

CS 571 - Data Visualization & Exploration

Multiple Views, Dashboards

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Upcoming Dates

Apr 25: Homework 4 (Due at 11:59pm Eastern)

~~(Tentatively) Apr 20: Project Peer Feedback~~

~~Groups will be assigned (Due Apr 25)~~

May 2: Homework 5 Due (Released Apr 21)

Apr 28: Final Quiz

Apr 29: Final Group Activity

Single vs Multiple Views

But Beware!



From the Design Guidelines Lecture...

But Beware!



From the Design Guidelines Lecture...

But Beware!



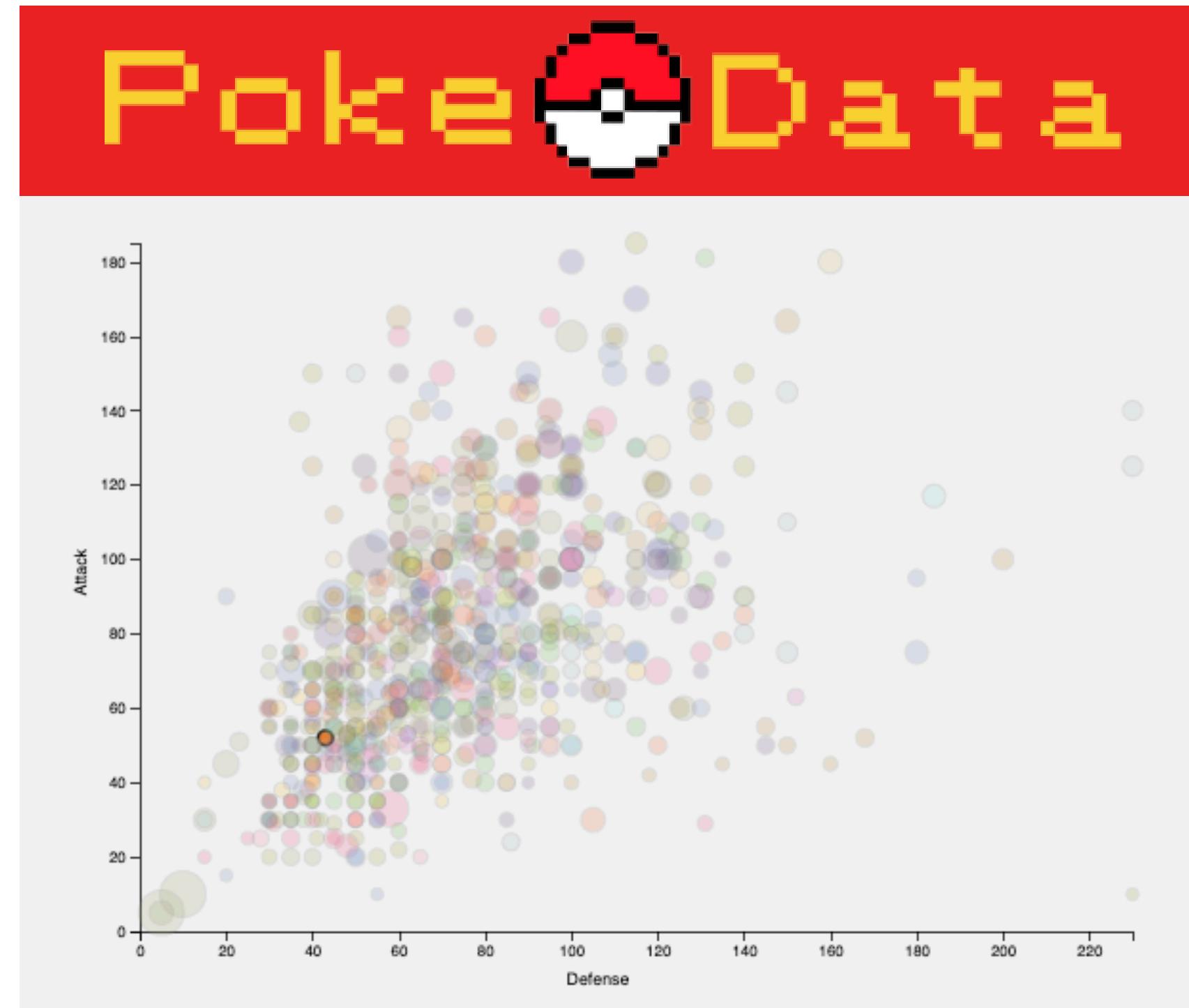
From the Design Guidelines Lecture...

Why Multiple Views?

We are better at making comparisons with our eyes than our memory

Trade-off: Display Space vs. Working Memory

Display Space vs. Working Memory



Display Space vs. Working Memory

Poke Data

Charmander #4

Types:

FIRE

Height: 0.6 m

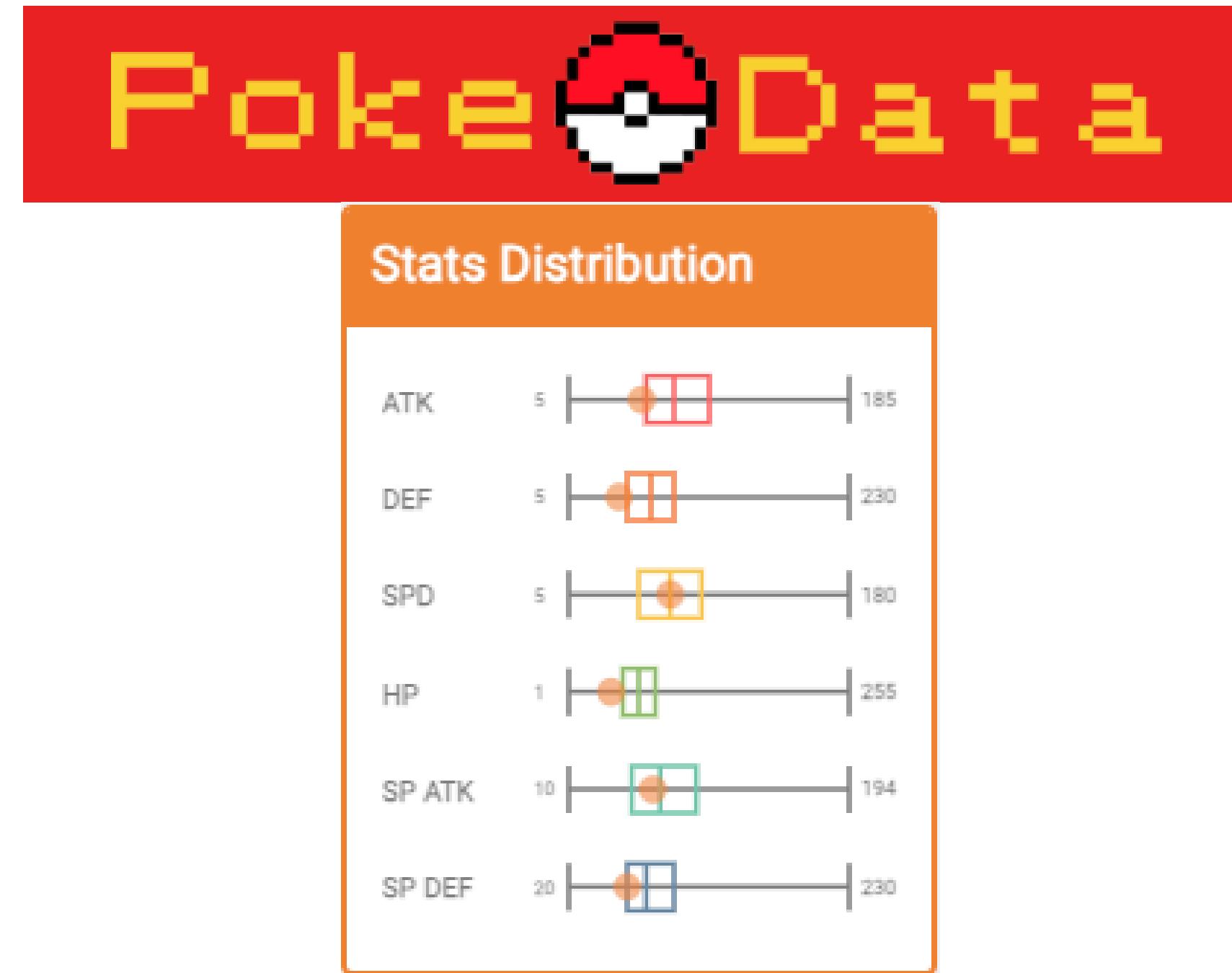
Weight: 8.5 kg

Evolution Chart

*Stats normalized to 100

Stat	Value (Normalized)
HP	100
ATK	~80
DEF	~70
SPEED	~60
SP ATK	~50
SP DEF	~40

Display Space vs. Working Memory



Display Space vs. Working Memory

Poke Data

Clear all X

Filters ▾

Search for pokemon

#	Name	Type 1	Type 2	Attack	Defense	Speed	HP	Special Attack	Special Defense
1	Bulbasaur	GRASS	POISON	■	■	■	■	■	■
2	Ivysaur	GRASS	POISON	■	■	■	■	■	■
3	Venusaur	GRASS	POISON	■	■	■	■	■	■
4	Charmander	FIRE	-	■	■	■	■	■	■
5	Charmeleon	FIRE	-	■	■	■	■	■	■
6	Charizard	FIRE	FLYING	■	■	■	■	■	■
7	Squirtle	WATER	-	■	■	■	■	■	■
8	Wartortle	WATER	-	■	■	■	■	■	■
9	Blastoise	WATER	-	■	■	■	■	■	■
10	Caterpie	BUG	-	■	■	■	■	■	■
11	Metapod	BUG	-	■	■	■	■	■	■
12	Butterfree	BUG	FLYING	■	■	■	■	■	■
13	Weedle	BUG	POISON	■	■	■	■	■	■
14	Kakuna	BUG	POISON	■	■	■	■	■	■
15	Beedrill	BUG	POISON	■	■	■	■	■	■
16	Pidgey	NORMAL	FLYING	■	■	■	■	■	■
17	Pidgeotto	NORMAL	FLYING	■	■	■	■	■	■
18	Pidgeot	NORMAL	FLYING	■	■	■	■	■	■
19	Rattata	NORMAL	DARK	■	■	■	■	■	■

Display Space vs. Working Memory

PokeData

Choose Generation: All Generations | Process Book | Demo Video

Welcome to PokeData!

The world of Pokemon can be daunting with there being over 800 Pokemon, but Pokedata is here to help guide you. Feel free to browse through the list of Pokemon and see how their stats compare to the rest. Can't quite remember the name of a Pokemon? Try filtering the table based on what you do know. Feeling nostalgic about the generation you grew up with? Filter by just that generation!

Charmander #4

Types: FIRE
Height: 0.6 m
Weight: 8.5 kg

*Stats normalized to 100

Evolution Chart

Stats Distribution

#	Name	Type 1	Type 2	Attack	Defense	Speed	HP	Special Attack	Special Defense
1	Bulbasaur	GRASS	POISON	185	230	180	255	194	230
2	Ivysaur	GRASS	POISON	185	230	180	255	194	230
3	Venusaur	GRASS	POISON	185	230	180	255	194	230
4	Charmander	FIRE	-	185	230	180	255	194	230
5	Charmeleon	FIRE	-	185	230	180	255	194	230
6	Charizard	FIRE	FLYING	185	230	180	255	194	230
7	Squirtle	WATER	-	185	230	180	255	194	230
8	Wartortle	WATER	-	185	230	180	255	194	230
9	Blastoise	WATER	-	185	230	180	255	194	230
10	Caterpie	BUG	-	185	230	180	255	194	230
11	Metapod	BUG	-	185	230	180	255	194	230
12	Butterfree	BUG	FLYING	185	230	180	255	194	230
13	Weedle	BUG	POISON	185	230	180	255	194	230
14	Kakuna	BUG	POISON	185	230	180	255	194	230
15	Beedrill	BUG	POISON	185	230	180	255	194	230
16	Pidgey	NORMAL	FLYING	185	230	180	255	194	230
17	Pidgeotto	NORMAL	FLYING	185	230	180	255	194	230
18	Pidgeot	NORMAL	FLYING	185	230	180	255	194	230
19	Rattata	NORMAL	DARK	185	230	180	255	194	230

X Axis Data: Defense | Y Axis Data: Attack | Circle Size: HP

Clear all X | Filters | Search for pokemon

1 255

Multiple Views

Some Useful Vocabulary Terms:

Linked Views: multiple views that are **simultaneously visible** and **linked together** such that **actions in one view affect another**

Multiform: **different visual encodings** are used between views

what to Show

How to Interact

How to Layout

What to Show

Encoding: same or different

How to Interact

How to Layout

Charmander #4

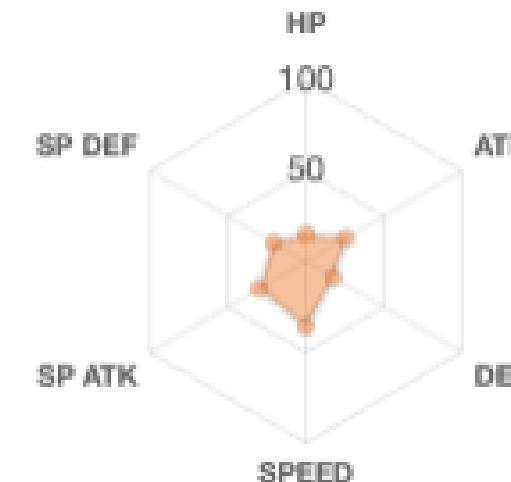


Types:

FIRE

Height: 0.6 m

Weight: 8.5 kg



Evolution Chart

*Stats normalized to 100

Beedrill #15

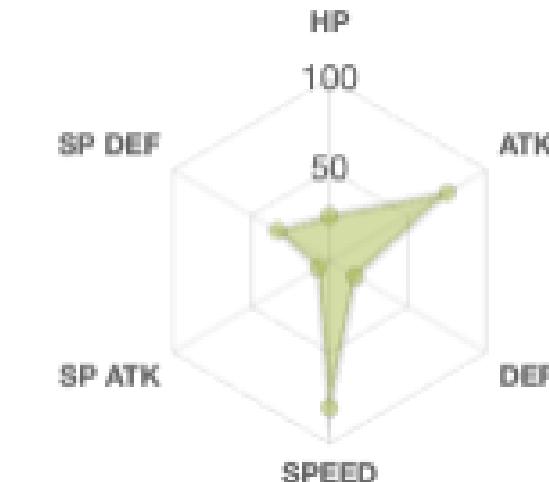


Types:

BUG POISON

Height: 1 m

Weight: 29.5 kg



*Stats normalized to 100

Evolution Chart

★ Palkia #484

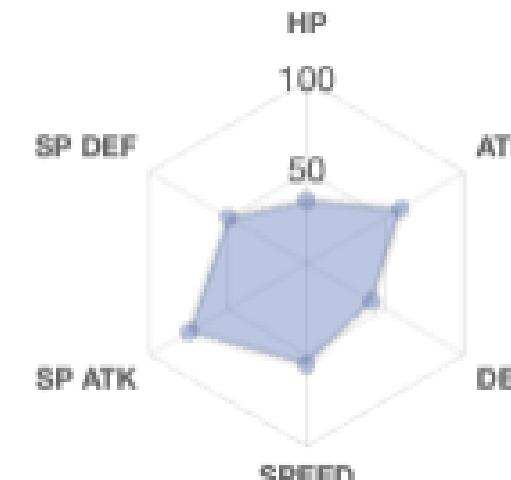


Types:

WATER DRAGON

Height: 4.2 m

Weight: 336 kg



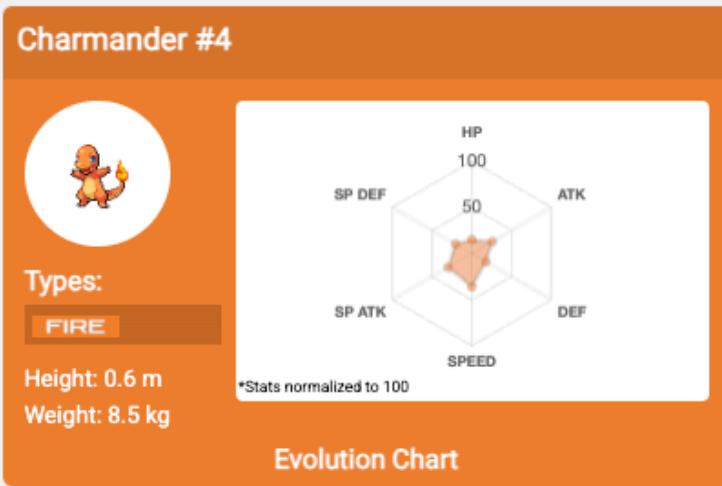
*Stats normalized to 100

Evolution Chart

Useful for comparison
between multiple items
with the same attributes

Welcome to PokeData!

The world of Pokemon can be daunting with there being over 800 Pokemon, but Pokedex is here to help guide you. Feel free to browse through the list of Pokemon and see how their stats compare to the rest. Can't quite remember the name of a Pokemon? Try filtering the table based on what you do know. Feeling nostalgic about the generation you grew up with? Filter by just that generation!



X Axis Data:
Defense

Y Axis Data:
Attack

Circle Size:
HP

○ 1 ● 255

Different encodings support different tasks simultaneously

What to Show

Encoding: same or different

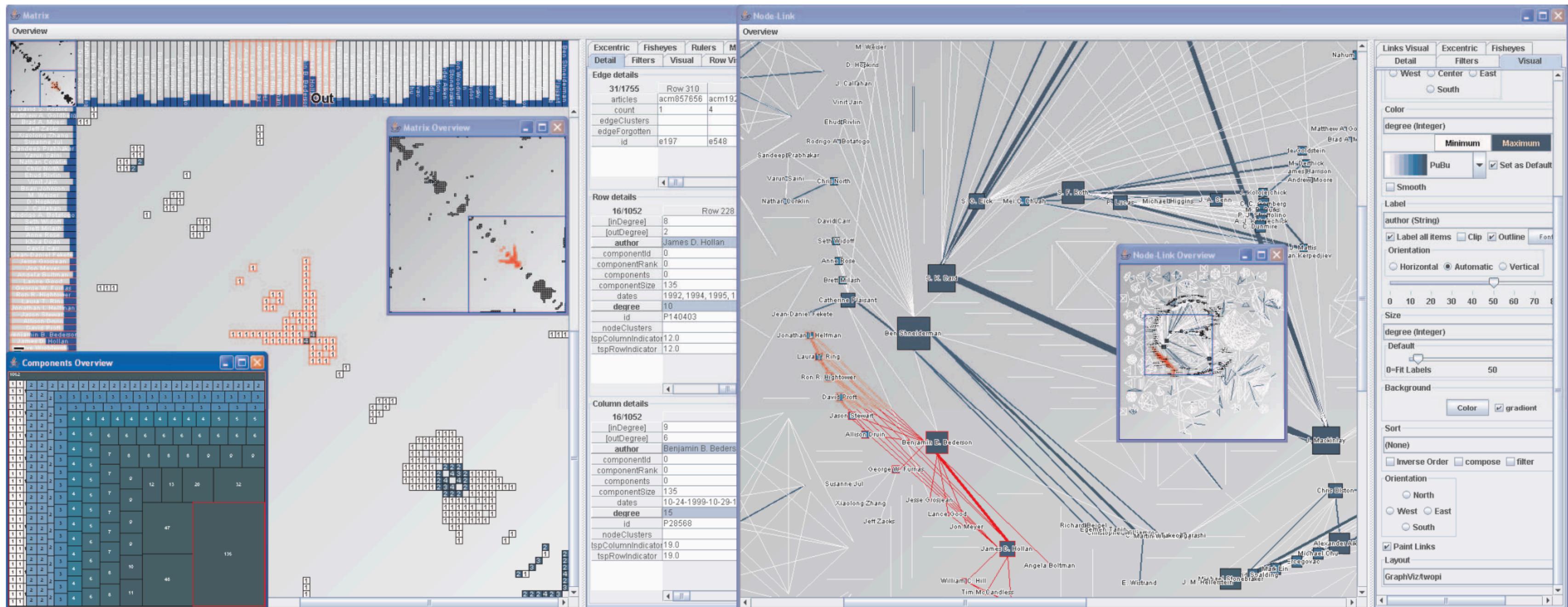
Dataset: share all, subset, or none

How to Interact

How to Layout

Option 1: Share **all** of the same data

Same data in each view, but with different encodings



Example: MatrixExplorer

Option 2: Data in one view is a **subset** of another

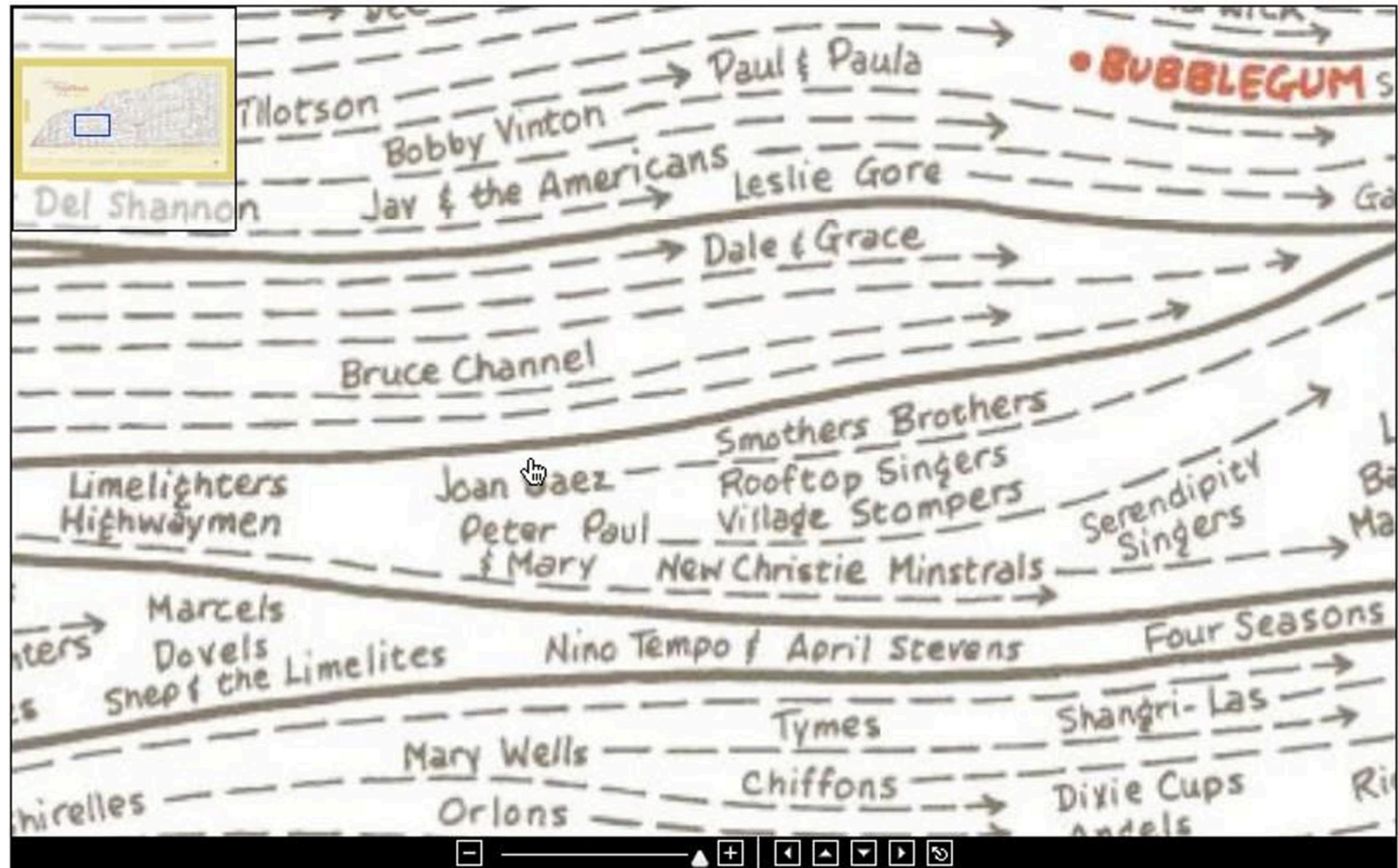
“Overview + Detail”

One view shows summarized information about the entire dataset, while **another view shows more detailed information** about a subset of the data

Useful when your dataset is large, and a **single view can't capture fine details**

Option 2: Data in one view is a **subset** of another

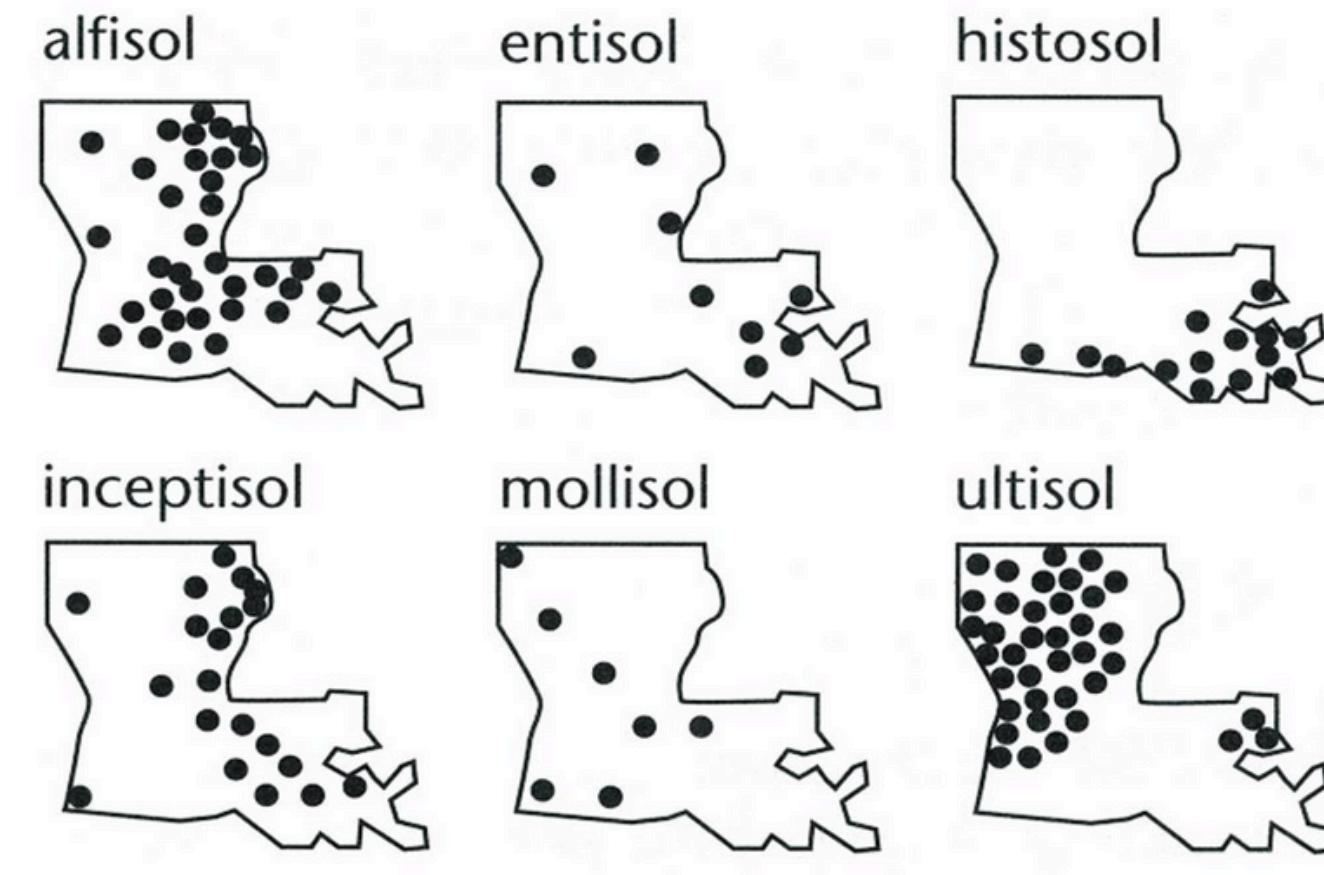
“Overview + Detail”



