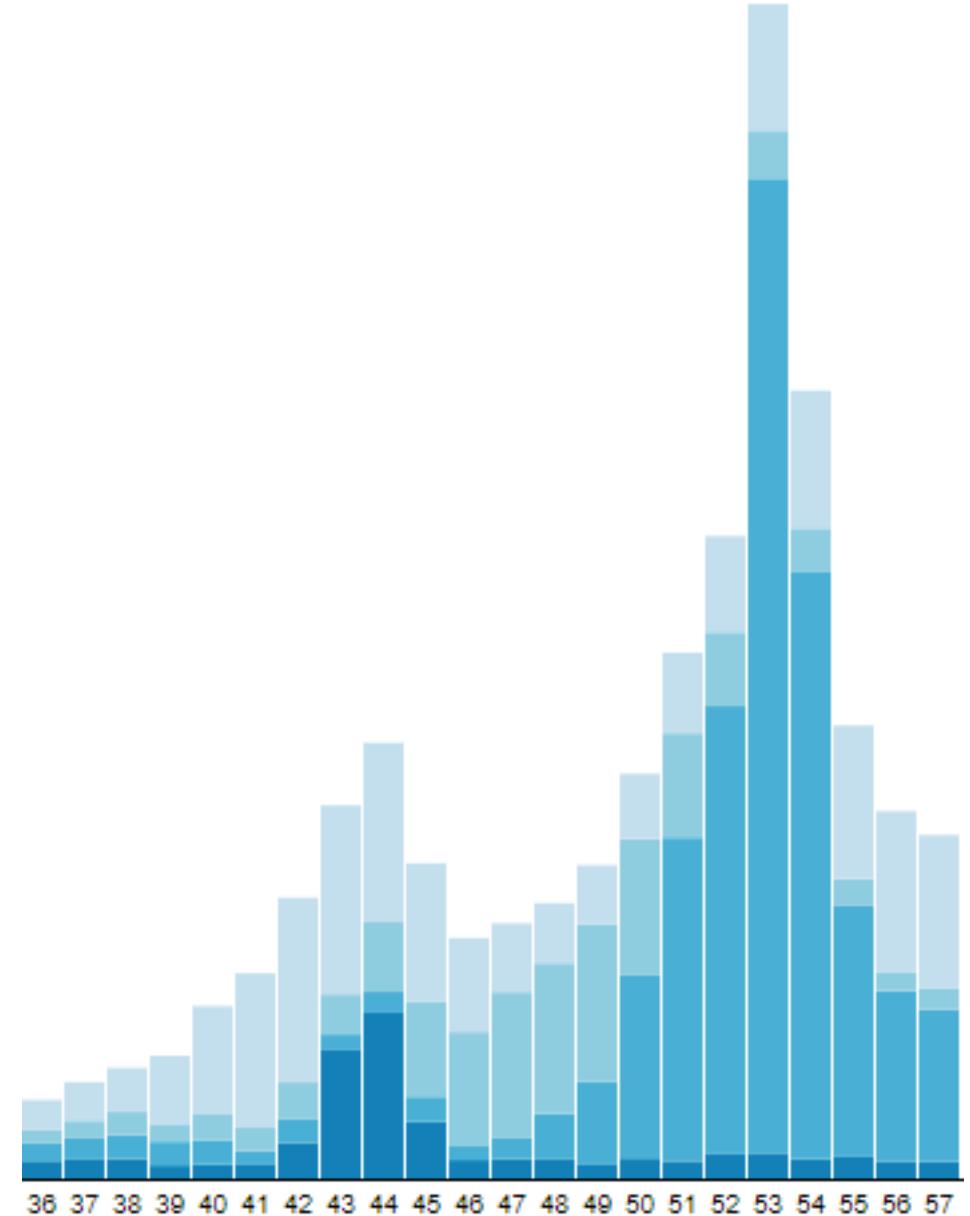
# Reconfigure

Show a different perspective /  
spatial arrangement

Examples:

- Changing scatterplot scale
- Sorting / rearranging columns

<http://bl.ocks.org/mbostock/3943967>



# Reconfigure - staged animations

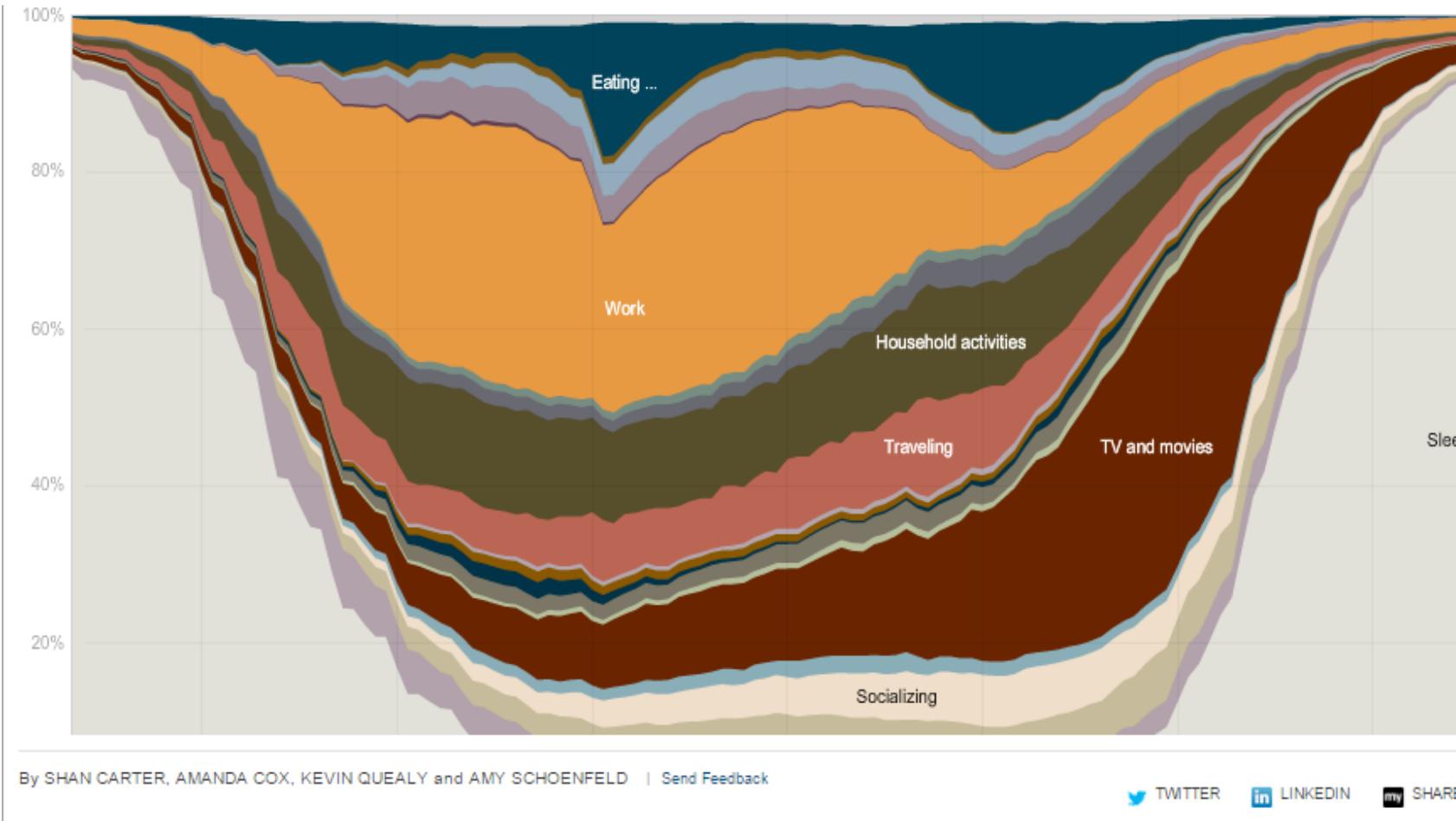
Staged animation can help make reconfiguration clearer

