CS 571 - Data Visualization & Exploration

Multiple Views, Dashboards

Instructor: Hamza Elhamdadi

UMassAmherst

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...

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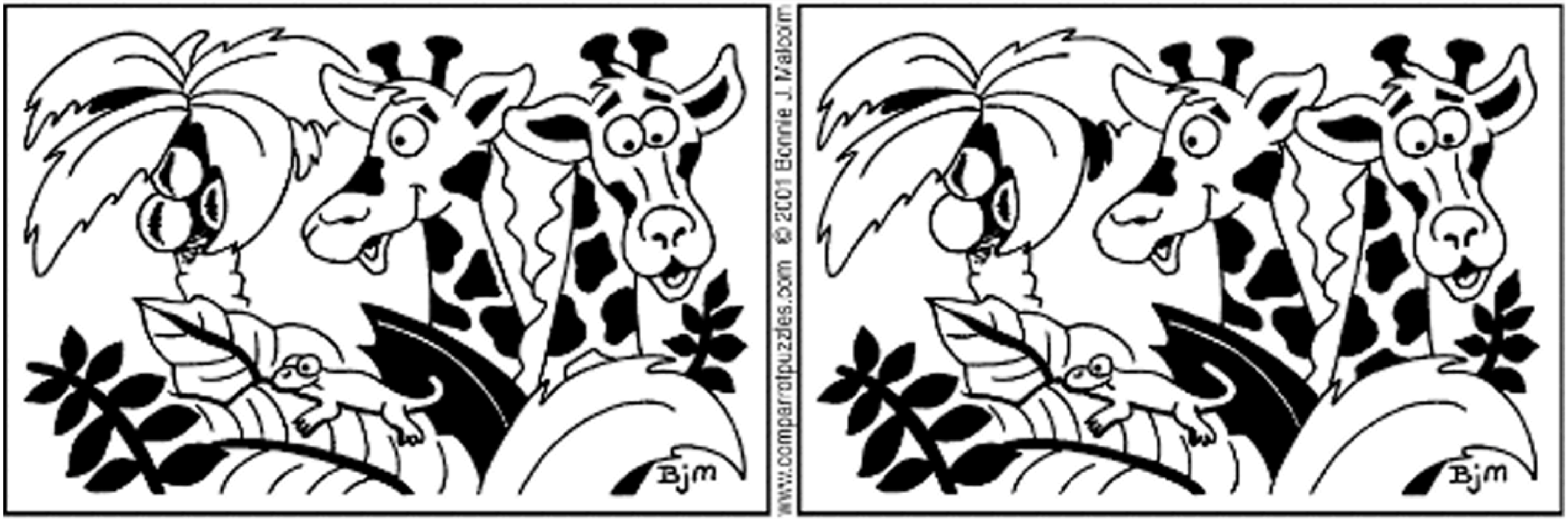


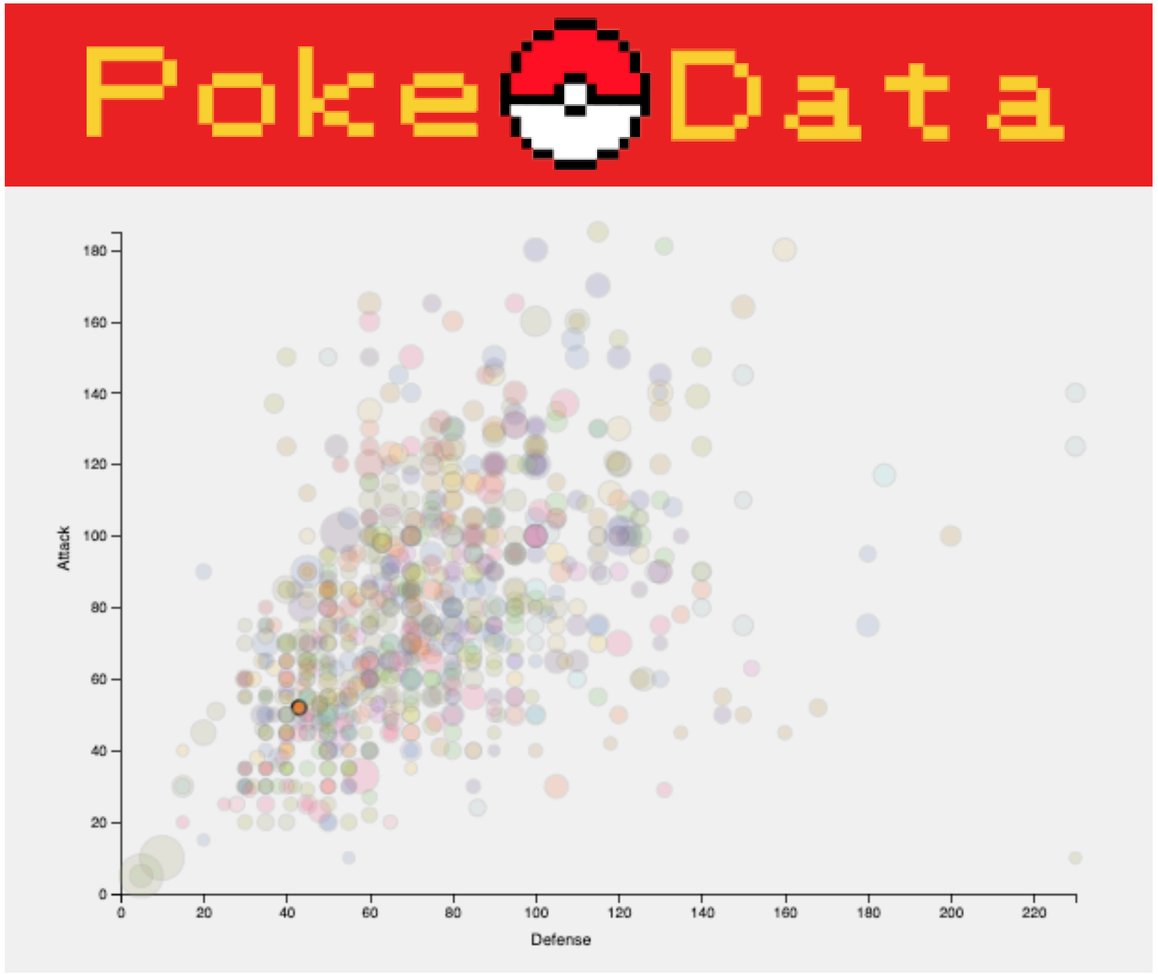
From the Design Guidelines Lecture...

Why Multiple Views?