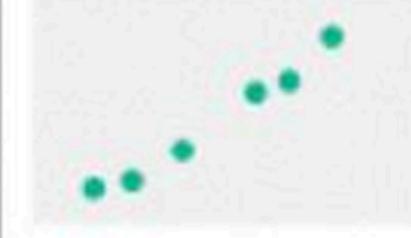
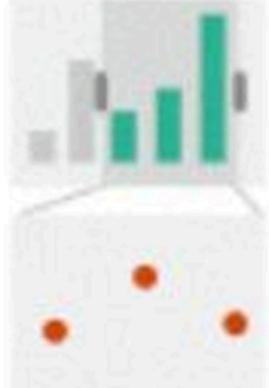
Option 3: Different views share **no** data

Example: Small Multiples

- each view uses the same visual encoding but shows a different subset of the data



Useful for quick comparisons relying on vision not memory

		Shared Data		
		All	Subset	None
Shared Encoding	Same	Redundant	 Overview/ Detail	 Small Multiples
	Different	 Multiform	 Multiform, Overview/ Detail	No Linkage

What to Show

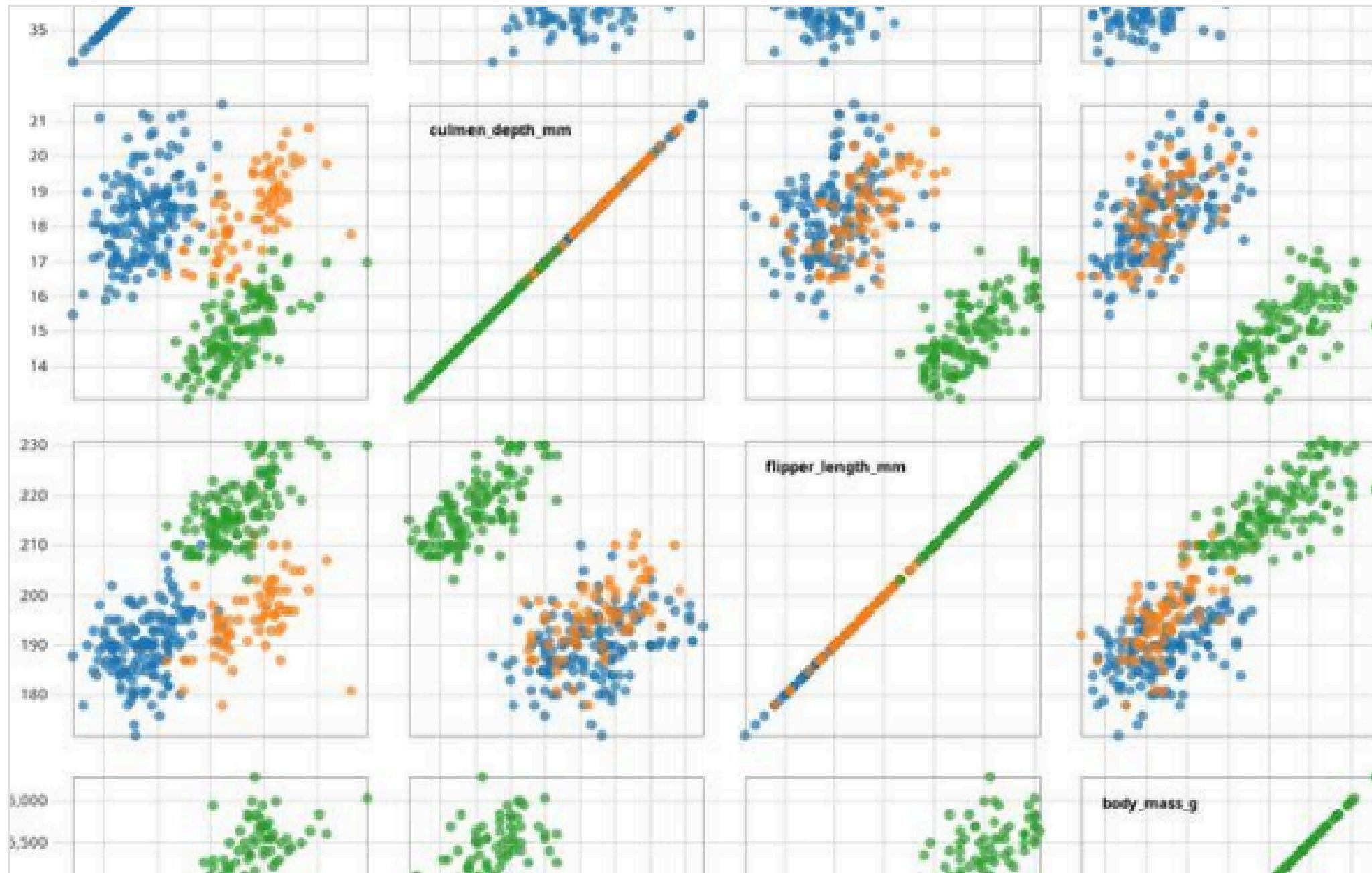
Encoding: same or different

Dataset: share all, subset, or none

How to Interact

Highlighting: to link, or not?

How to Layout



Brushable scatterplot matrix

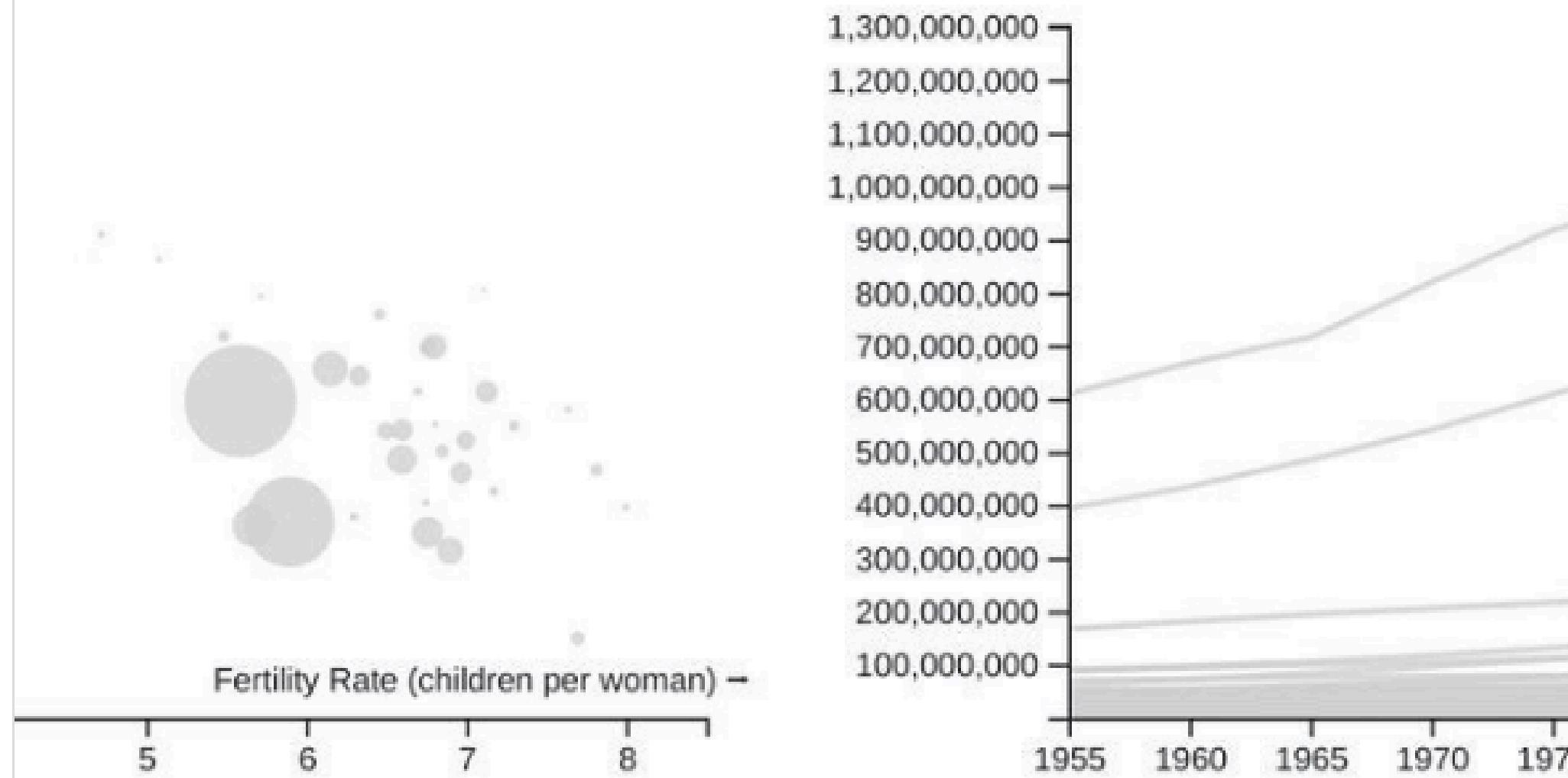
The scatterplot matrix (SPLOM) shows pairwise correlations for multi-dimensional data; each cell is a scatterplot where x encodes the column's dimension and y encodes the row's dimension. This matrix shows Kriste...

Observable / Jul 4, 2023

[Linked highlighting between same encodings](#)

Country in 1955

Population Development of Countries



D3. Part 3 - Brushing and Linking

This is building upon the D3. Part 2 - Exercise Solution adding brush interaction and small animations.

Observable / Dec 8, 2020

[Linked highlighting between different encodings](#)

What to Show

Encoding: same or different

Dataset: share all, subset, or none

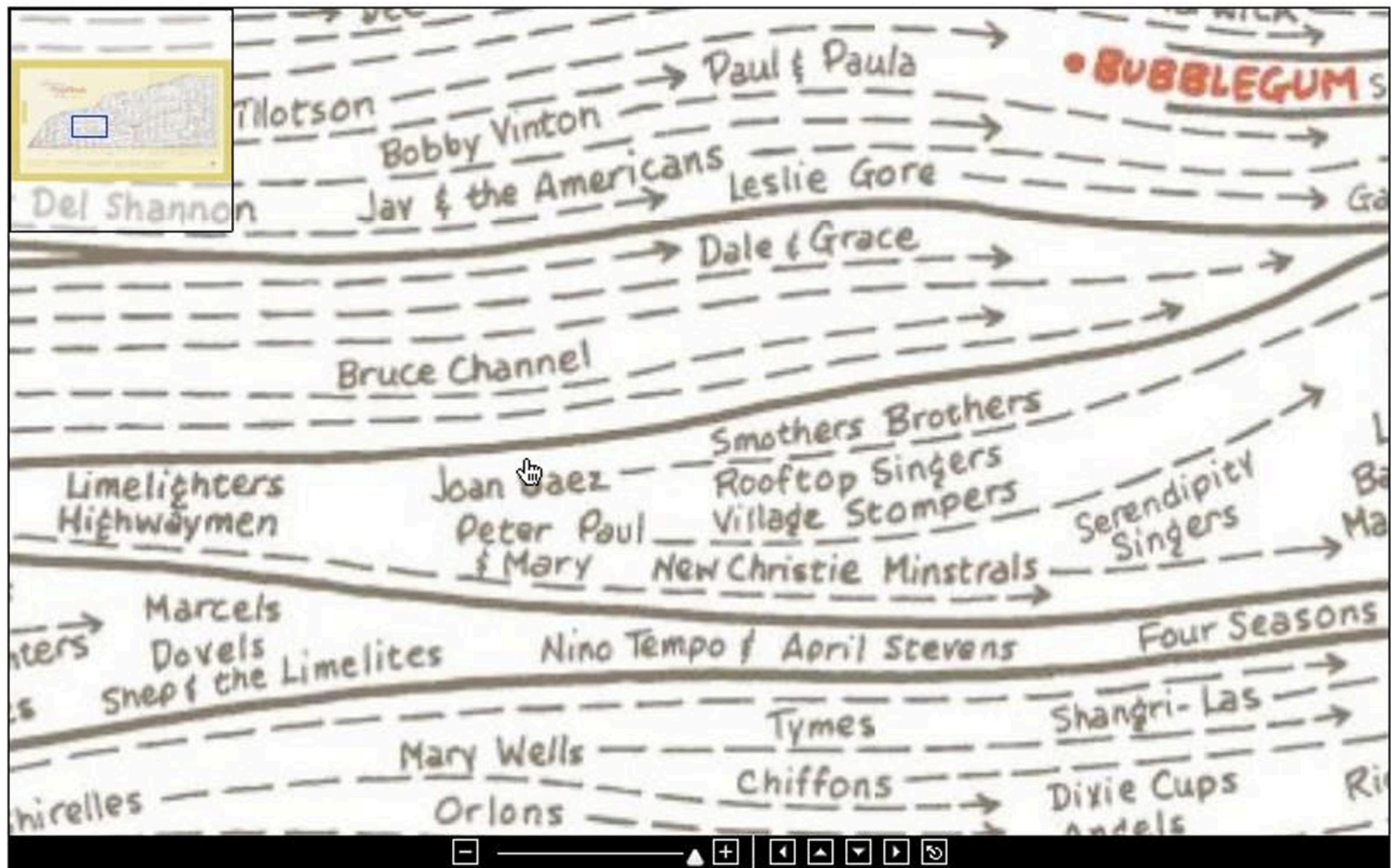
How to Interact

Highlighting: to link, or not?