Animate in steps rather than in “one go”

[http://vis.berkeley.edu/papers/animated\\_transitions/](http://vis.berkeley.edu/papers/animated_transitions/)

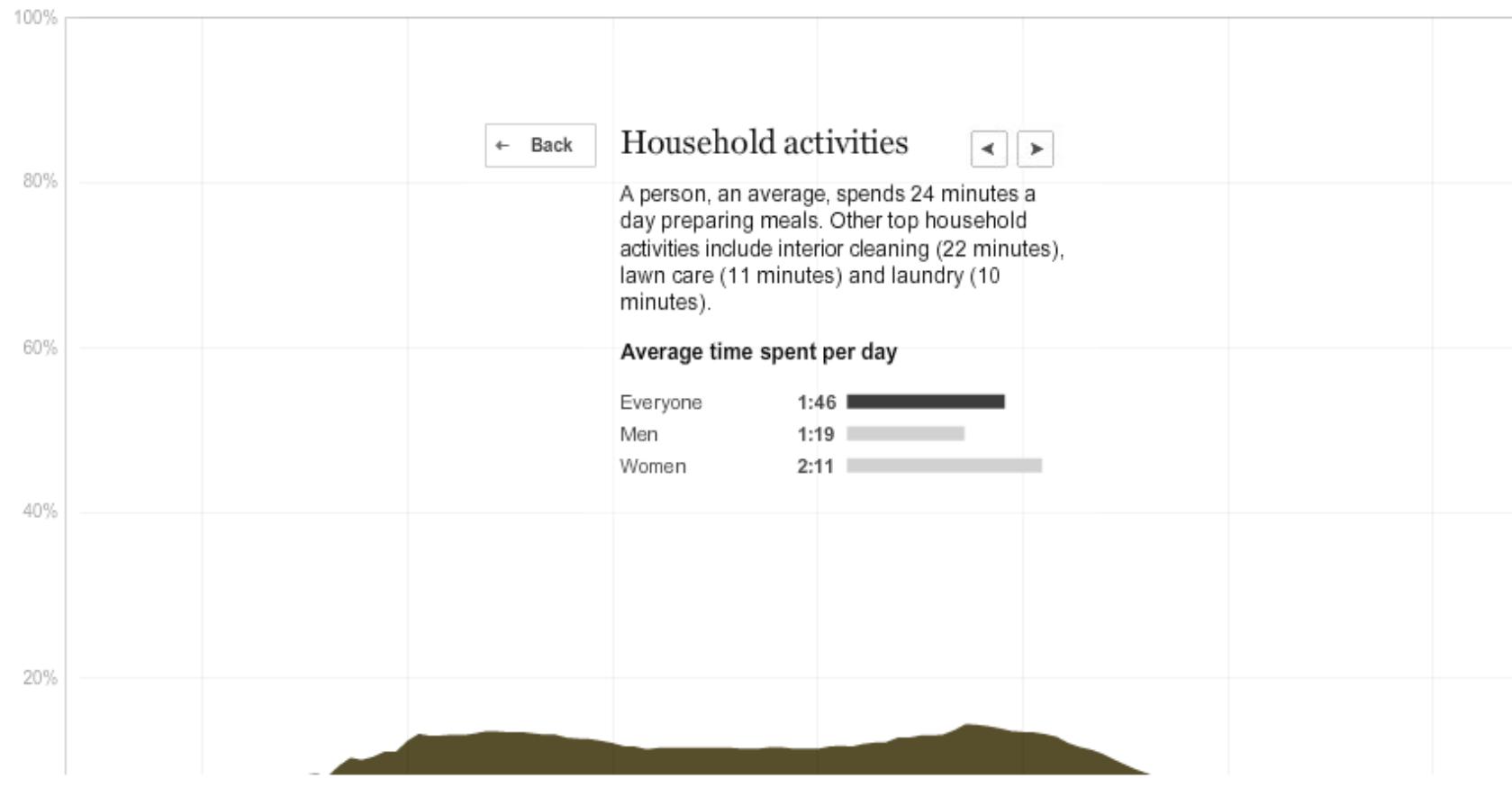
In d3: <https://stackoverflow.com/a/15798636>

# Reconfigure - dynamic baselines



<http://www.nytimes.com/interactive/2009/07/31/business/20080801-metrics-graphic.html>

# Reconfigure - dynamic baselines



TWITTER

LINKEDIN

SHARE

<http://www.nytimes.com/interactive/2009/07/31/business/20080801-metrics-graphic.html>