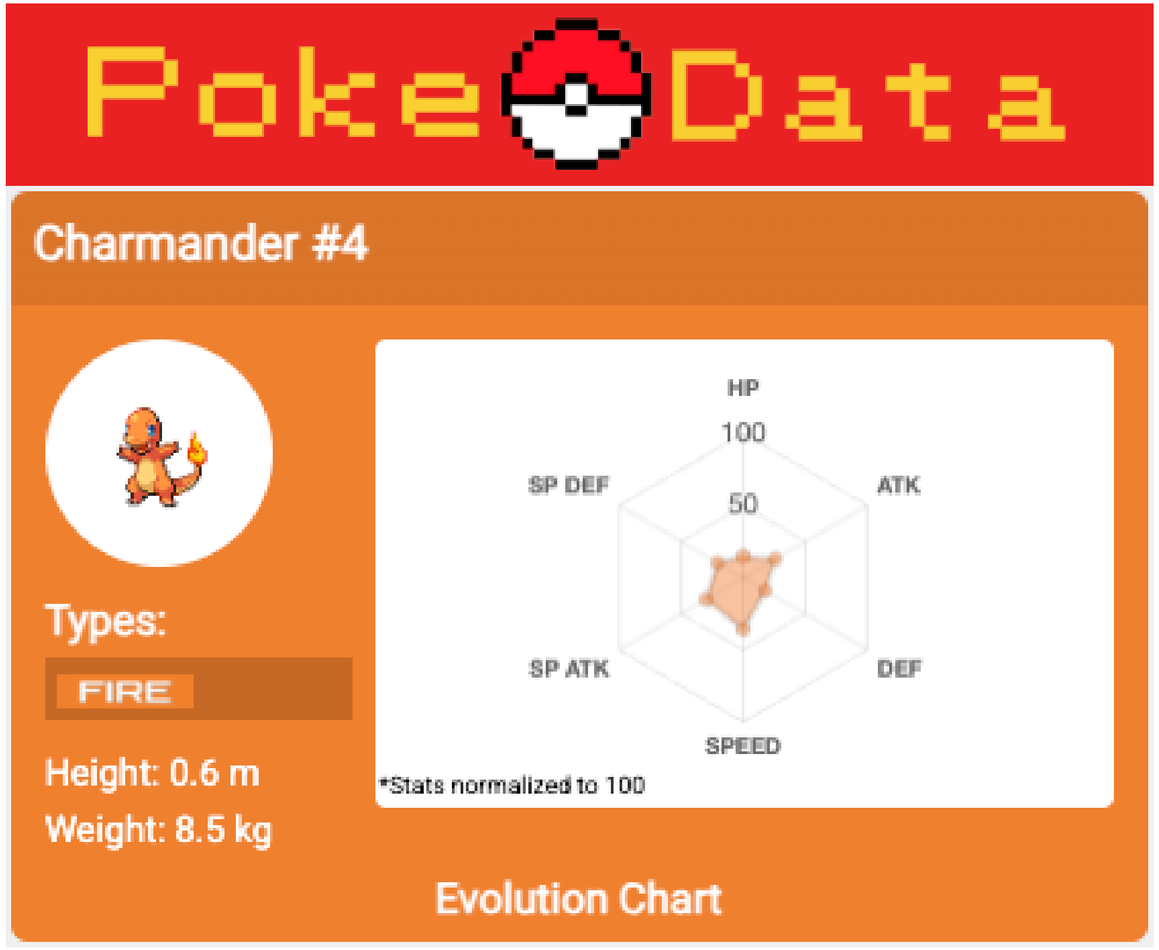
We are better at making comparisons with our eyes than our memory