Navigation: to share, or not?

How to Layout

Linked Navigation



What to Show

Encoding: same or different

Dataset: share all, subset, or none

How to Interact

Highlighting: to link, or not?

Navigation: to share, or not?

How to Layout

Partition

Partitioning

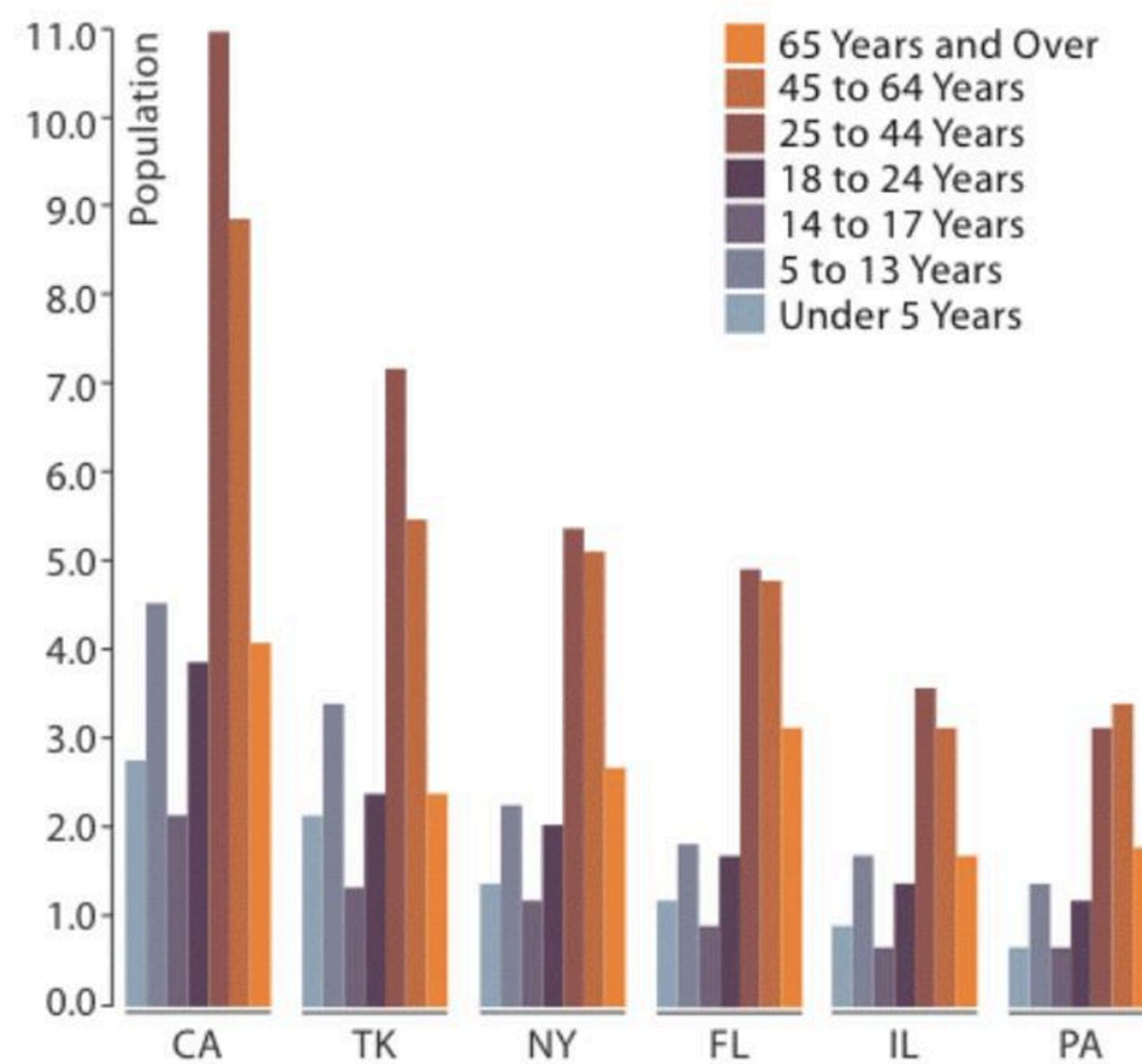
An action on the dataset that **separates the data into groups**

Design choices:

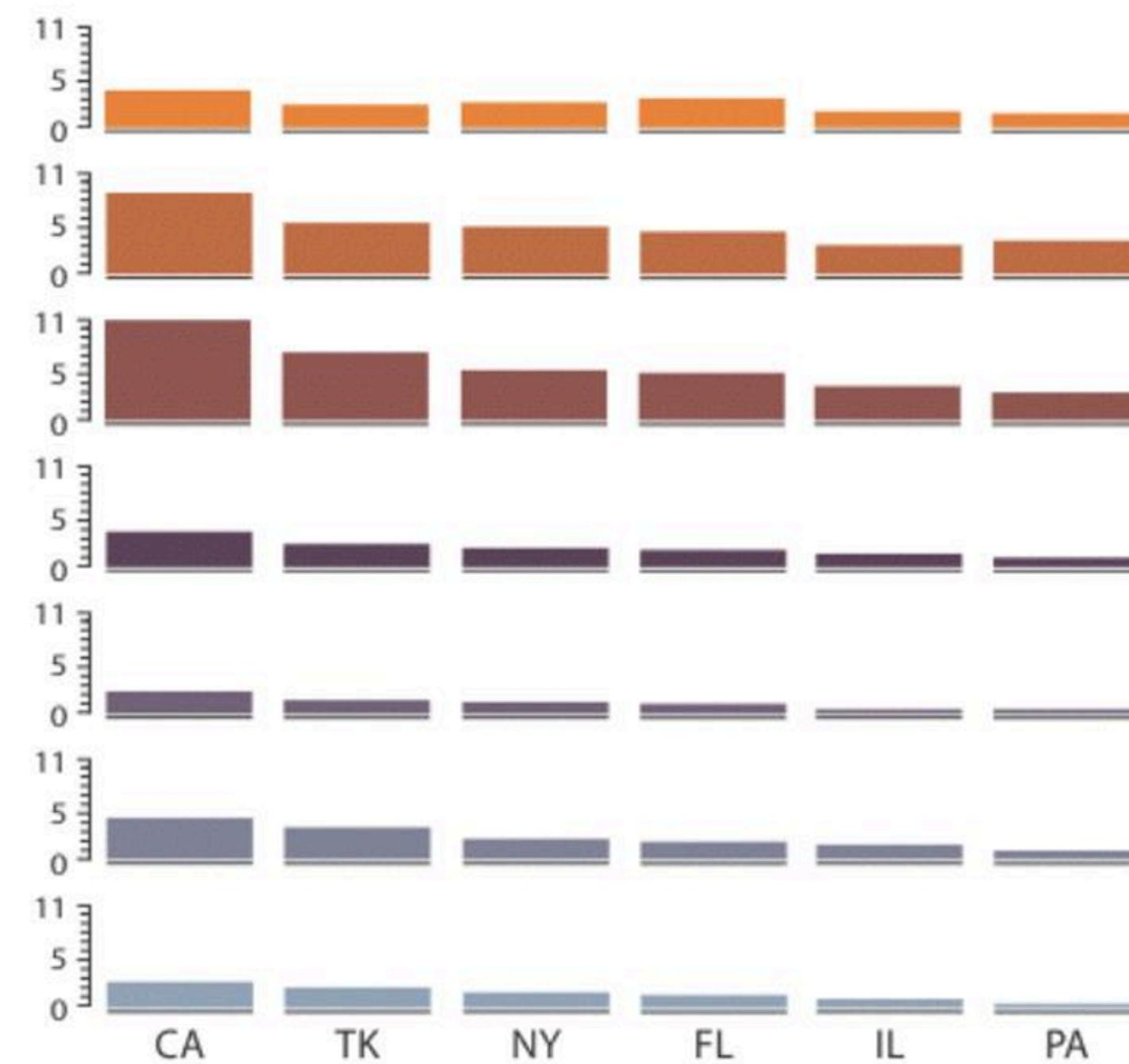
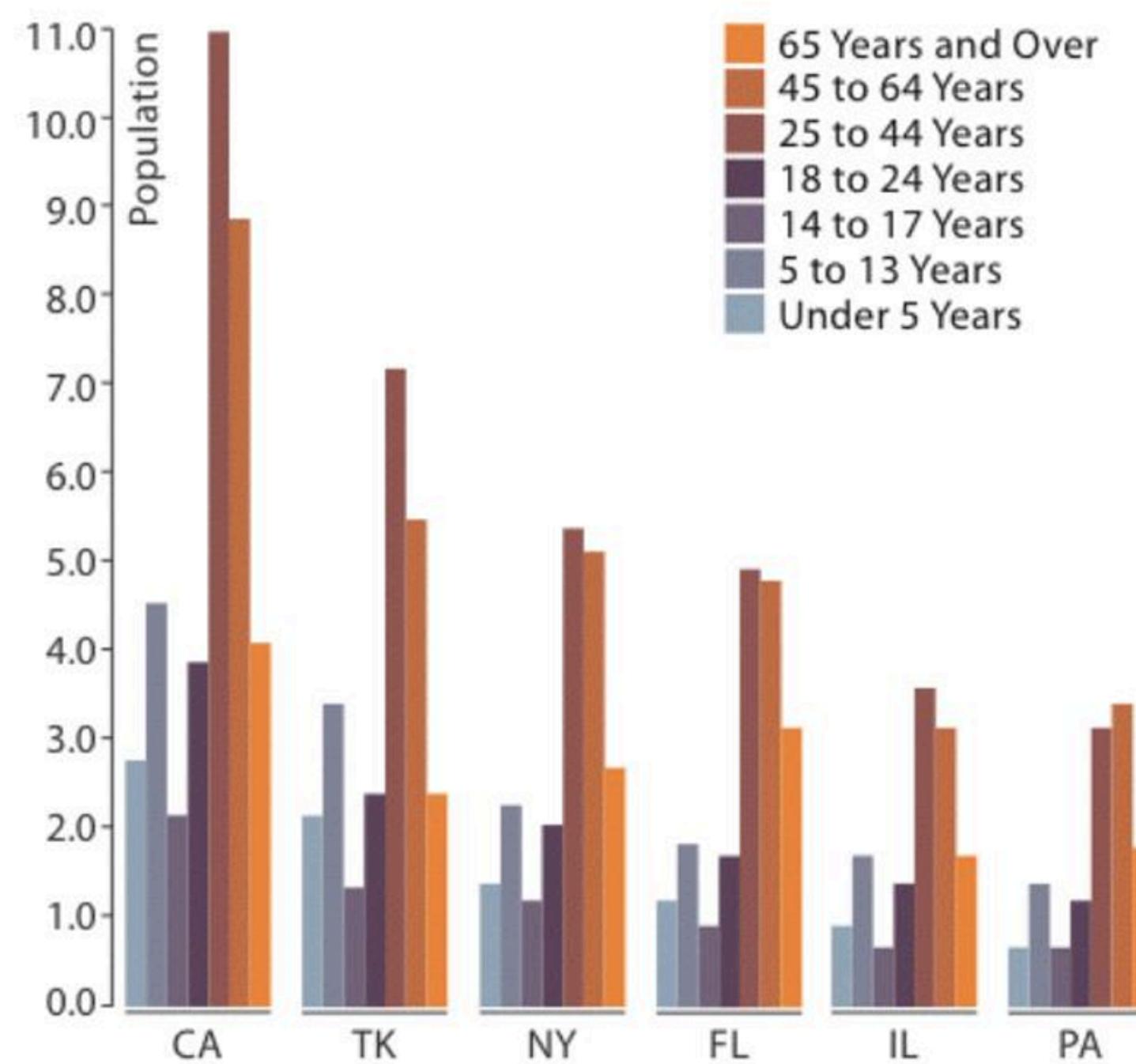
- how to divide data between views, given a hierarchy of attributes
- how many splits (and views)