# Encode

Show a different representation /  
change **channels/encodings**

Colors

Sizes

Orientation

Font

Shape

# Abstract/Elaborate

Show more or less detail  
Adjust level of abstraction

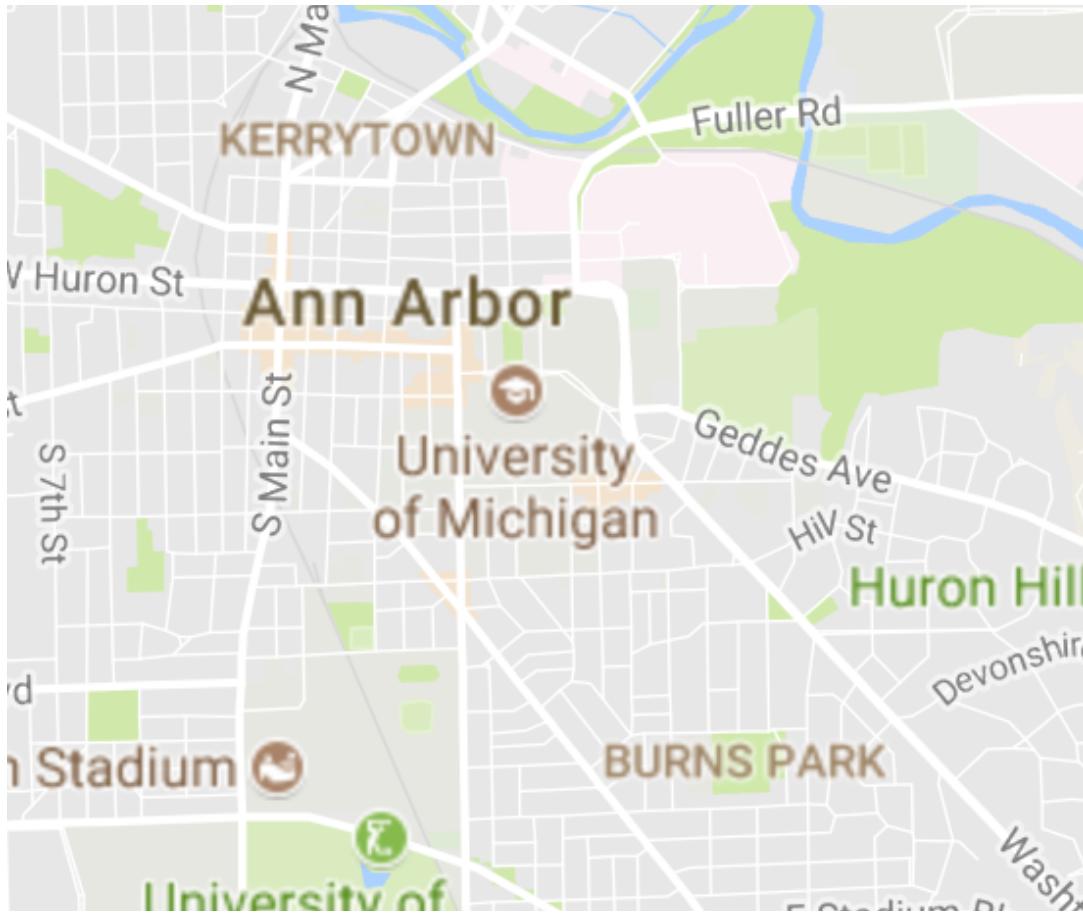
Examples:

- Unfolding sub-categories
- Drill-down
- Zooming in: **elaboration**
- Zooming out: **abstraction**



[http://mbostock.github.io/d3/  
talk/20111116/force-collapse.html](http://mbostock.github.io/d3/talk/20111116/force-collapse.html)

# Abstract/Elaborate - Semantic zoom



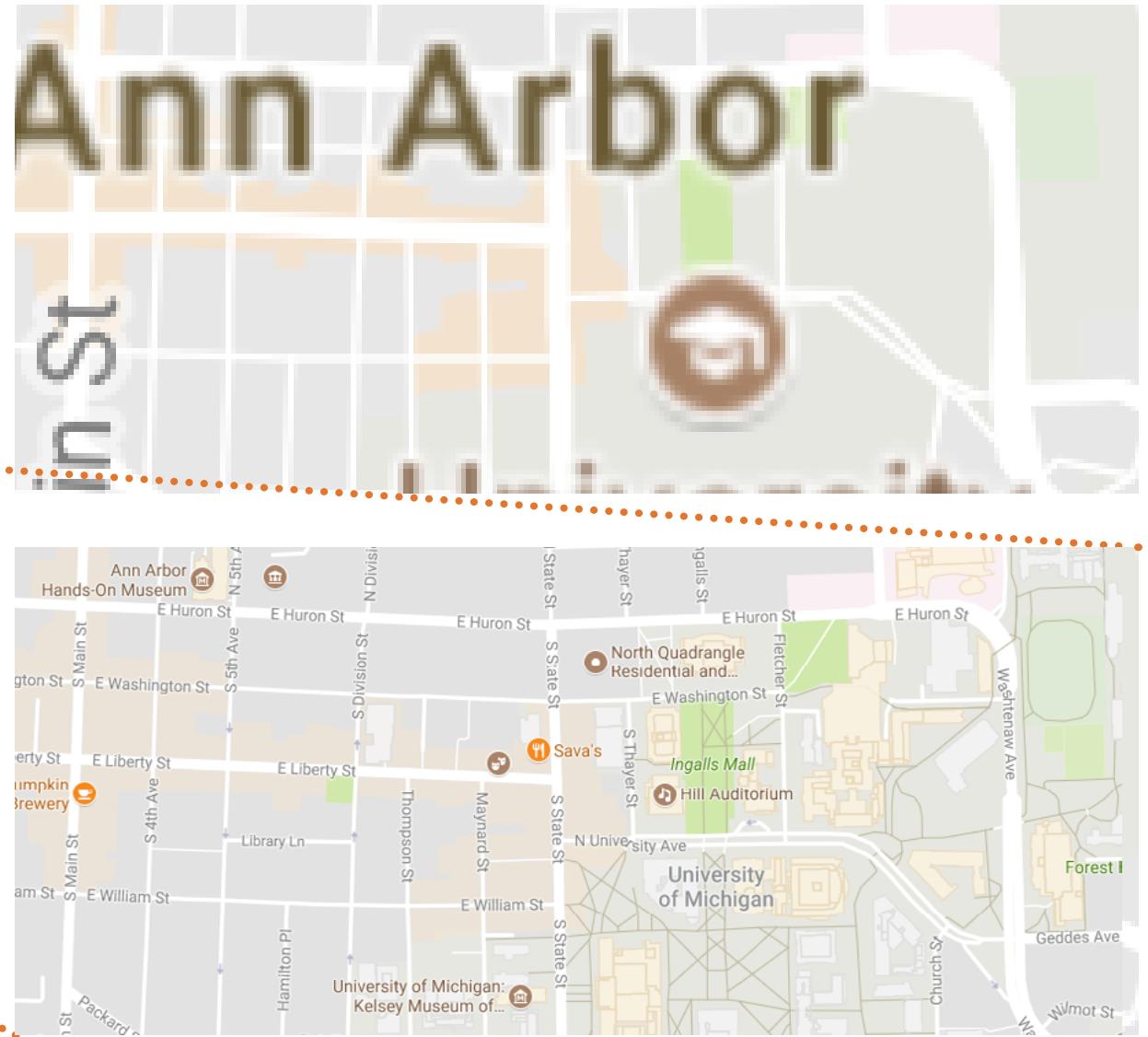
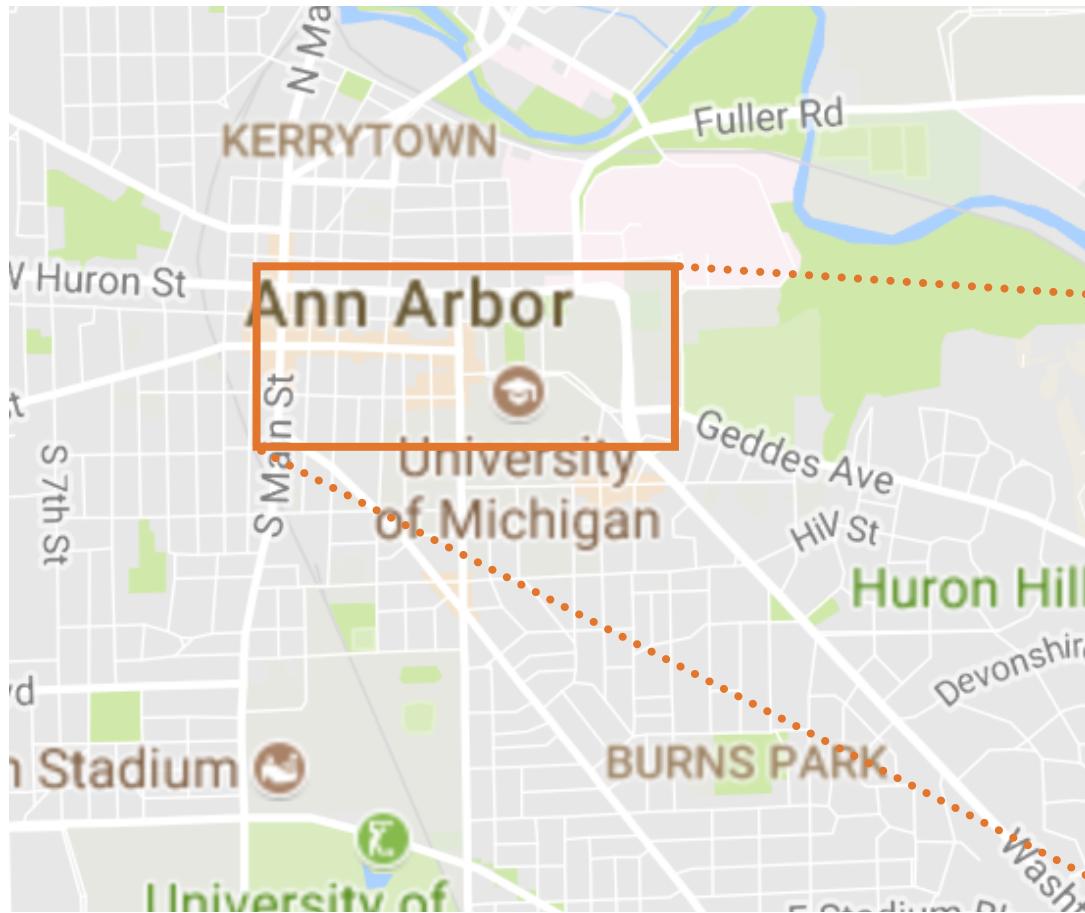
# Abstract/Elaborate - Semantic zoom