Trade-off: Display Space vs. Working Memory

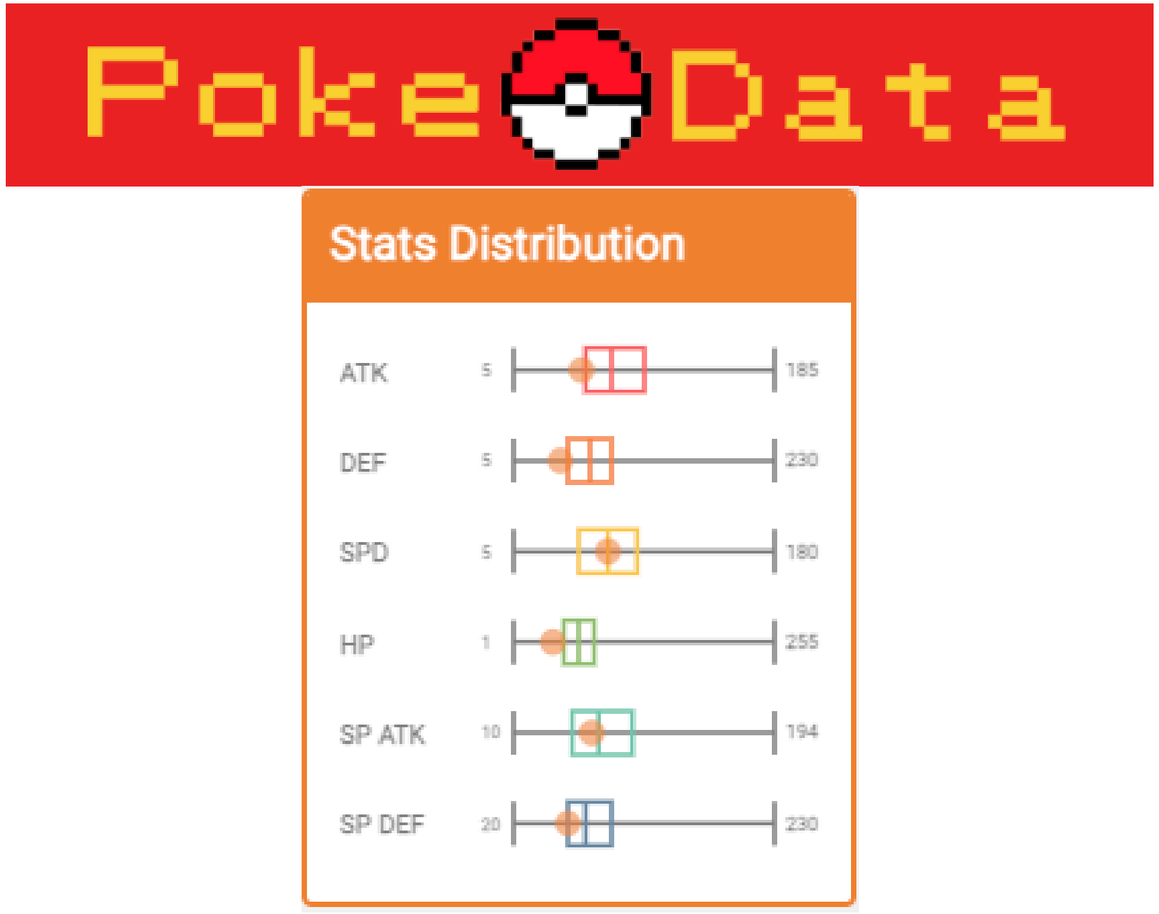
Display Space vs. Working Memory



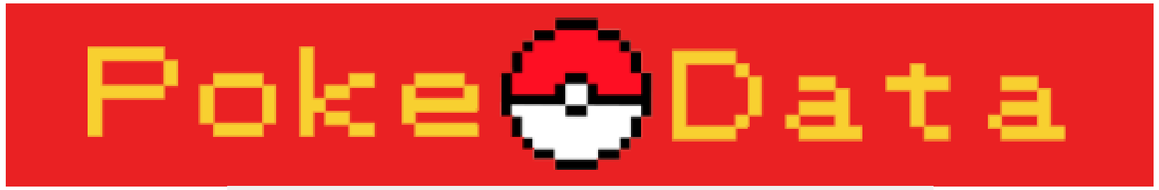
Display Space vs. Working Memory



Display Space vs. Working Memory



Display Space vs. Working Memory



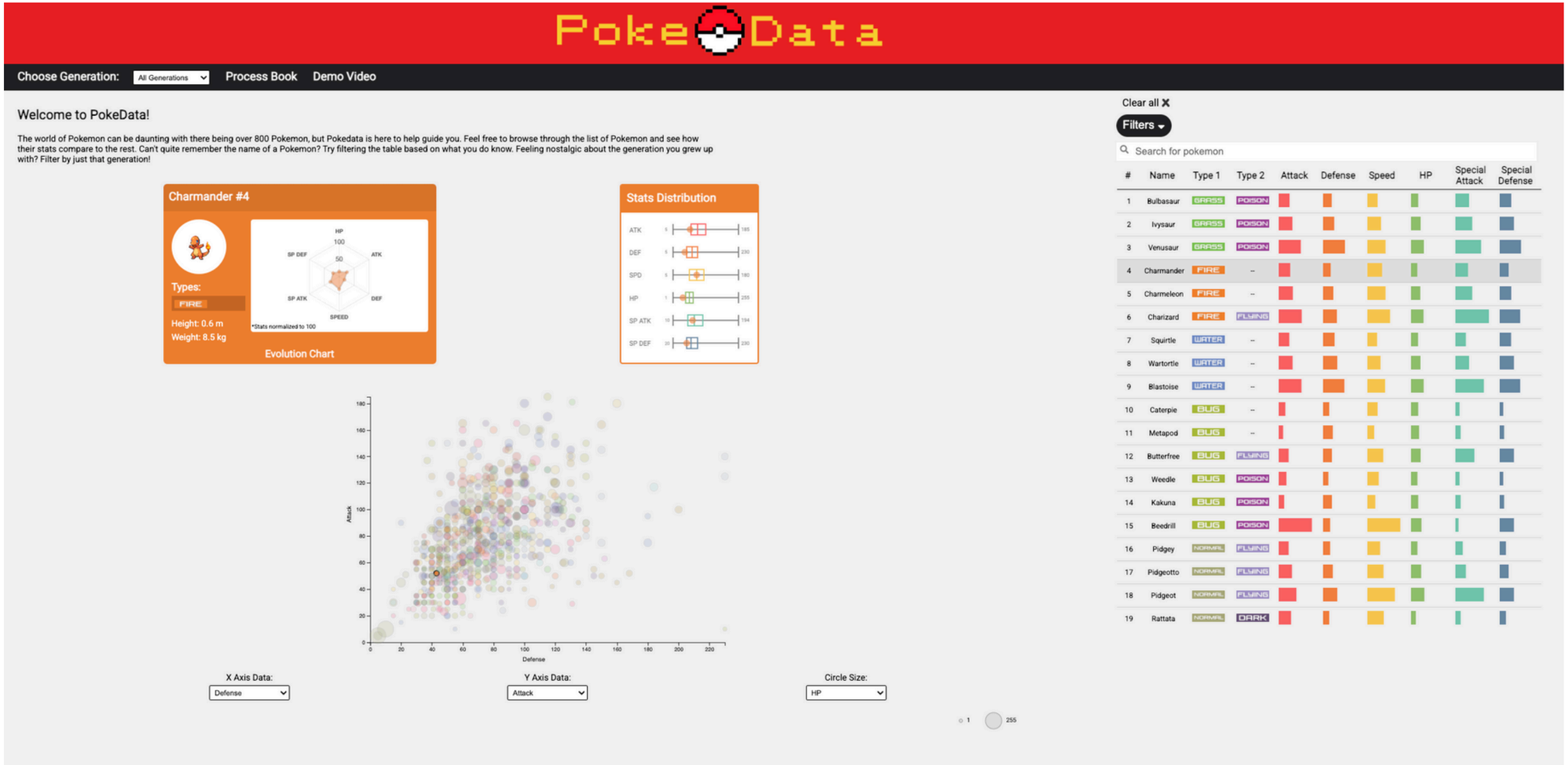
Clear all ✕

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



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

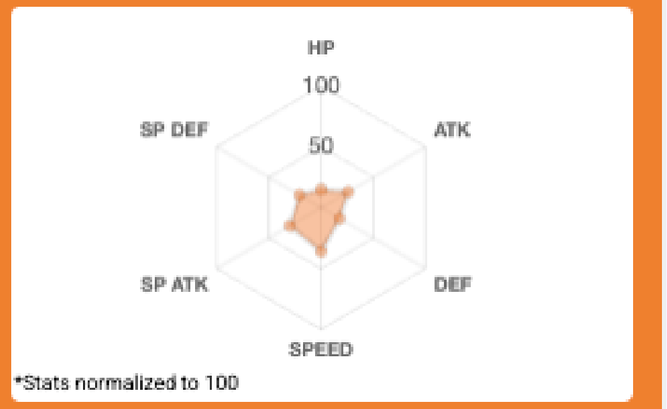
Charmander #4

Types:

FIRE

Height: 0.6 m

Weight: 8.5 kg



Evolution Chart

Beedrill #15

Types:

BUG POISON

Height: 1 m

Weight: 29.5 kg

Evolution Chart

★ Palkia #484

Types:

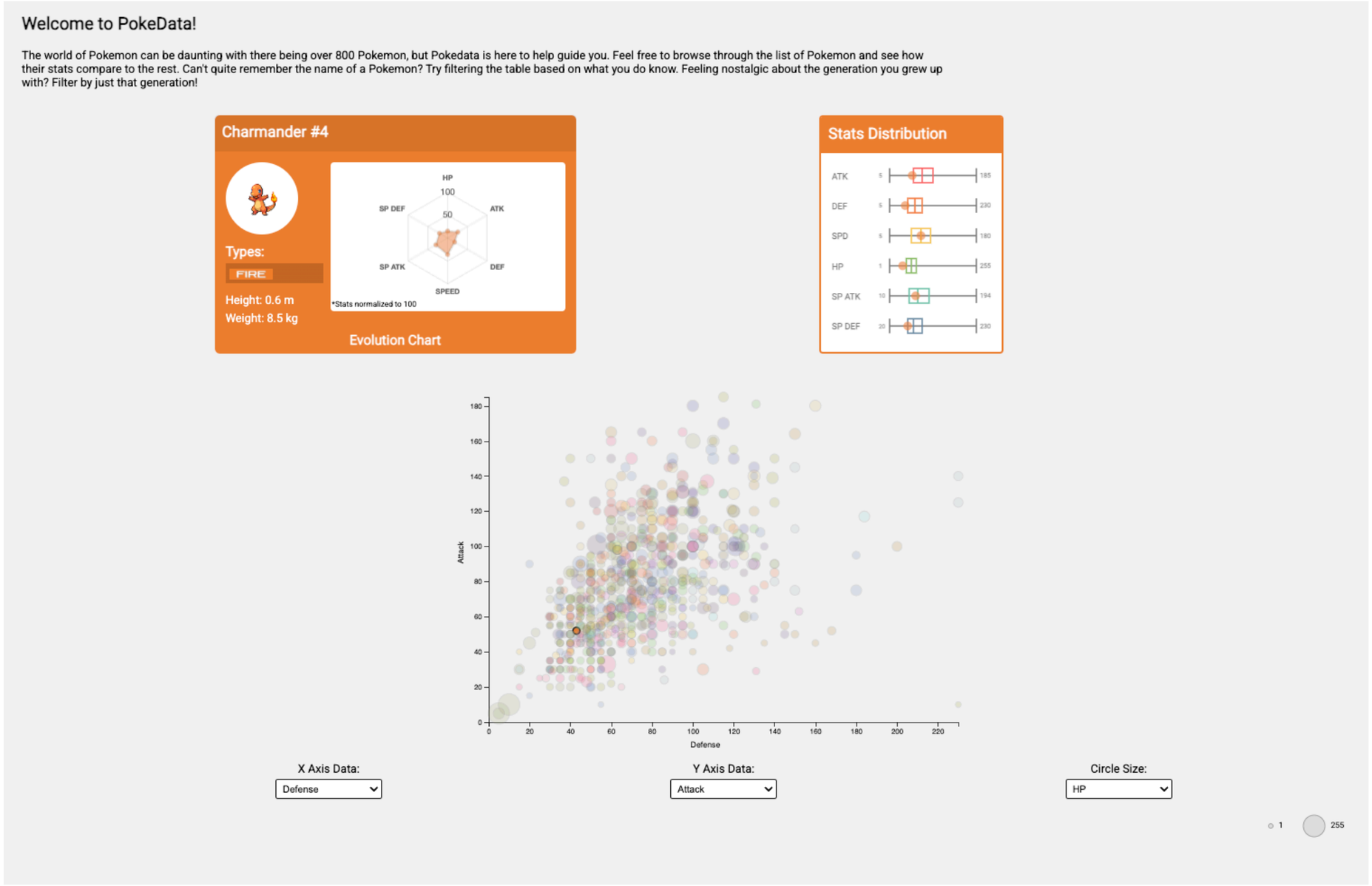
WATER DRAGON

Height: 4.2 m

Weight: 336 kg

Evolution Chart

Useful for comparison between multiple items with the same attributes



Different encodings support different tasks simultaneously

What to Show

Encoding: same or different

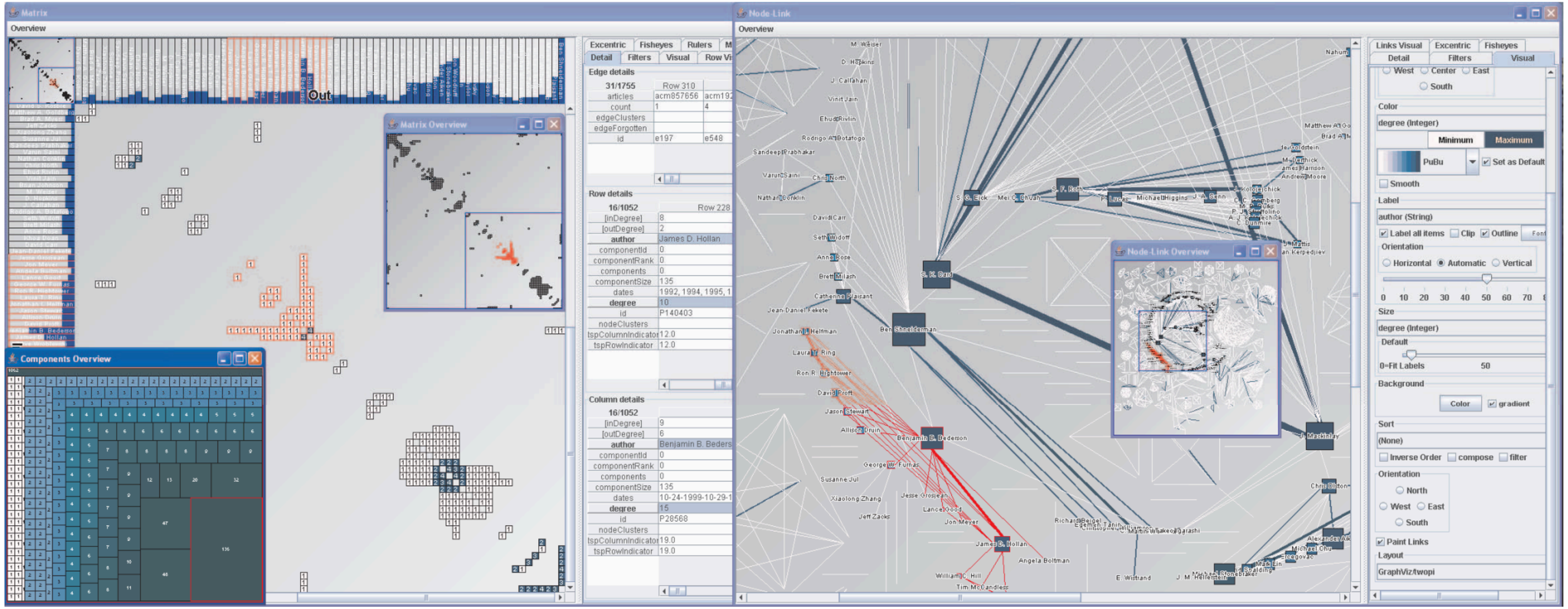
Dataset: share all, subset, or none

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

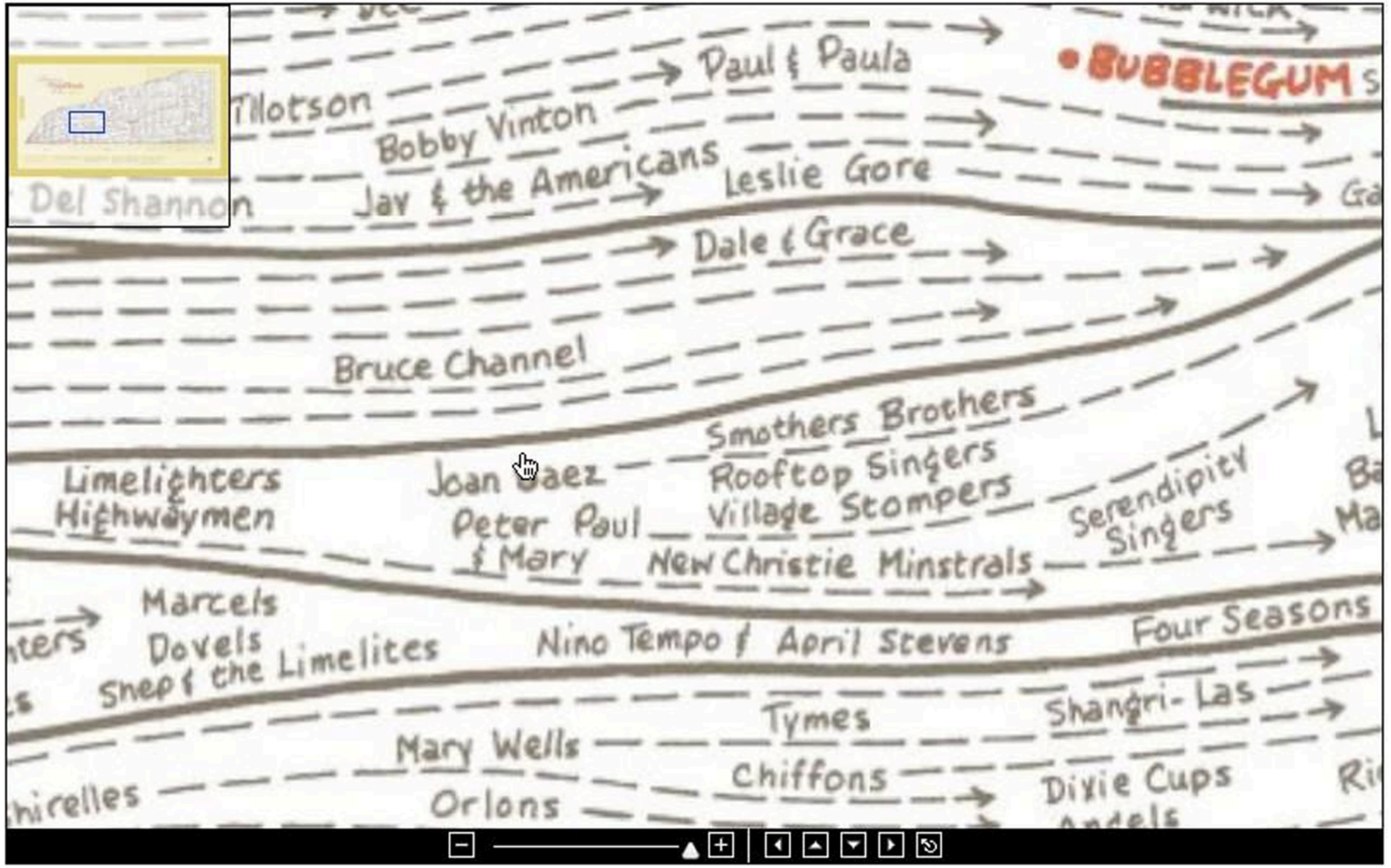
“Overview + Detail”