Attributes used for partitioning are typically categorical

Partitioning



Partitioning

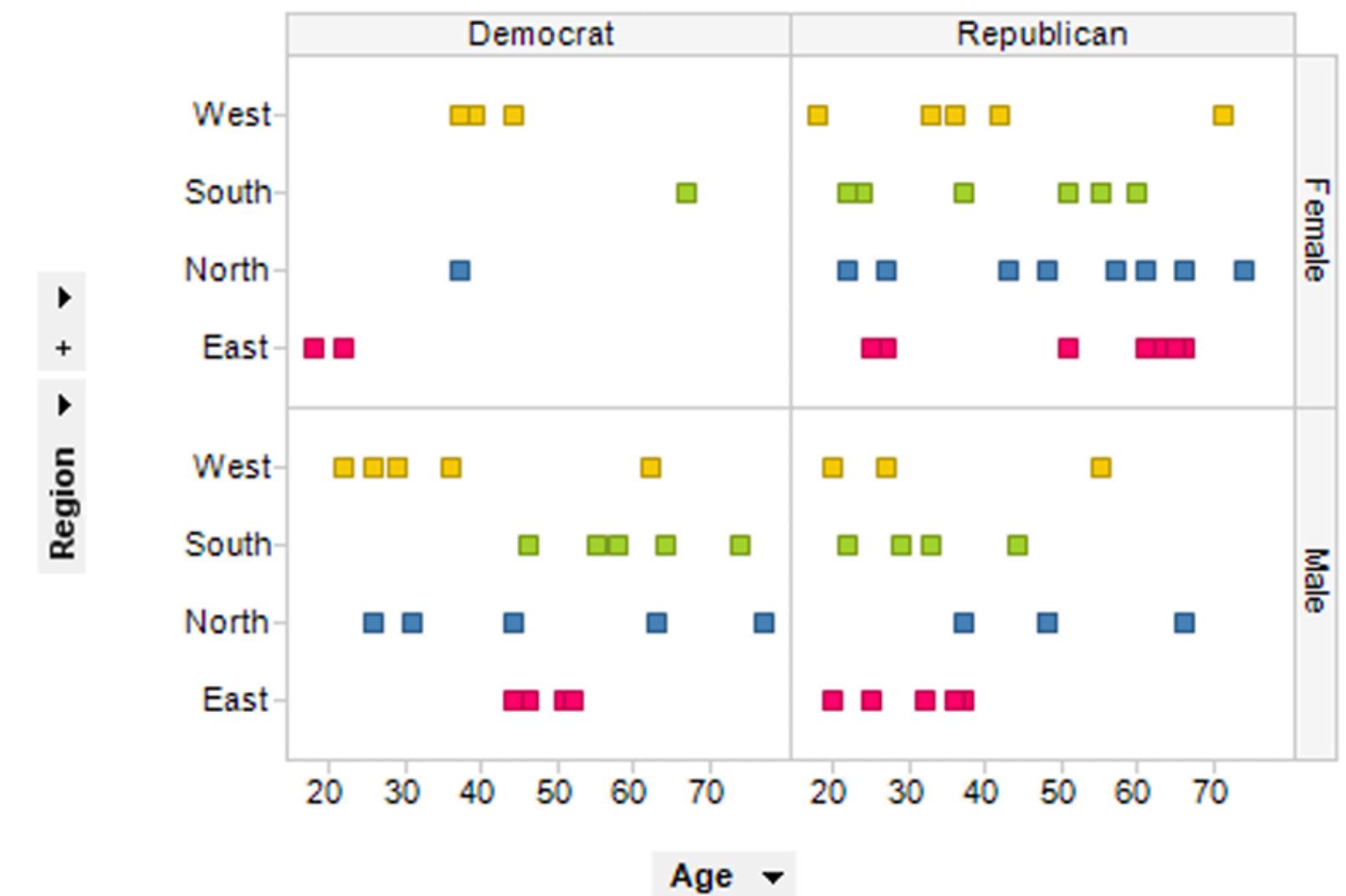


Partitioning



Partitioning

trellising this visualization based on
Gender and Political affiliation



Partitioning: Recursive Subdivision

Dataset: UK Housing Data

Split by **neighborhood**

Then by **type**

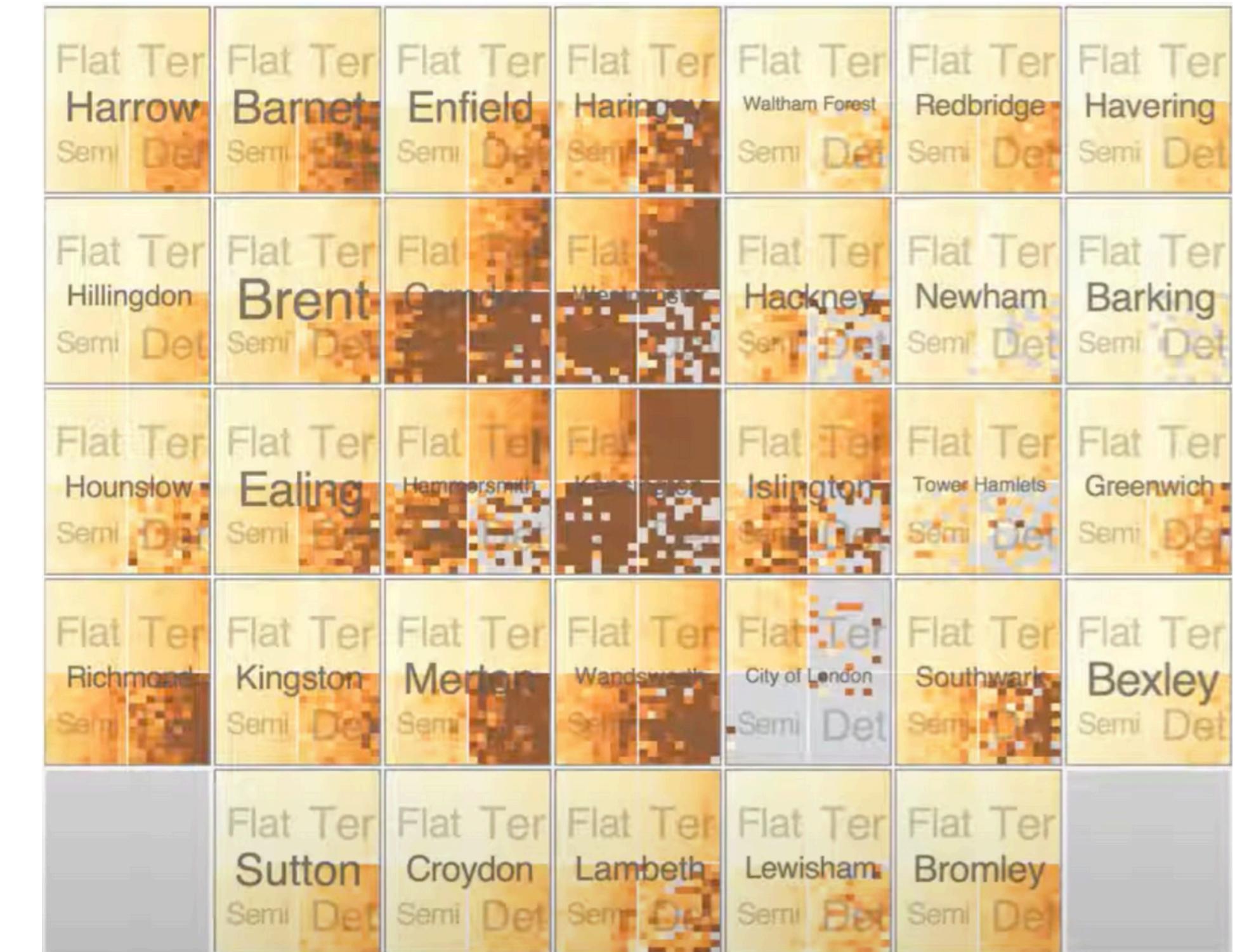
Then by **time** (years as rows,
months as columns)

Color by **price**

(darker = more expensive)

Patterns:

- where it's expensive
- where detached housing costs much more



Partitioning: Recursive Subdivision

Dataset: UK Housing Data

Switch the order of splits

First by **type**

Then by **neighborhood**

Color by **price variation**

(darker = more variation)

Patterns:

- within a specific house type,
which neighborhoods are
more inconsistent



What to Show

Encoding: same or different

Dataset: share all, subset, or none

How to Interact

Highlighting: to link, or not?

Navigation: to share, or not?

How to Layout

Partition

Superimpose

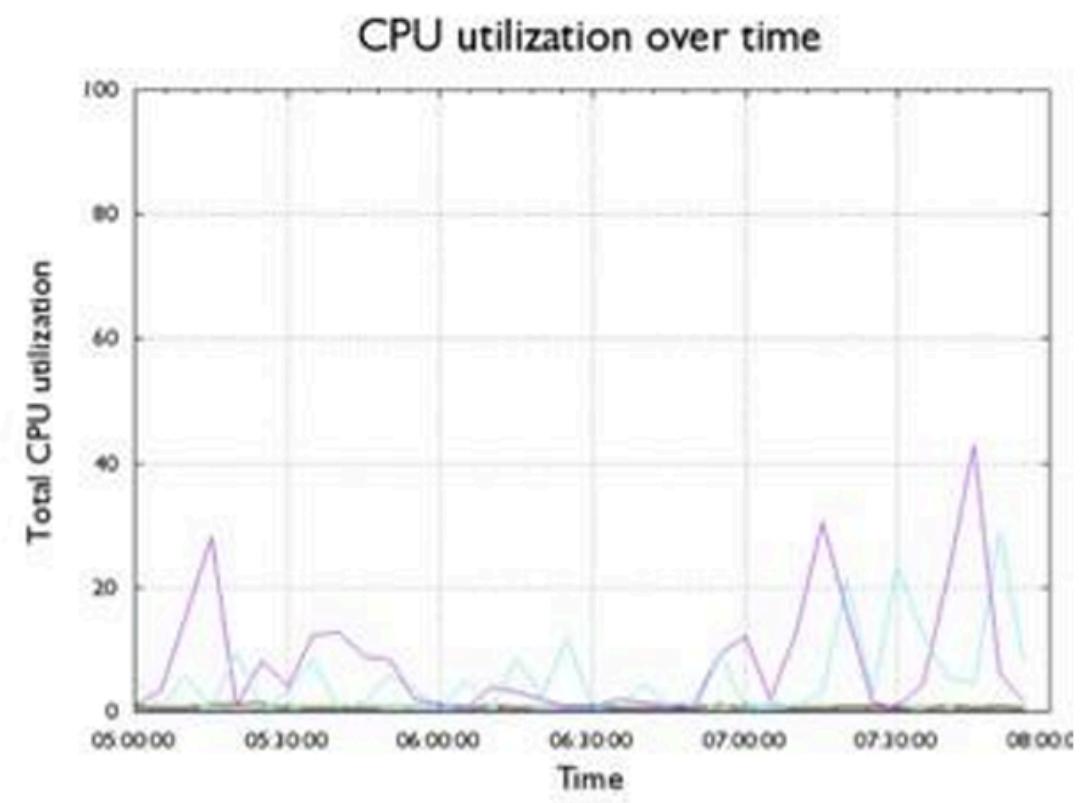
Layering (Superimpose)

Combine multiple views on top of one another to form a composite view

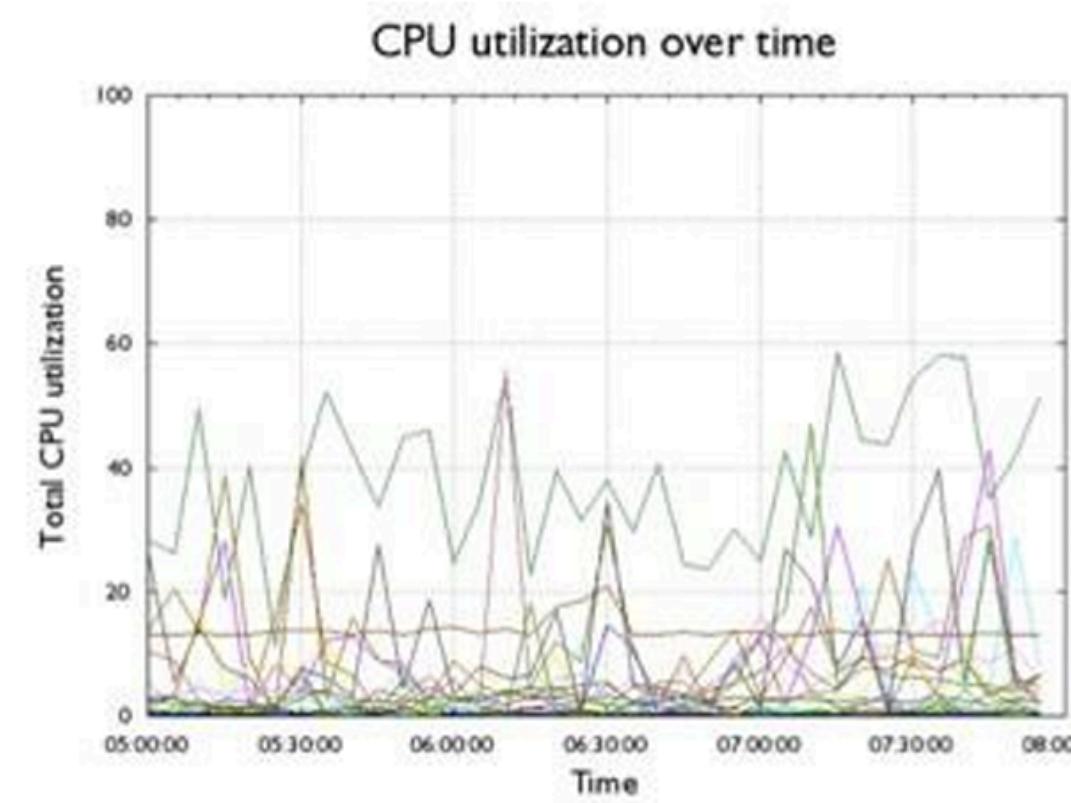
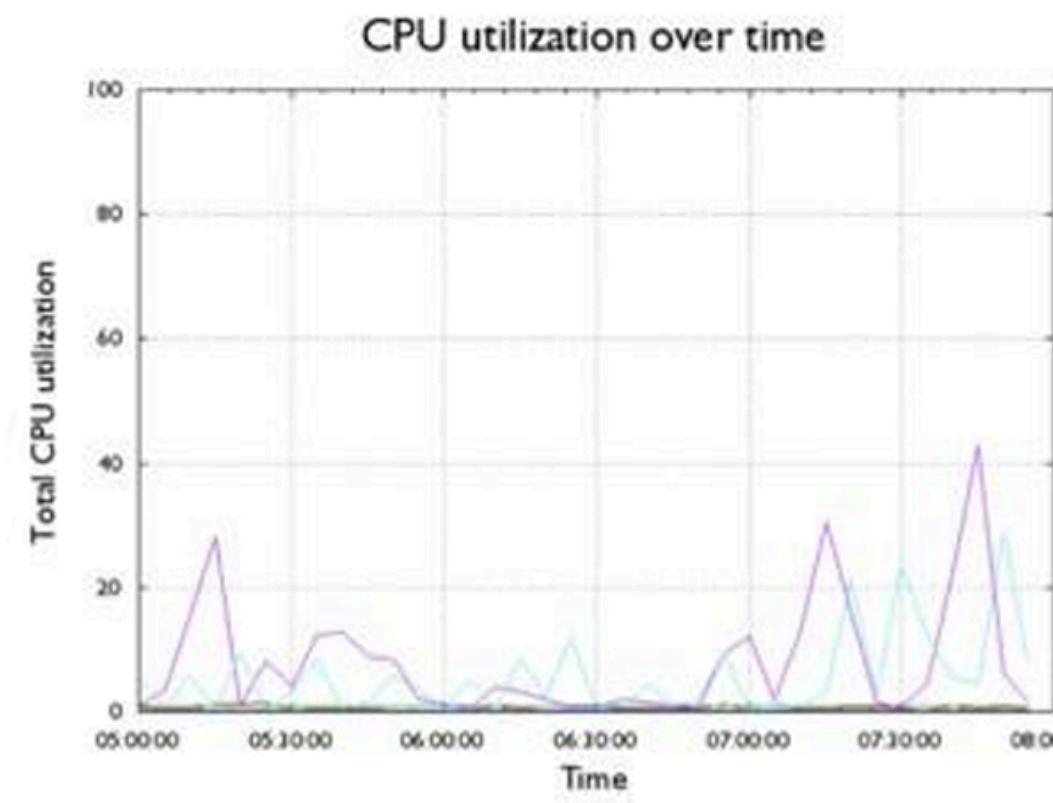
- supports a larger, more-detailed view than using multiple separate views