# Abstract/Elaborate - Semantic zoom



# Abstract/Elaborate - Semantic zoom



# **Connect**

Show/highlight  
related items

Examples:

- Brushing and linking

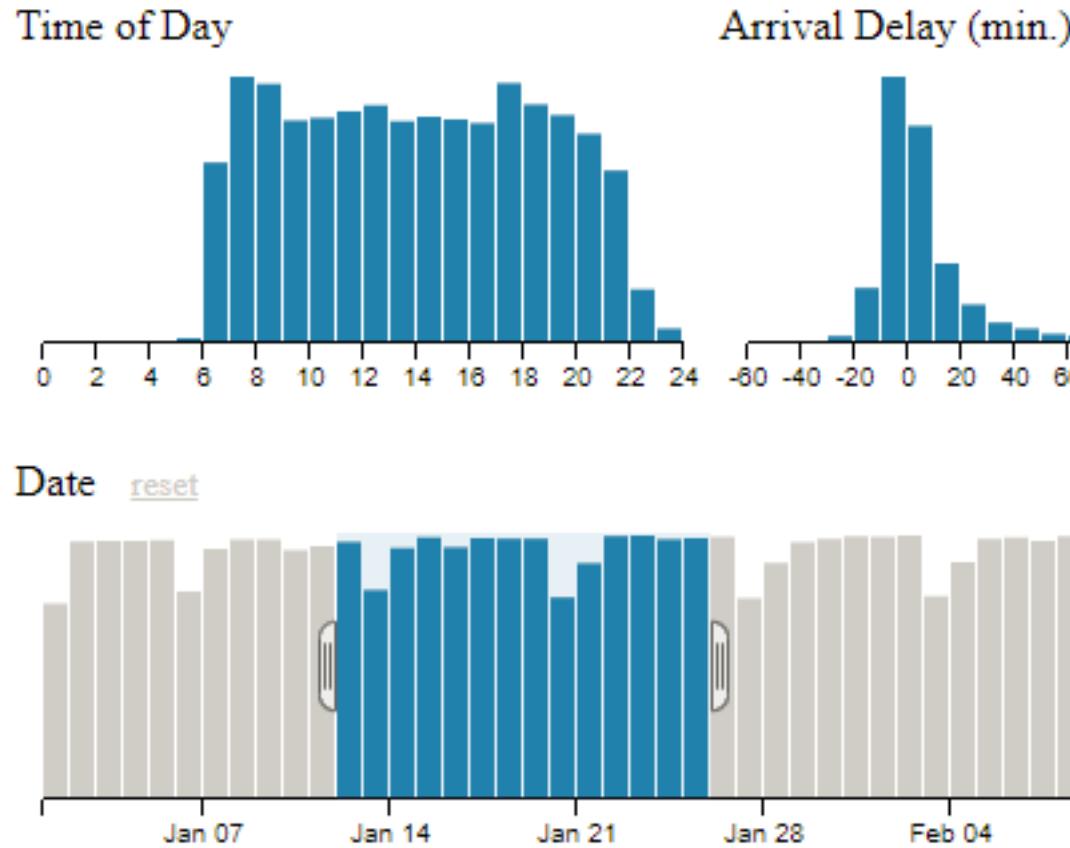
# **Filter**

Show something  
conditionally

Examples:

- Brushing and linking
- NameVoyager
- Basically any flight search engine, housing search engine, ...