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

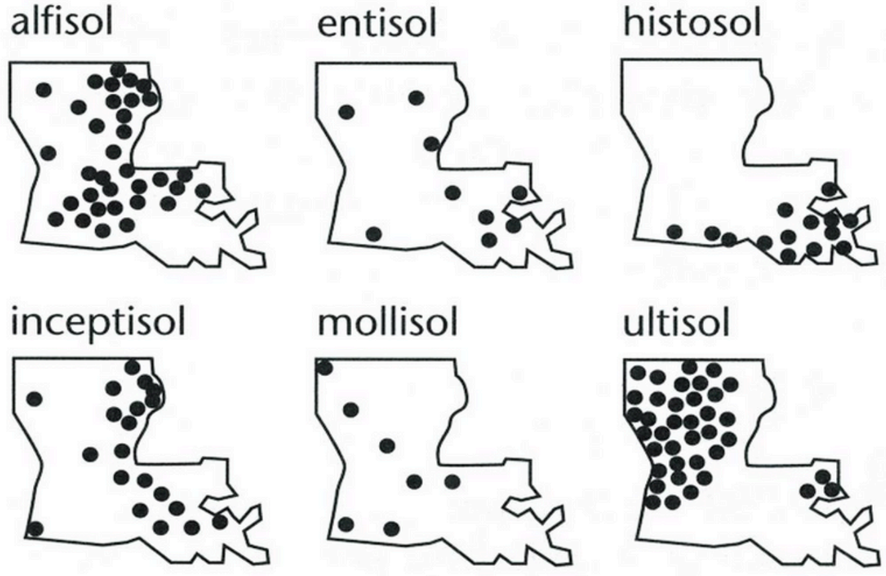
“Overview + Detail”



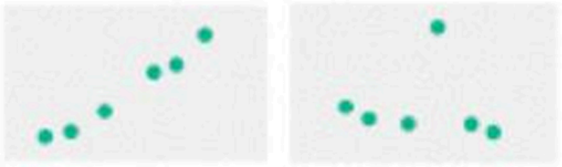
Option 3: Different views share **no** data

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

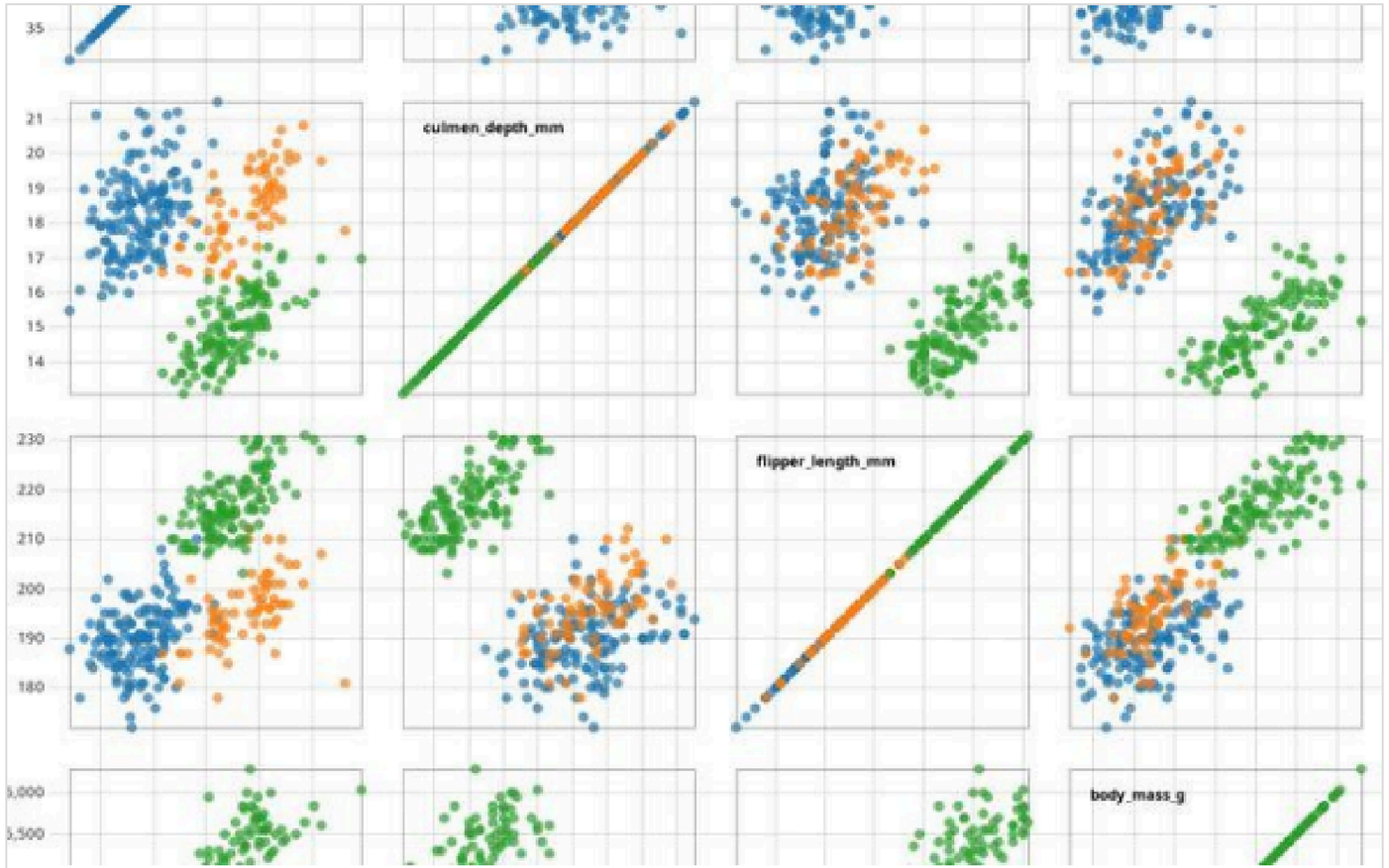
Encoding: same or different

Dataset: share all, subset, or none

How to Interact

Highlighting: to link, or not?