Trade-off: Visual encodings and number of layers are constrained

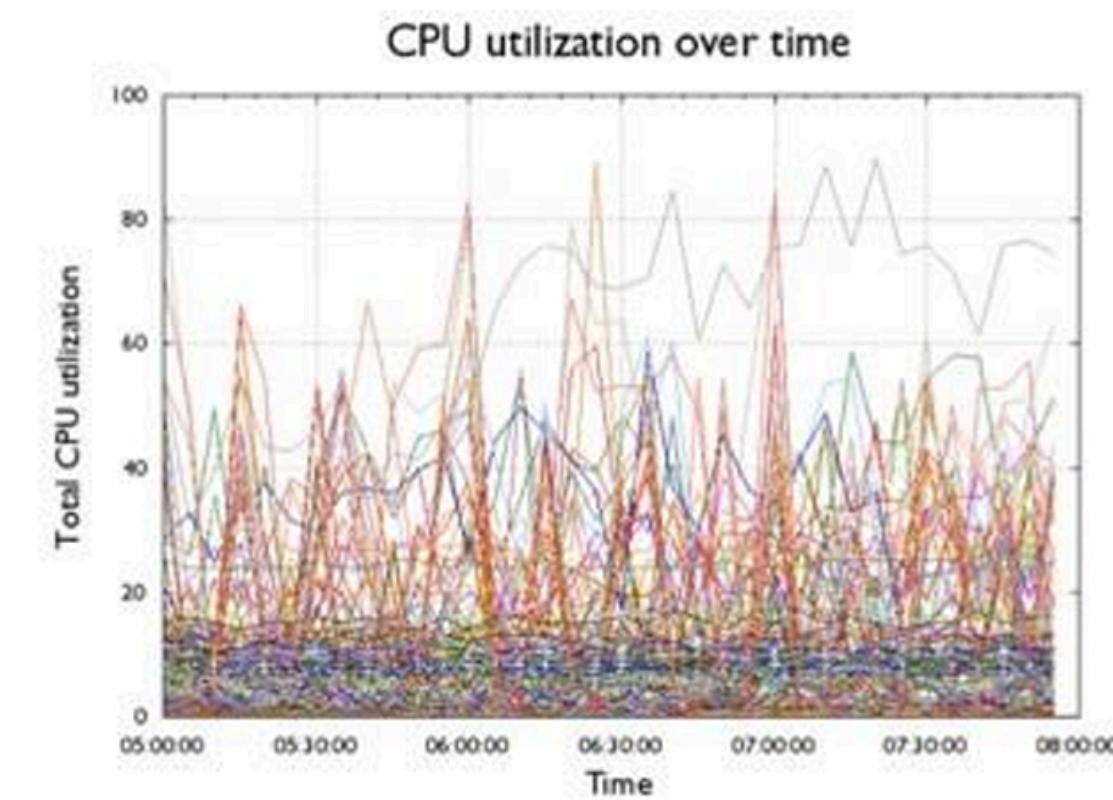
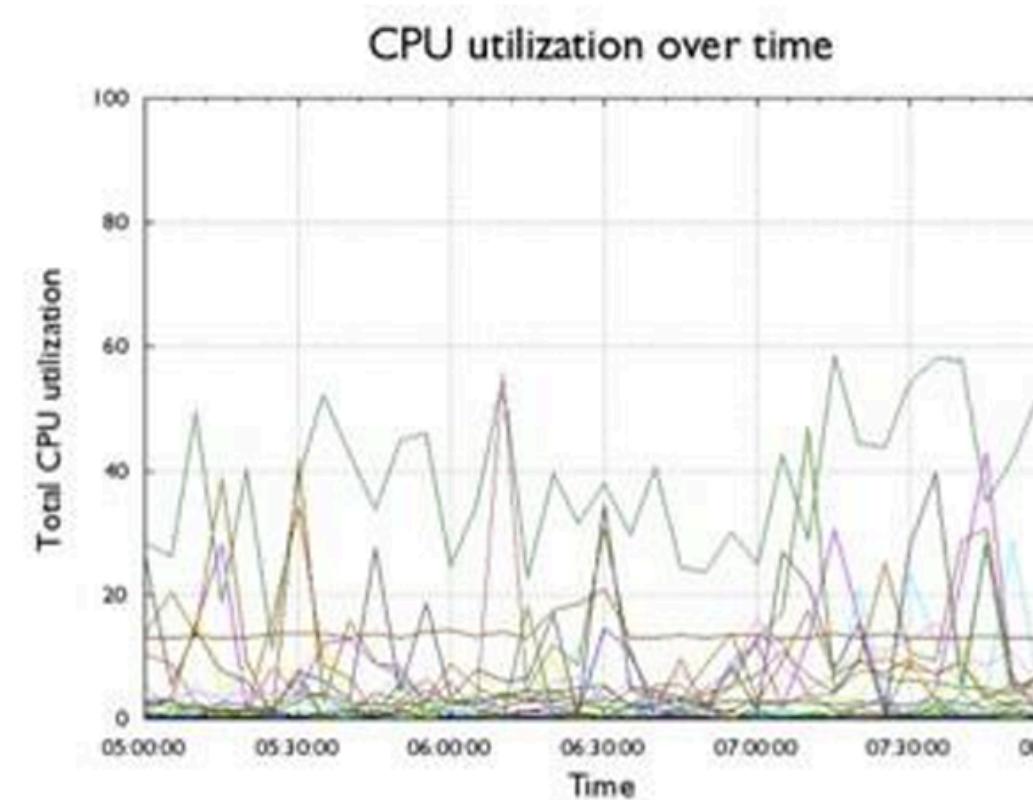
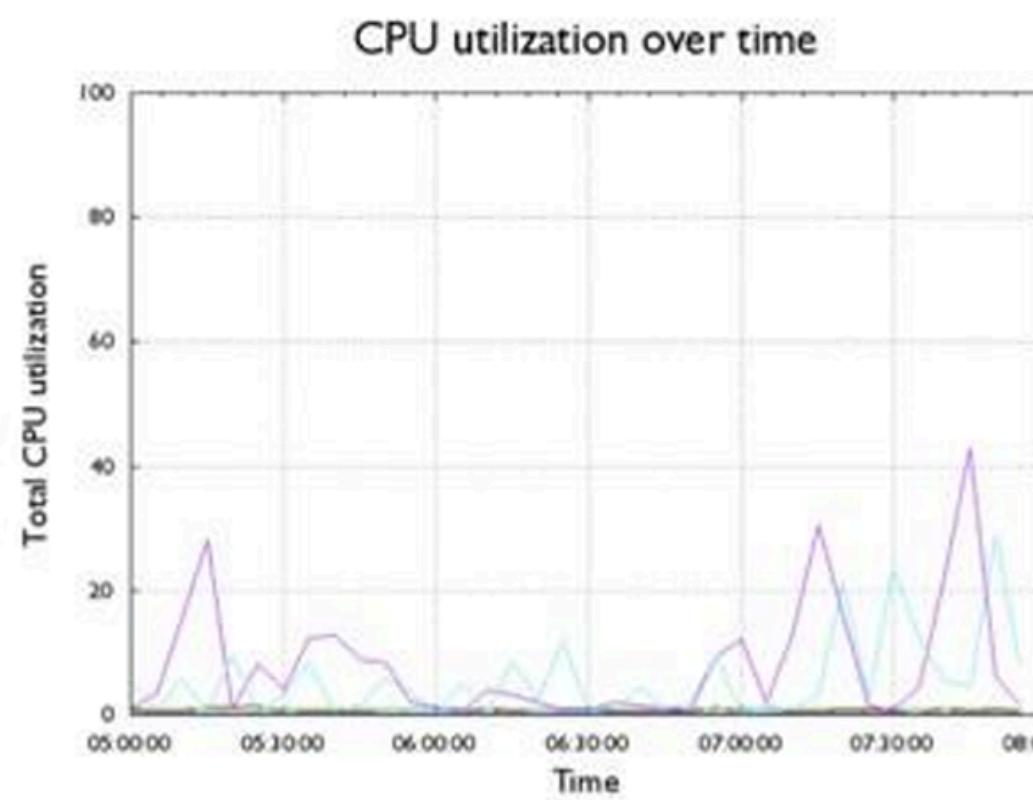
Static Layering: Overlays