# Connect/Filter: Brushing and linking

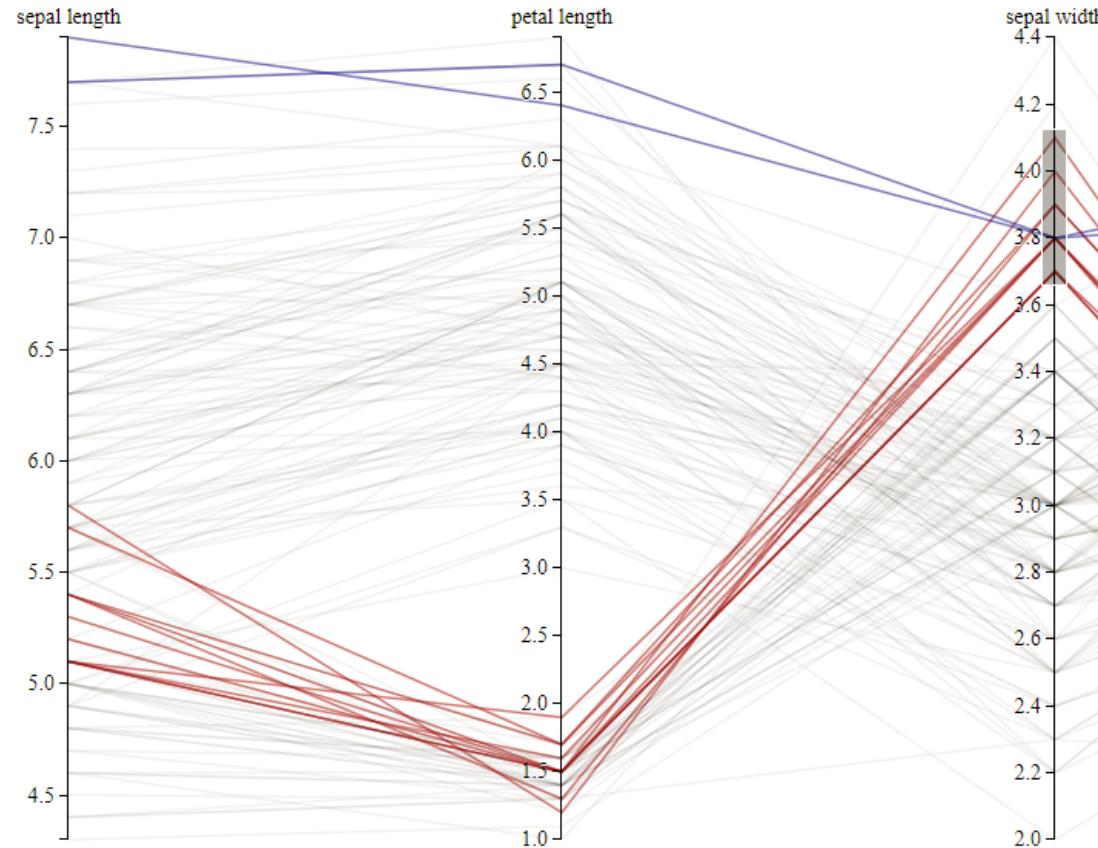


CrossFilter

<http://square.github.io/crossfilter/>

[https://vega.github.io/vega-lite/examples/interactive\\_layered\\_crossfilter.html](https://vega.github.io/vega-lite/examples/interactive_layered_crossfilter.html)

# Connect/Filter: Brushing and linking

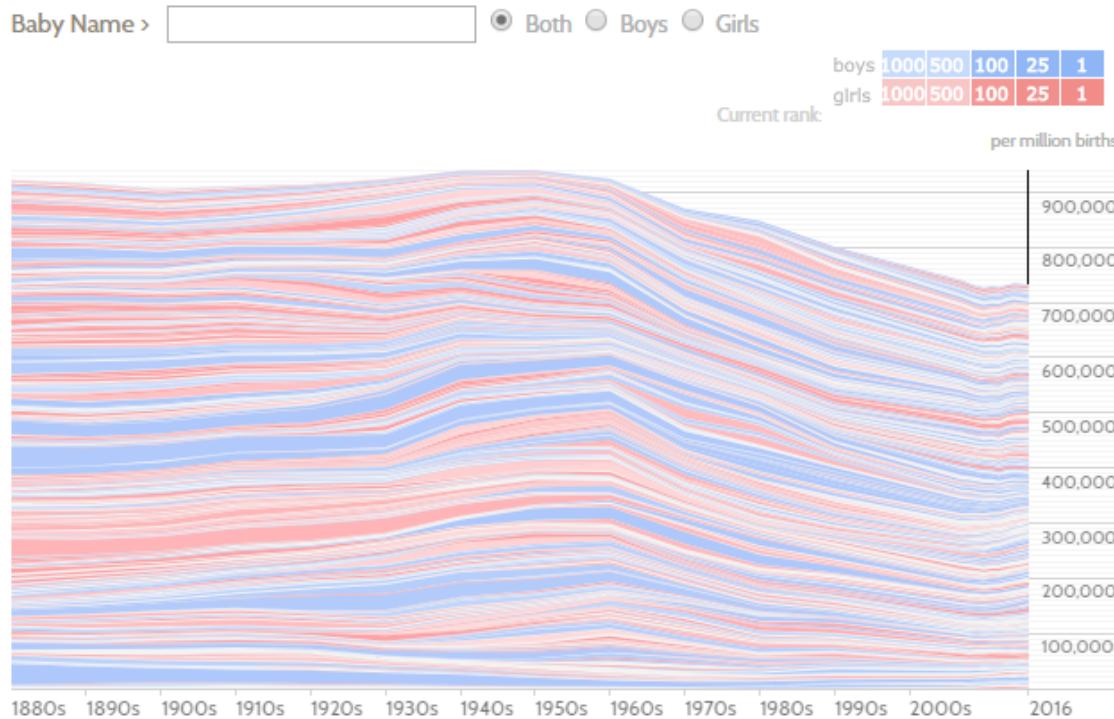


Interactive parallel coordinates

<https://syntagmatic.github.io/parallel-coordinates/>

# Connect/Filter: Keystroke filtering

NameVoyager: Explore baby names and name trends letter by letter  
Looking for the perfect baby name? [Sign up for free](#) to receive access to our expert tools!