How to Layout

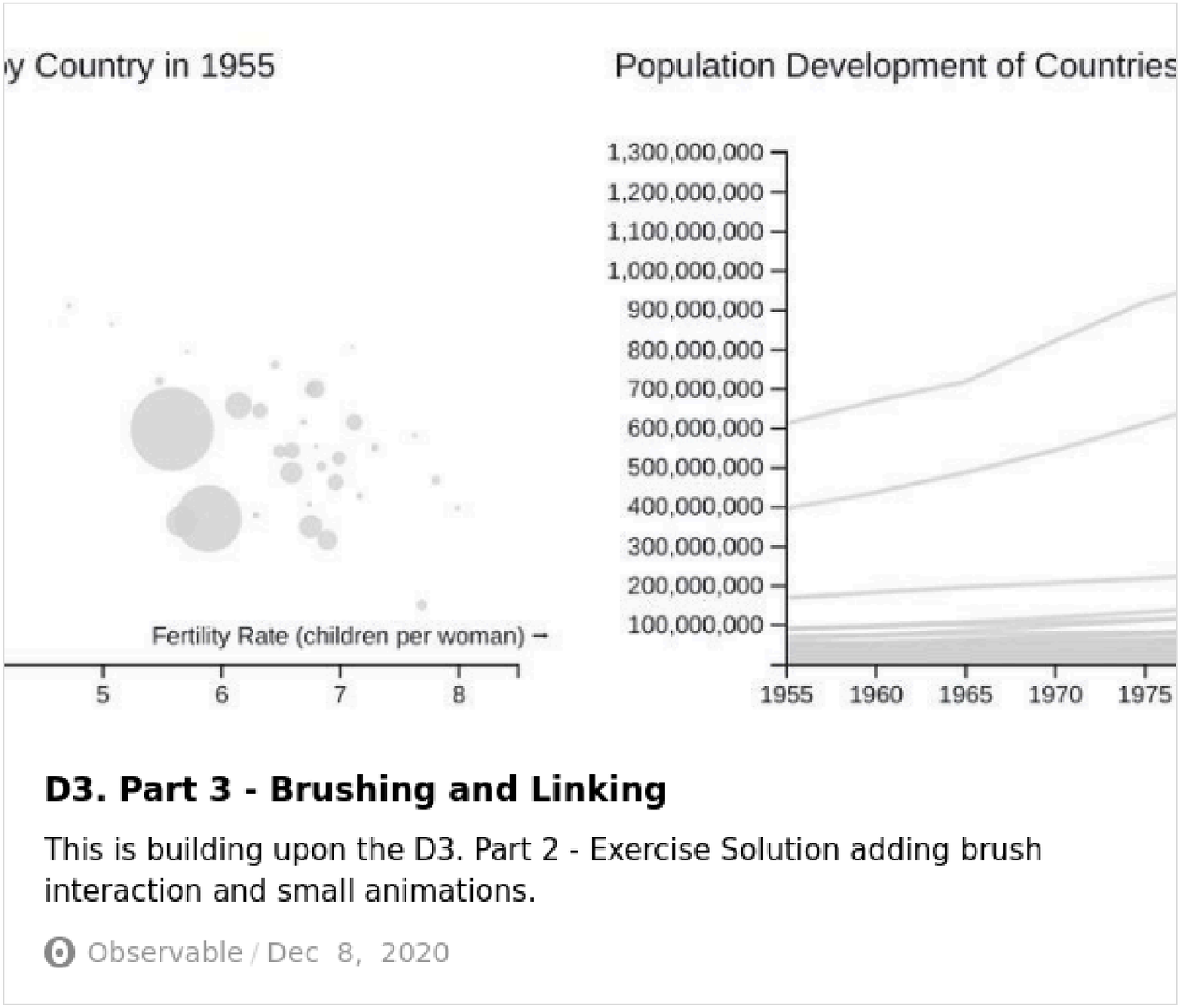


Brushable scatterplot matrix

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]



[Linked highlighting between different encodings]