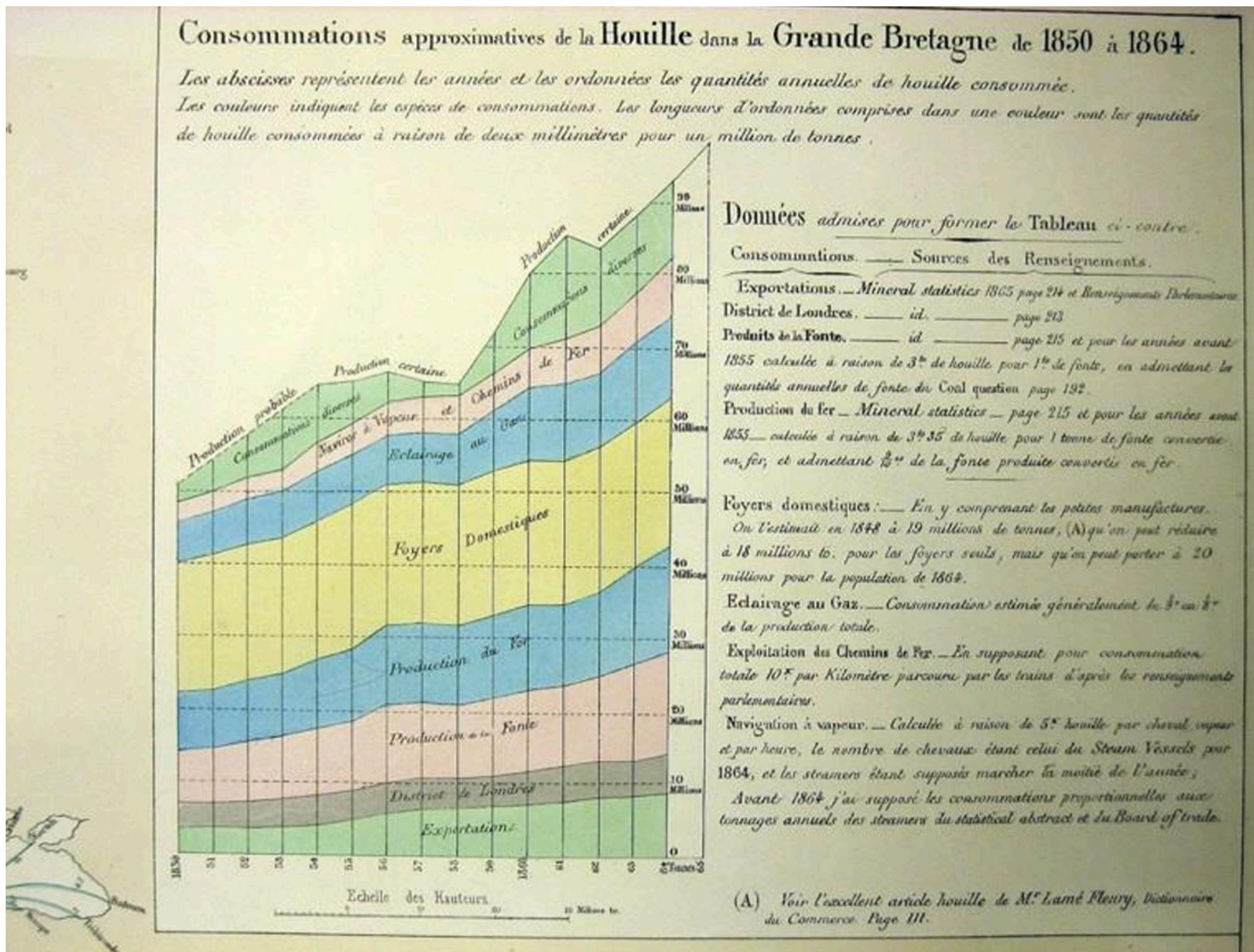
Static Layering: Overlays



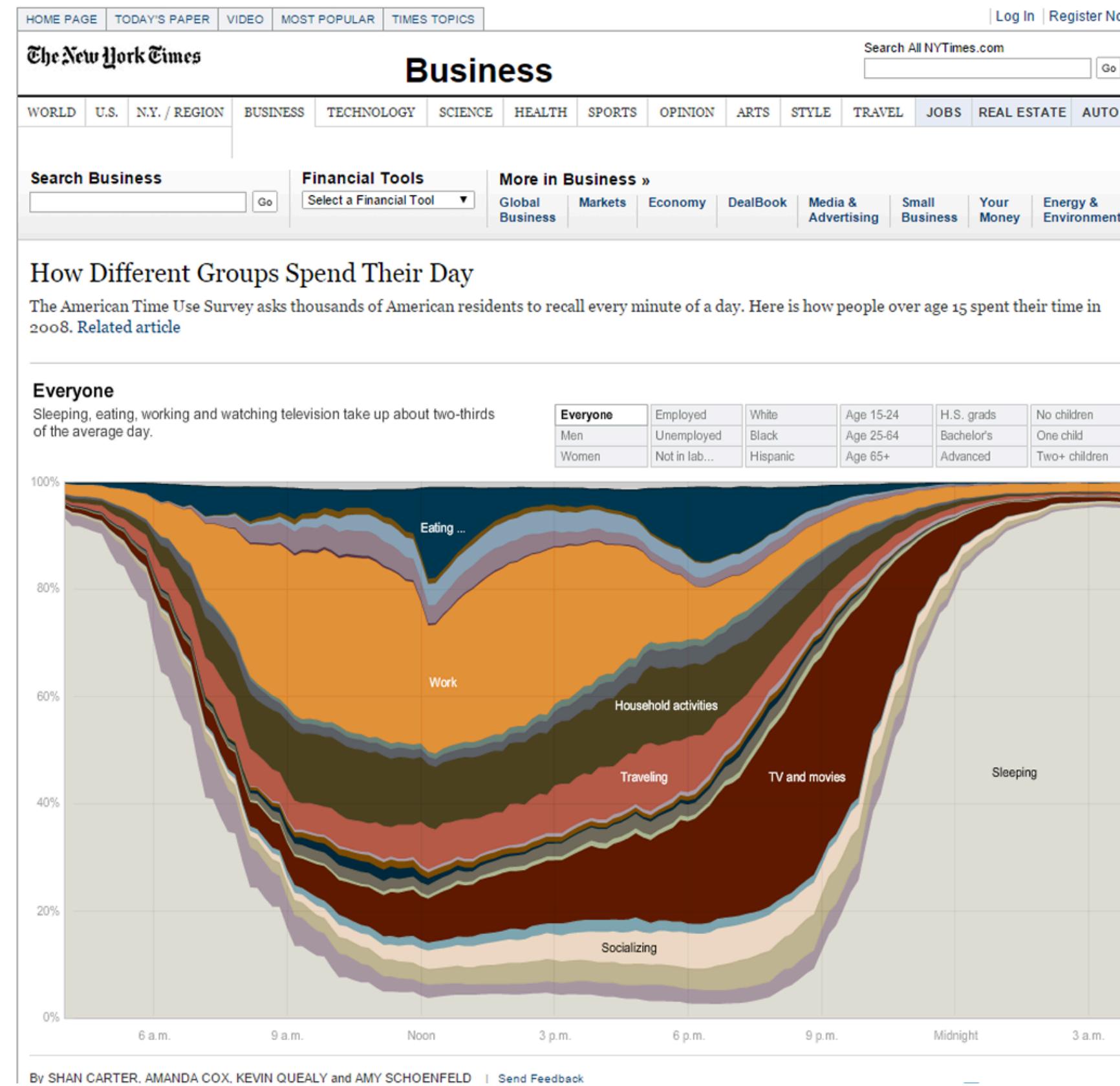
Static Layering: Overlays



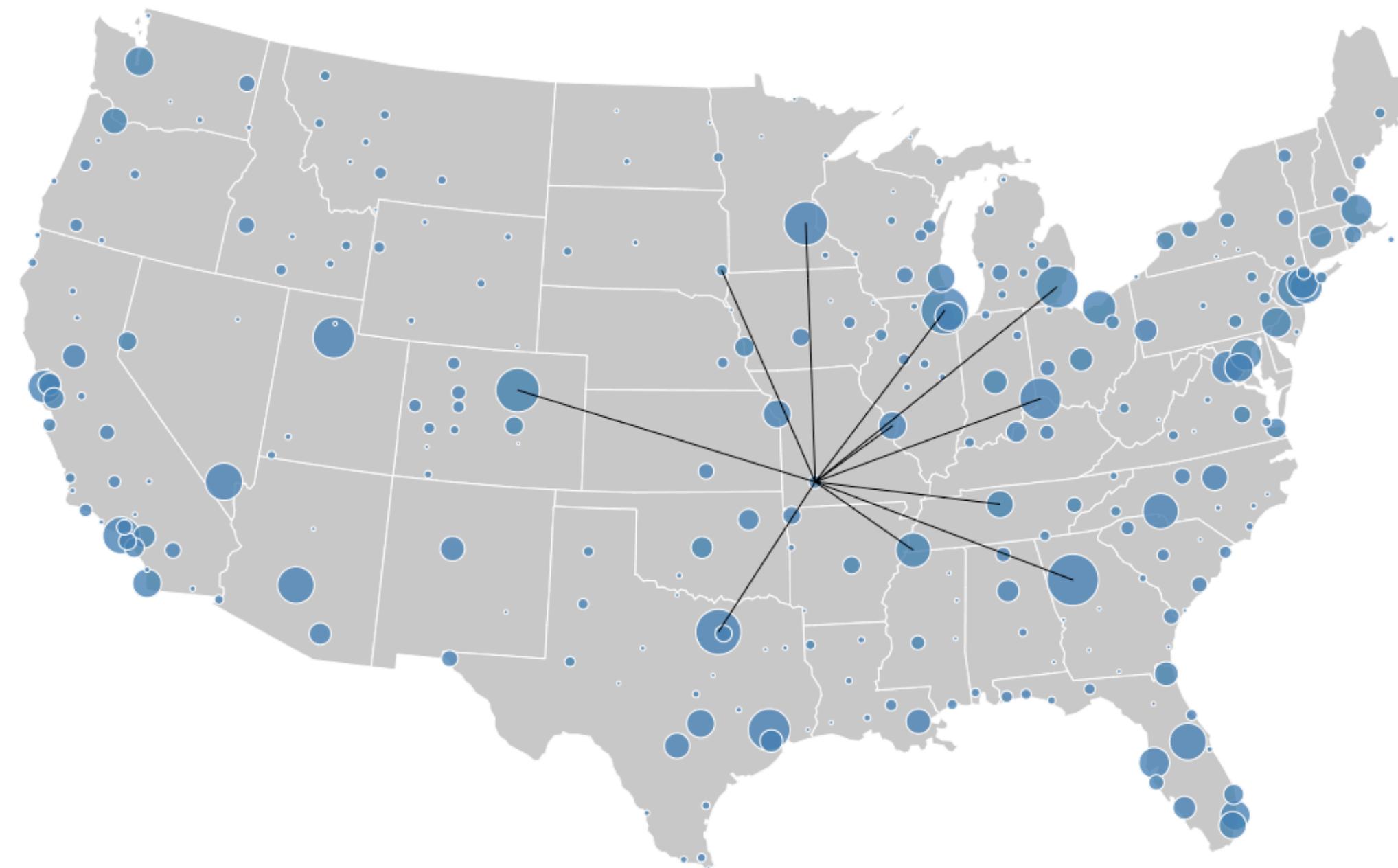
Static Layering: Item-Level Stacking



Static Layering: Item-Level Stacking



Dynamic Layering (On Demand)



Springfield-Branson Regional, 2008
great arcs and symbol map

show Voronoi

<https://mbostock.github.io/d3/talk/20111116/airports.html>

Focus + Context

Focus + Context

Techniques to show **detail (focus)** and **overview (context)** simultaneously

A user selects a region of interest (focus) through **navigation** or **selection**

And context is provided through **aggregation, reduction** or **layering**

Elision

Elide (or Suppress) Data

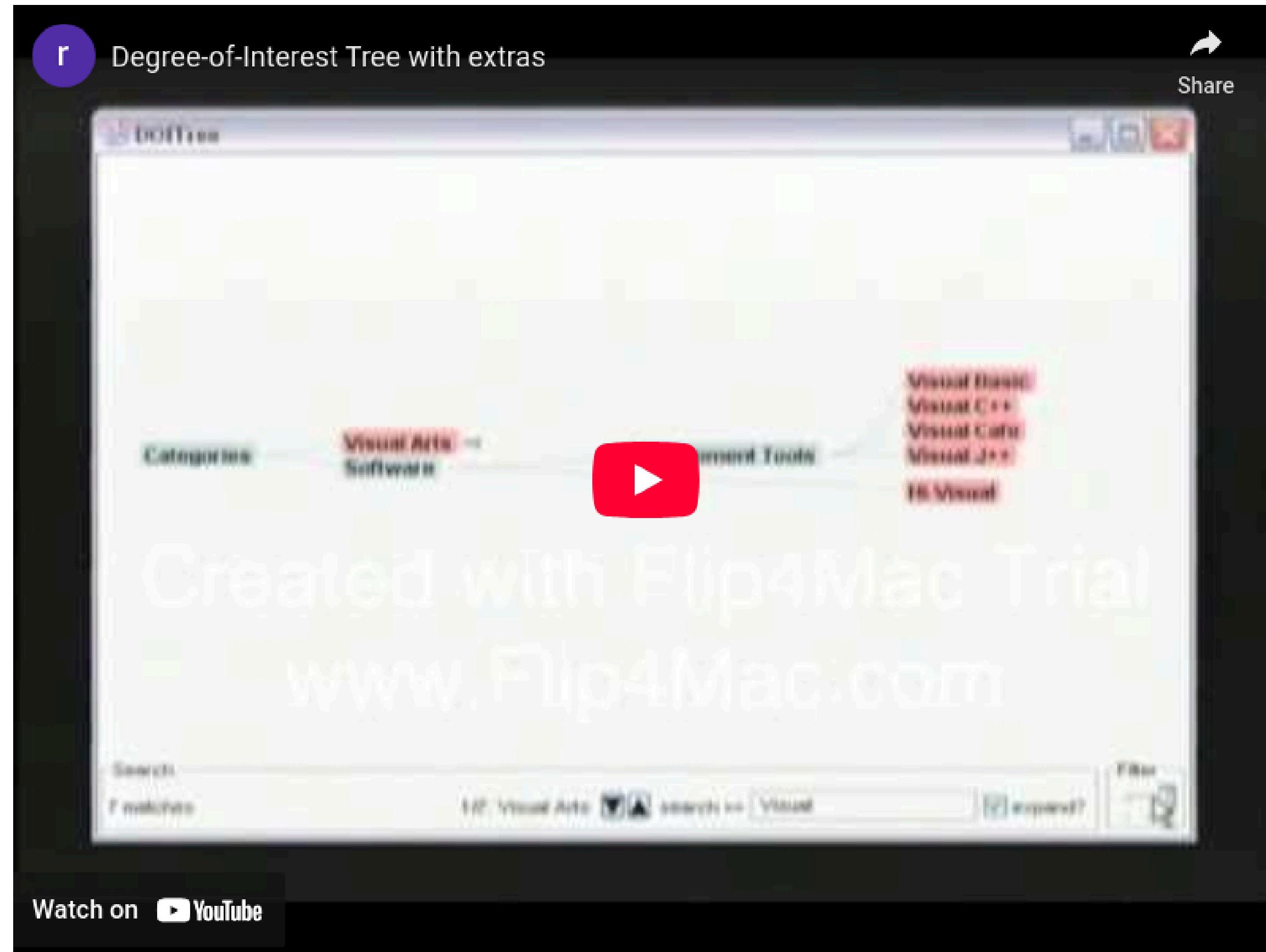
The **focus** items are **shown in detail**,
and **other** items are **summarized (suppressed) for context**



DOI: Degree of Interest

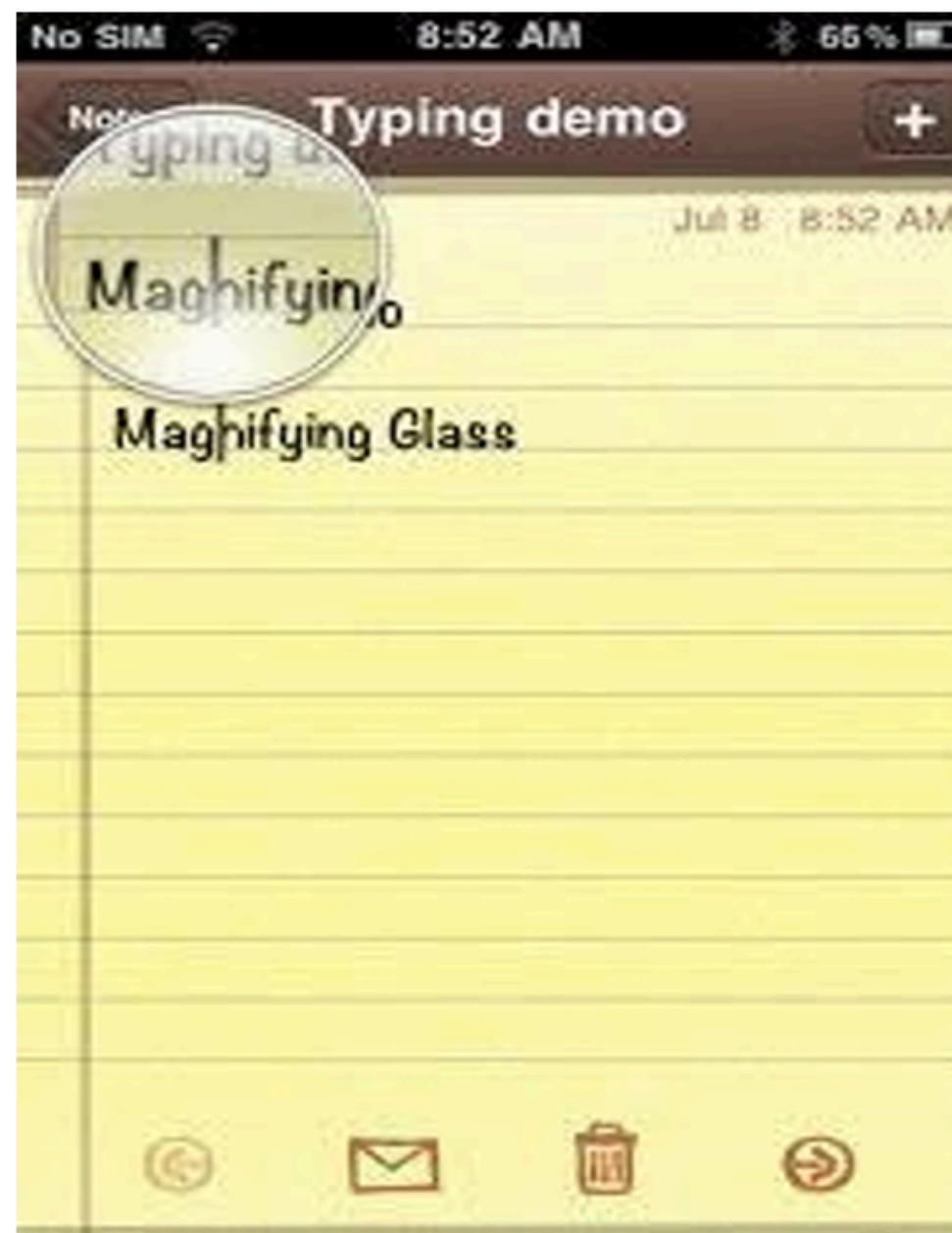
- humans often represent their **own neighborhood in detail**, yet **only major landmarks farther away**
- balance between **local detail** and **global context**