Click a name graph to view that name. Double-click to read more about it.

[enlarge](#)

NameVoyager  
<http://www.babynamewizard.com/voyager>

# Connect/Filter: Dynamic Queries

The image shows the PadMapper website interface. On the left is a map of the Ann Arbor area, specifically the University of Michigan North Campus and surrounding neighborhoods like Michigan Station, Warden, and Pittsfield Charter Township. Numerous red location pins are scattered across the map, indicating available rental listings. To the right of the map is a sidebar with various filtering options:

- RENT Edit**: A slider from \$0 to \$5,000+.
- LENGTH**: Buttons for Long Term and Short Term.
- BEDROOMS**: Buttons for Studio, 1, 2, 3, and 4+.
- TYPE**: Buttons for Apartment, House, Room, and Other.
- BATHROOMS**: Buttons for 1+, 2+, 3+, and 4+.
- PETS**: Buttons for Dogs and Cats.
- Keyword Search**: A text input field for searching specific features like Garage, Parking, Furnished, Washer.
- ADVANCED**: Fields for Max rent per bedroom (e.g. \$1,000), Max age of listing (7+ days), and Square Feet (e.g. 200 to e.g. 1,400).

PadMapper

<https://www.padmapper.com/>

# Summary

**When** static representation does not scale,  
interaction can help

Brings in issues of animation, connecting views

Now you're designing **many visualizations simultaneously**—each view must still work!

More examples...

# Explorable explanations

## Ten Brighter Ideas

1 Conservation is key and simply achieved. Start by

- turning off lights
- unplugging electrical equipment when not in use

2 If every U.S. household installed just one compact fluorescent light bulb, it would displace the electricity provided by one nuclear reactor. 1=1!

Twenty compact fluorescents in every household would displace the need for at least 25% of all U.S. reactors.

3 Updating heating, lighting, cooling and other electrical appliances with energy-efficient models can

- save more energy than all operating U.S. reactors produce annually
- reduce home electricity use by at least 20%

4 Energy efficiency is the cheapest and fastest way to

### Premise

Suppose 35% of US households always turned off lights in unoccupied rooms.

### Result

This would save 17.2 TWh per year.

### Context



This is the output of 2.2 nuclear reactors.  
or 2.2% of the 104 US nuclear reactors.



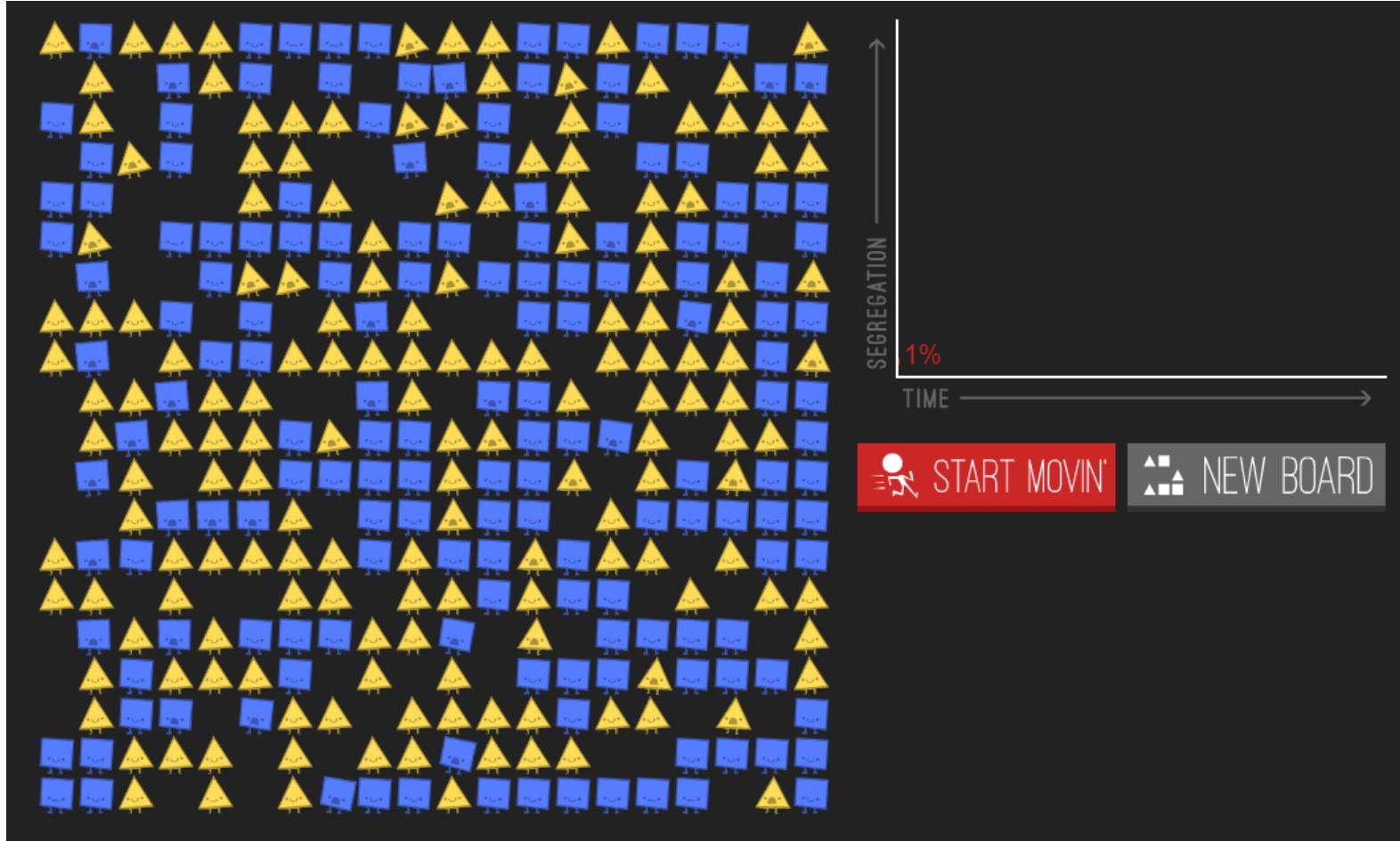
This is the output of 14.1 coal plants.  
or 0.98% of the 1445 US coal plants.



This is 17% of US residential lighting energy.