What to Show

Encoding: same or different

Dataset: share all, subset, or none

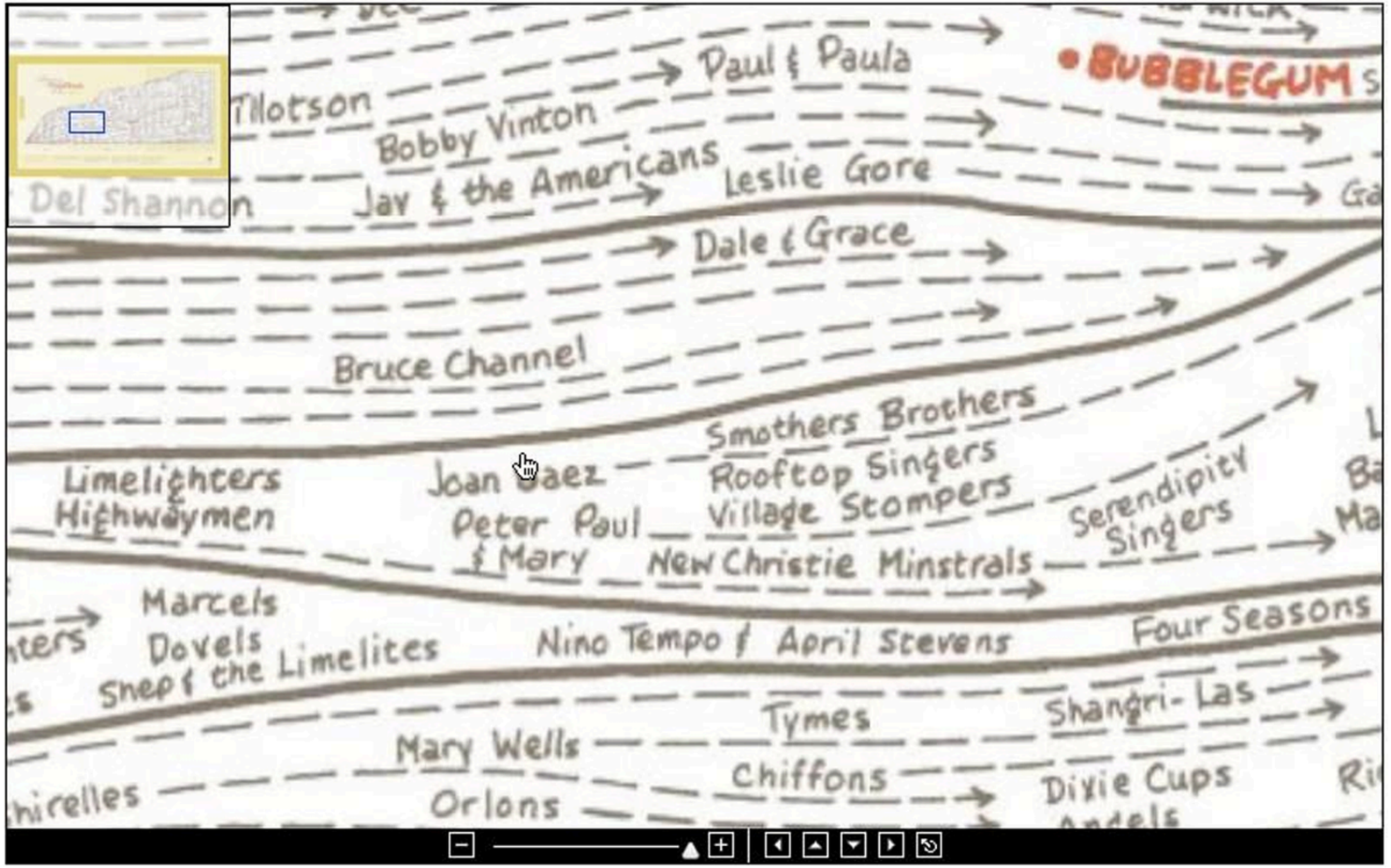
How to Interact

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

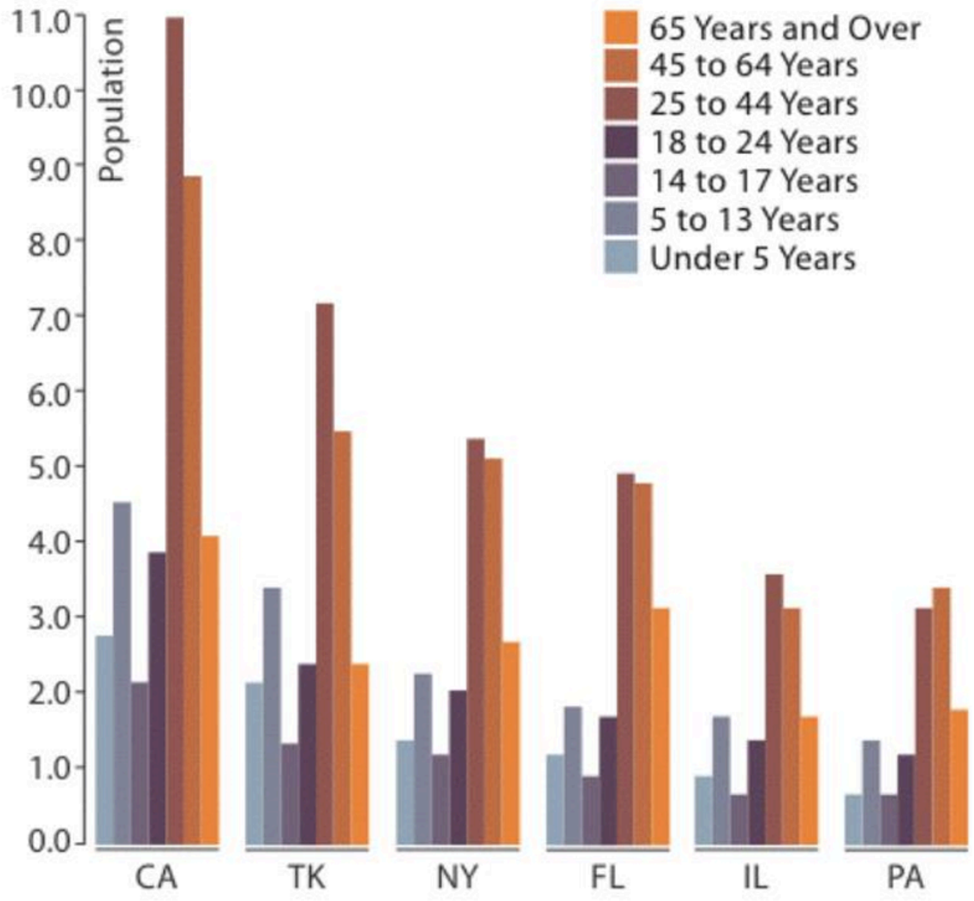
An action on the dataset that **separates the data into groups**

Design choices:

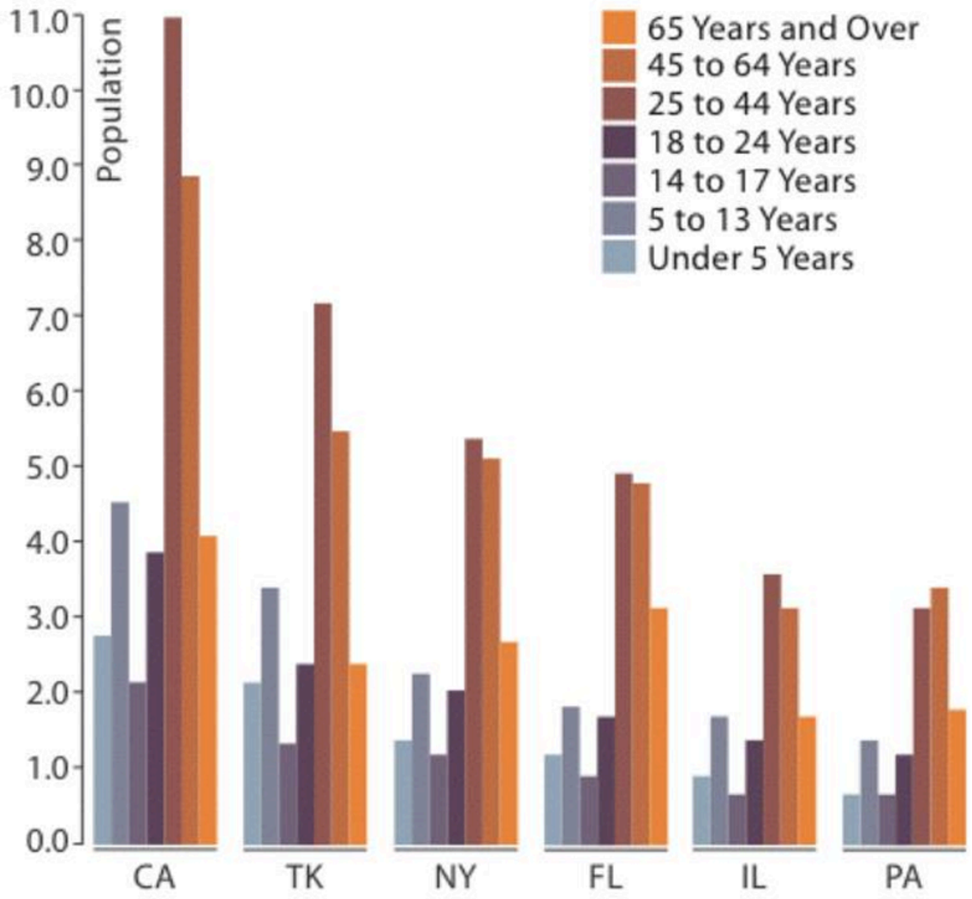
- how to divide data between views, given a hierarchy of attributes
- how many splits (and views)