Elision

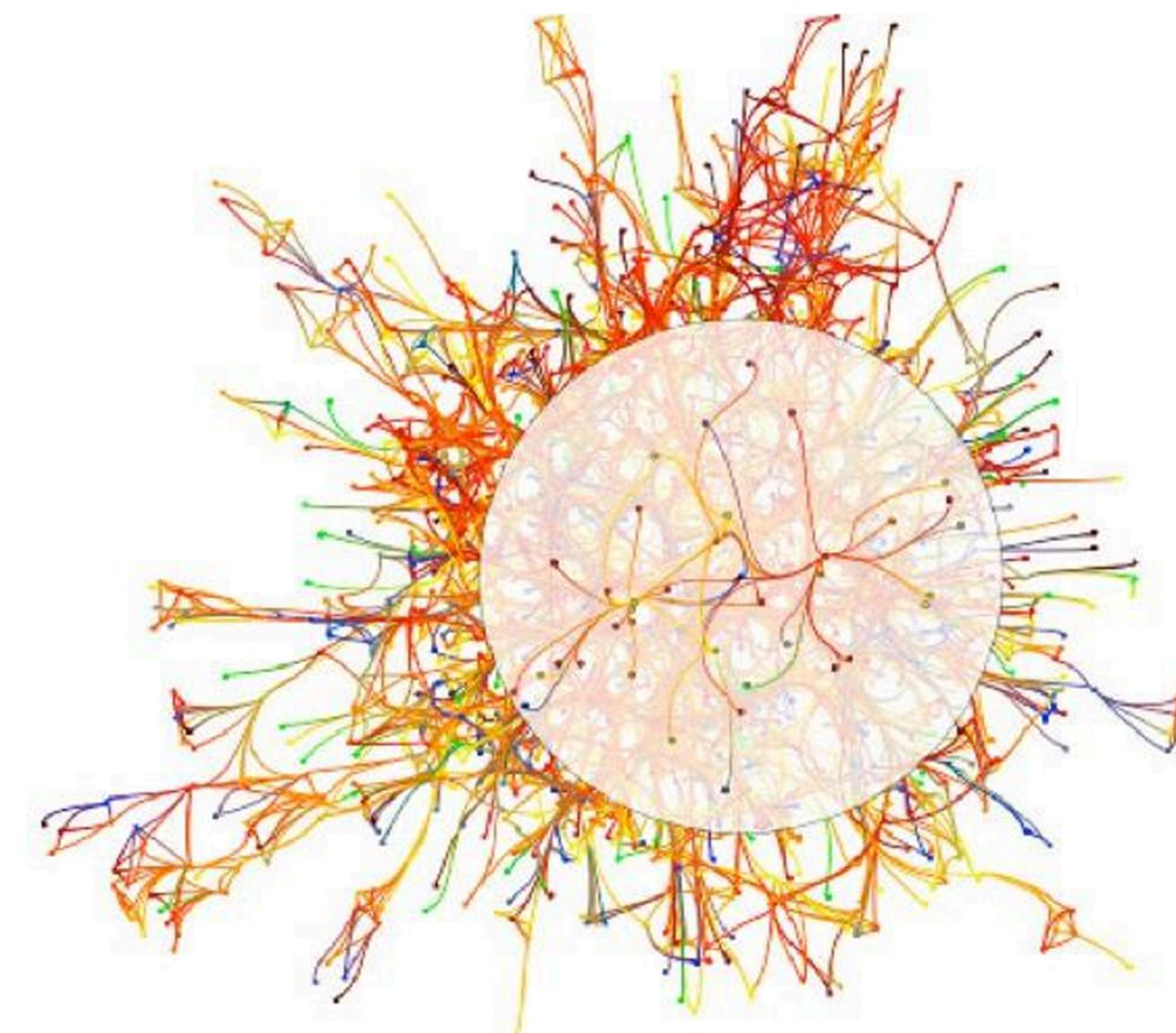


Superimposed “Focus” Layer

Focus on a single layer (region) of the view



Magnification



Highlight / Suppress

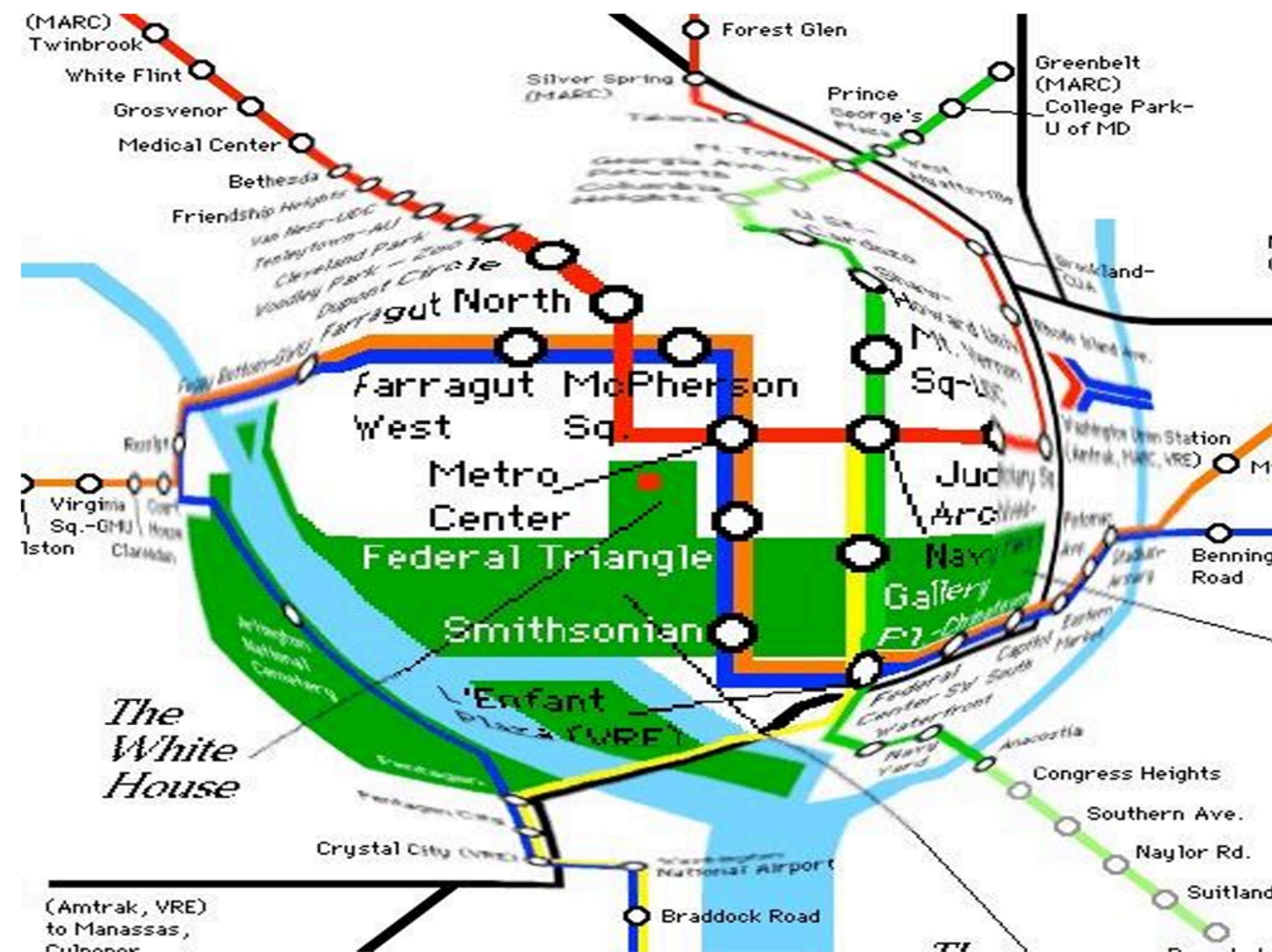
Distort Geometry

Use **Geometric Distortion** of the **contextual** regions to make room for details in the **focus** region(s)

Note: Distortion is unsuitable for comparing relative spatial differences

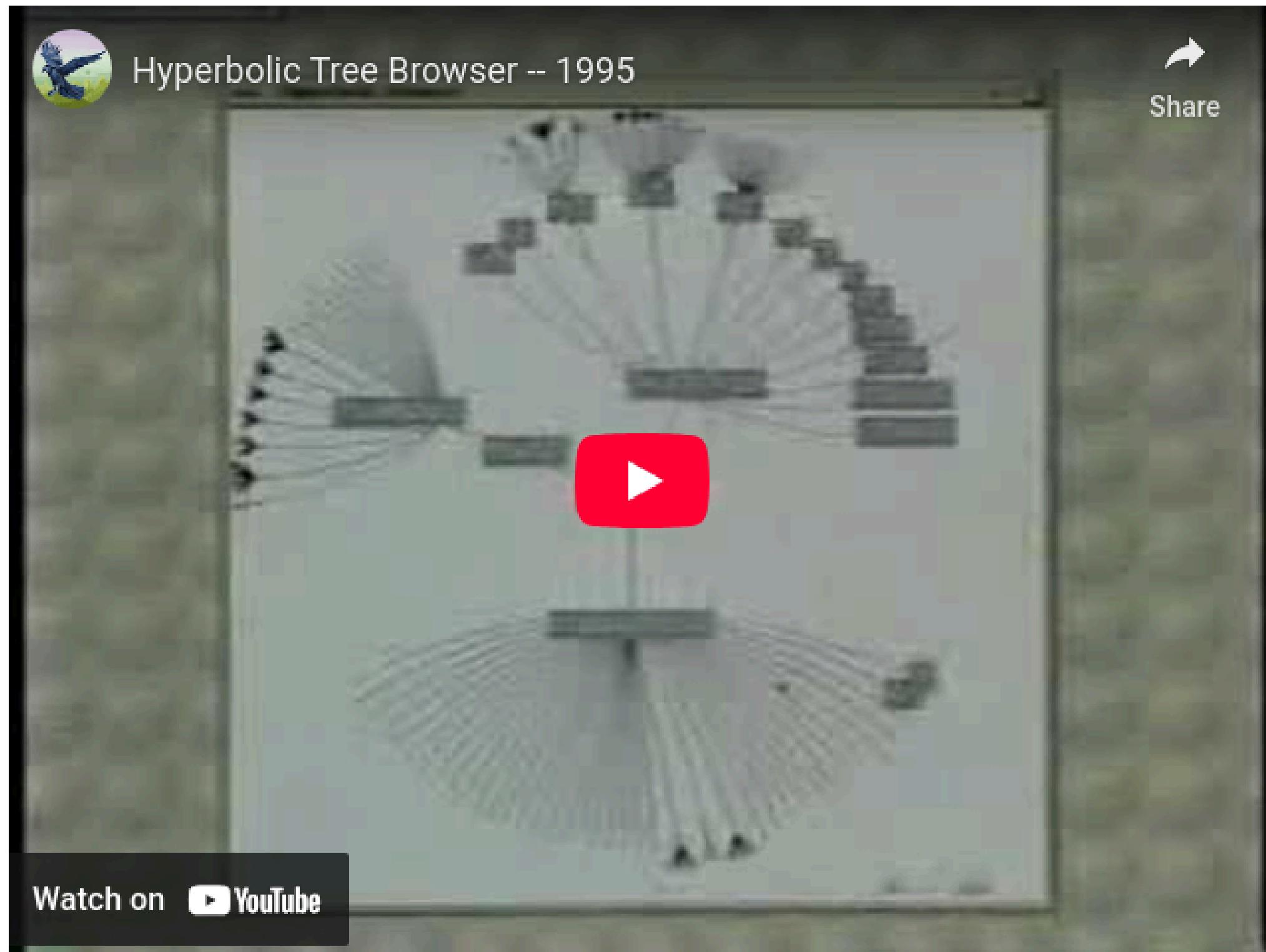
Distort Geometry

Fisheye



Distort Geometry

Hyperbolic
Geometry



FIN

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