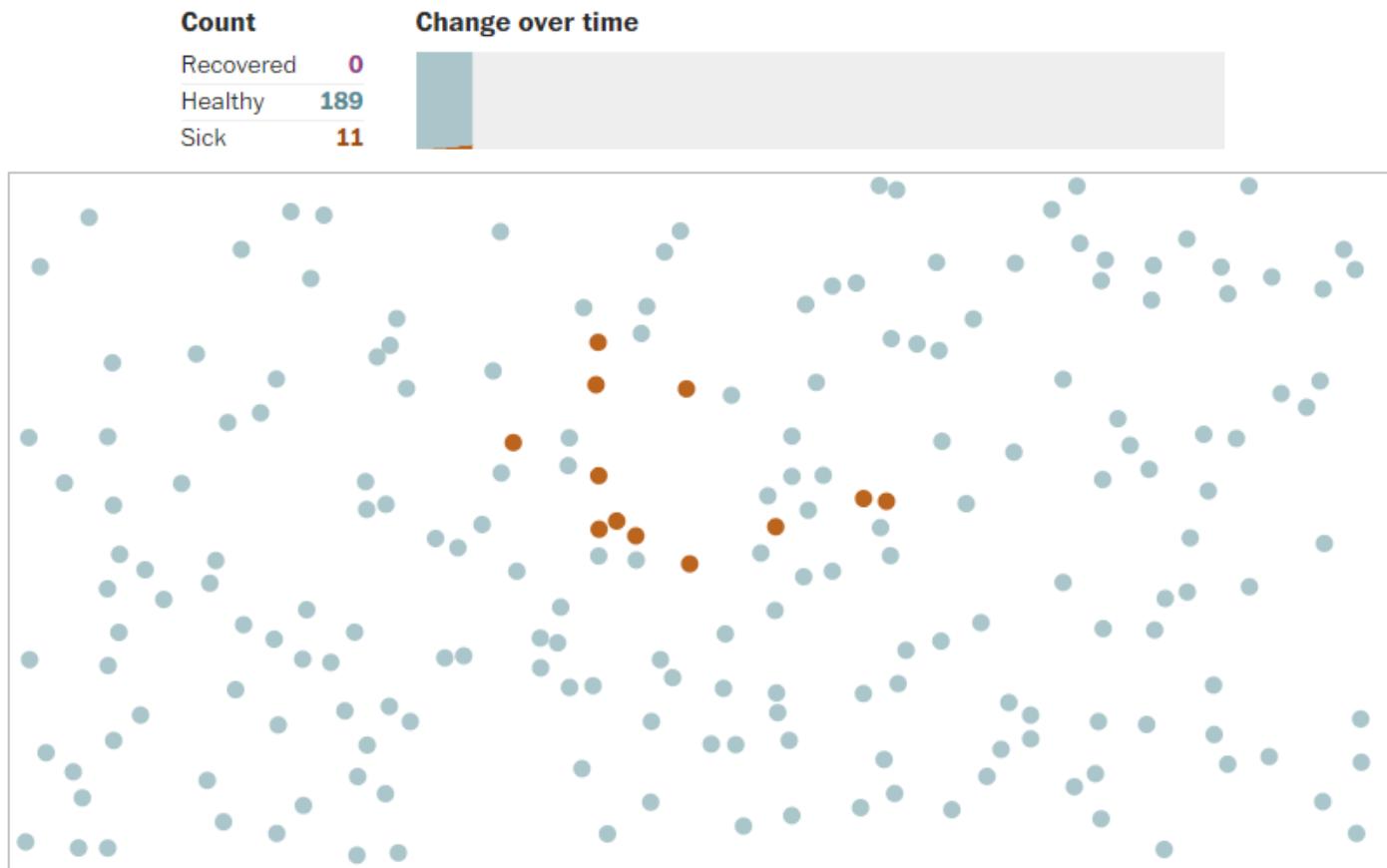
<http://worrydream.com/TenBrighterIdeas/>

# Parable of the Polygons



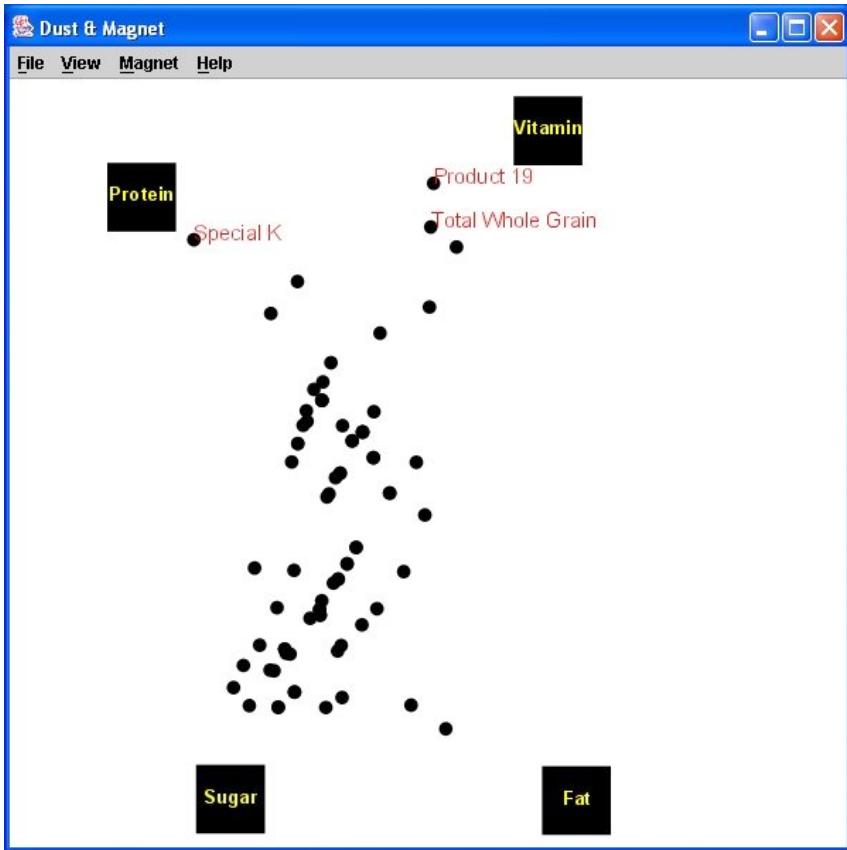
<https://ncase.me/polygons/>

# Coronavirus simulator



<https://www.washingtonpost.com/graphics/2020/world/corona-simulator/>

# Dust & magnets



Yi, Melton, Stasko, and Jacko, (IV'05)  
<http://www.cc.gatech.edu/gvu/ii/dnm/>

# LineUp



Gratzl et al., 2013  
<https://www.youtube.com/watch?v=iFqCBI4T8ks>

# Data in controls: Kayak vs Hipmunk

KAYAK Hotels Flights Cars Packages Rentals Cruises More ▾

Detroit (DTT) → Montreal (YMQ) Sat 12/9 – Sat 12/9 1 adult

OUR ADVICE: We're still gathering data for this route.

81 out of 195 | RESET

TOP FILTERS MORE

**Stops**

- nonstop \$593
- 1 stop \$406
- 2+ stops \$391

**Times**

Take-off Detroit (DTT)	Arrival
Sat 6:00a	12:30p
Take-off Montreal (YMQ)	Arrival
Sat 1:30p	0:00p
Landing Montreal (YMQ)	Arrival
Sat 10:00a	5:30p
Landing Detroit (DTT)	Arrival
Sat 6:00p	Sun 5:30p

**Durations**

Track Prices Receive emails with price changes and travel tips for this trip. OFF

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**BEST FLIGHTS**

Airline	Flight Time	From	To	Duration	Price	
United	6:00 am	DTW	IAD, BOS	11:56 am YUL	5h 56m	\$391 Hacker Fare
Air Canada	6:00 pm	YUL	YYZ	9:55 pm DTW	3h 55m	\$442 Expedia
Operated by Air Canada Express - Air Georgian, Air Canada Express - Jazz, Mesa Airlines DBA United Express						
Air Canada	10:40 am	DTW	YYZ	2:13 pm YUL	3h 33m	\$442 Expedia
Air Canada	6:00 pm	YUL	YYZ	9:55 pm DTW	3h 55m	\$475 Book easily on KAYAK
Operated by Air Canada Express - Air Georgian						
WestJet	12:15 pm	DTW	nonstop	2:11 pm YUL	1h 56m	\$593 KAYAK
WestJet	4:30 pm	YUL	nonstop	6:49 pm DTW	2h 19m	\$415.91+ View Deal
Operated by Gojet Airlines DBA Delta Connection						
United	6:00 am	DTW	IAD, BOS	11:56 am YUL	5h 56m	\$391 Hacker Fare
Air Canada	2:00 pm	YUL	YYZ	6:05 pm DTW	4h 05m	\$474.25+ View Deal
Operated by Air Canada Express - Air Georgian, Air Canada Express - Jazz, Mesa Airlines DBA United Express						

hipmunk Hotels Cars Packages Deals

DTW ↔ YUL: Sat Dec 9 – Mon Dec 11, 1 person, Coach

Search Hotels in Montreal

Compare Rates on Partner Sites:

travelocity OneTravel cheapair priceline SmartFares CheapFlight

Sort: Agony Price Duration Takeoff Landing Filter: Airlines Stops

Fare Alerts 26 of 87 flights. See all from \$404

1 Select Departure DTW → YUL, Sat, Dec 9

2 Select Return YUL → DTW, Mon, Dec 11

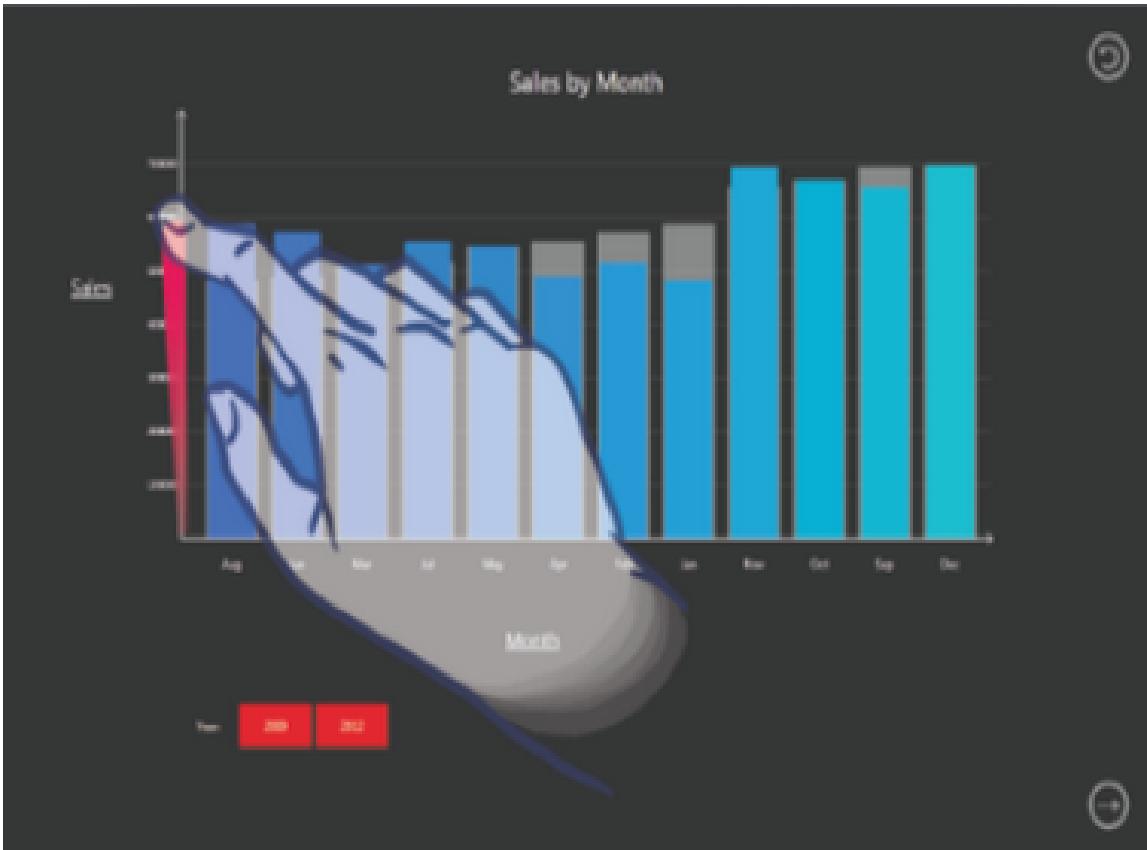
Cheapest trip from \$404.41

Total trip price/person Includes taxes & fees. Additional baggage fees may apply.

ORBITZ Lowest Price Guaranteed!

Select Leg	Price	Duration	Flight Details	Return Options
Select Leg	\$405.91+	4h 56m	PHL AM	12 return options
Select Leg	\$404.41+	5h 24m	CL LGA	12 return options
See Flights	----			ad
Select Leg	\$405.91+	5h 32m	ORD Amer	10 return options
Select Leg	\$405.91+	5h 51m	LGA Arr	12 return options
Select Leg	\$415.91+	5h 03m	Am PHL Am	11 return options
Select Leg	\$474.25+	3h 33m	AI YYZ	21 return options

# TouchViz



TouchViz, Microsoft Research

<https://www.youtube.com/watch?v=qonOwuRIzh4>