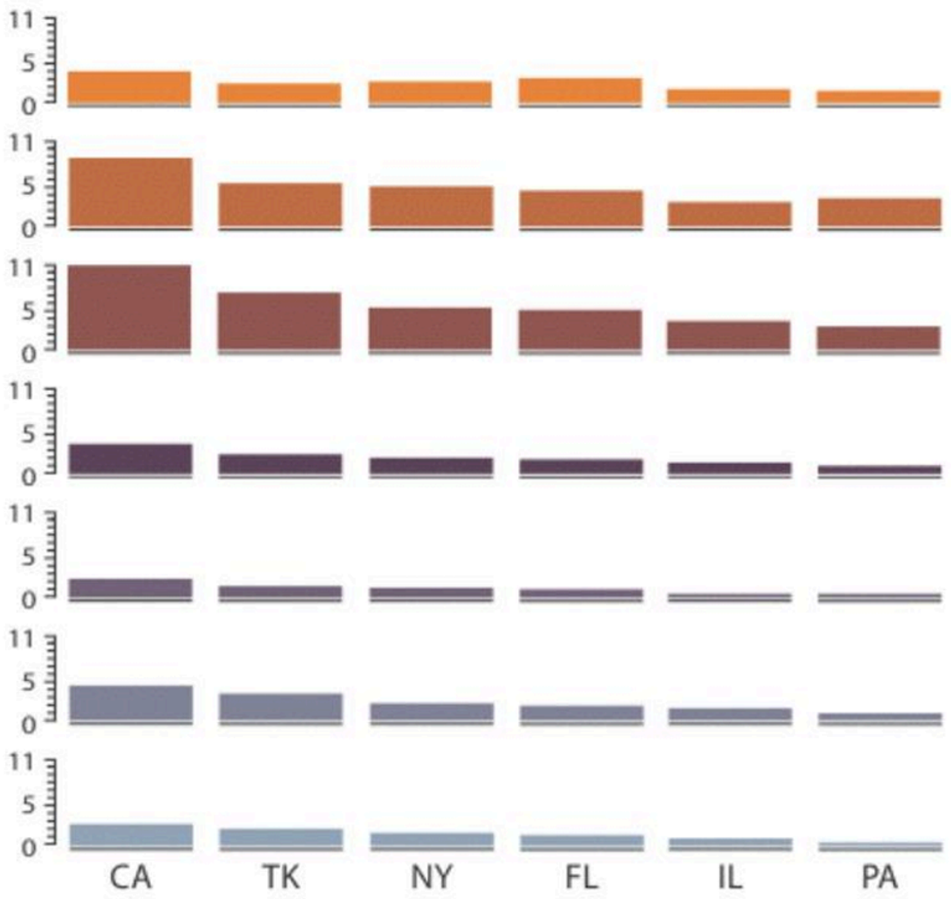
Attributes used for partitioning are typically categorical

Partitioning



Partitioning

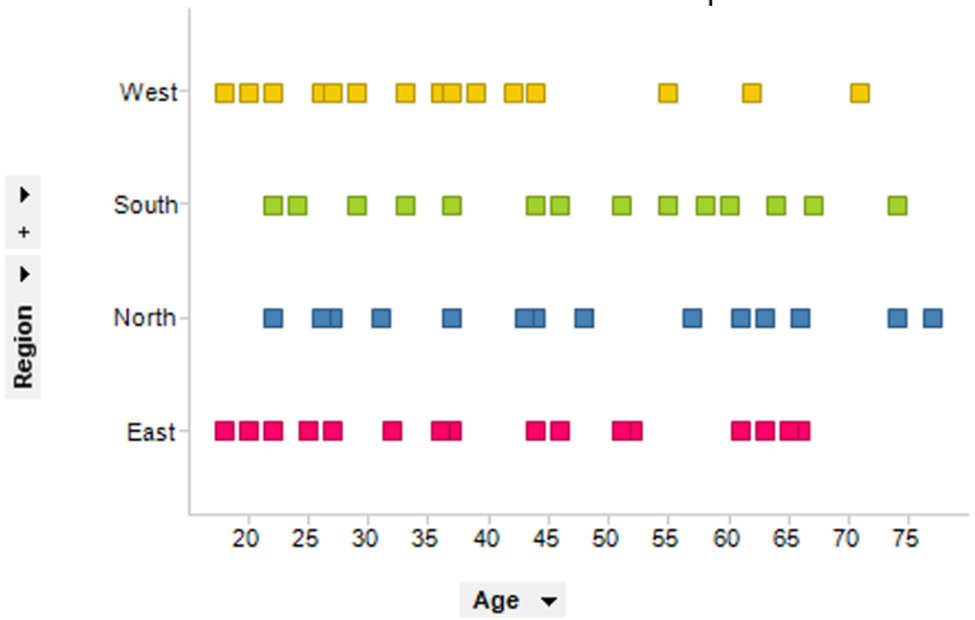




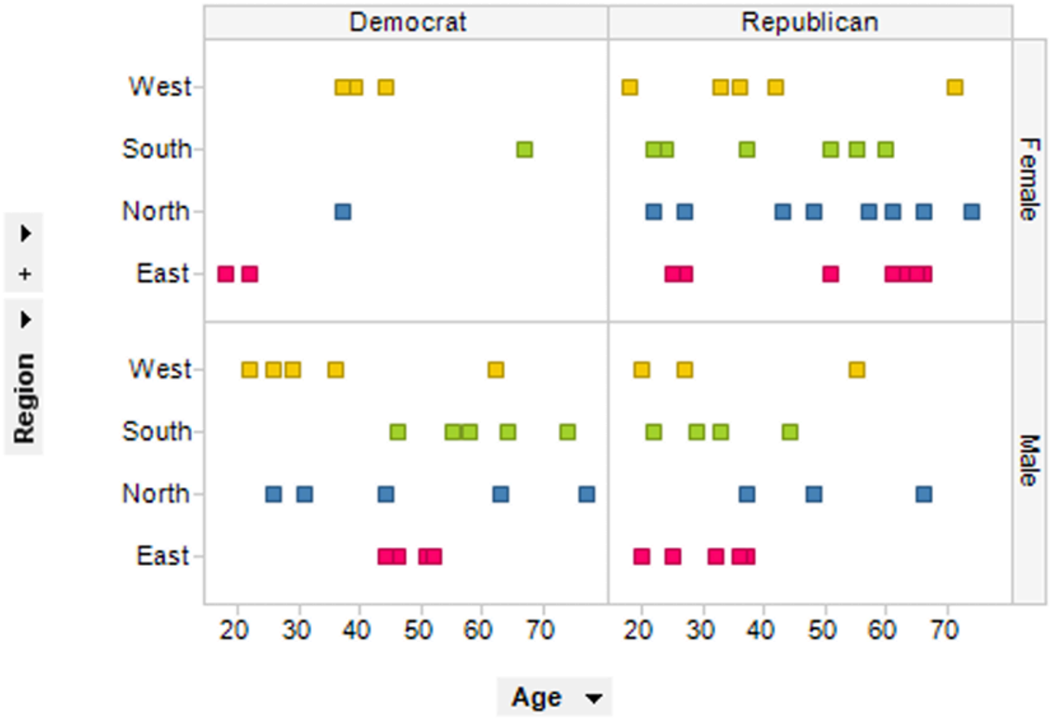
Partitioning

Partitioning

non-trellised scatter plot



trellising this visualization based on
Gender and Political affiliation



Partitioning: Recursive Subdivision

Dataset: UK Housing Data

Split by **neighborhood**

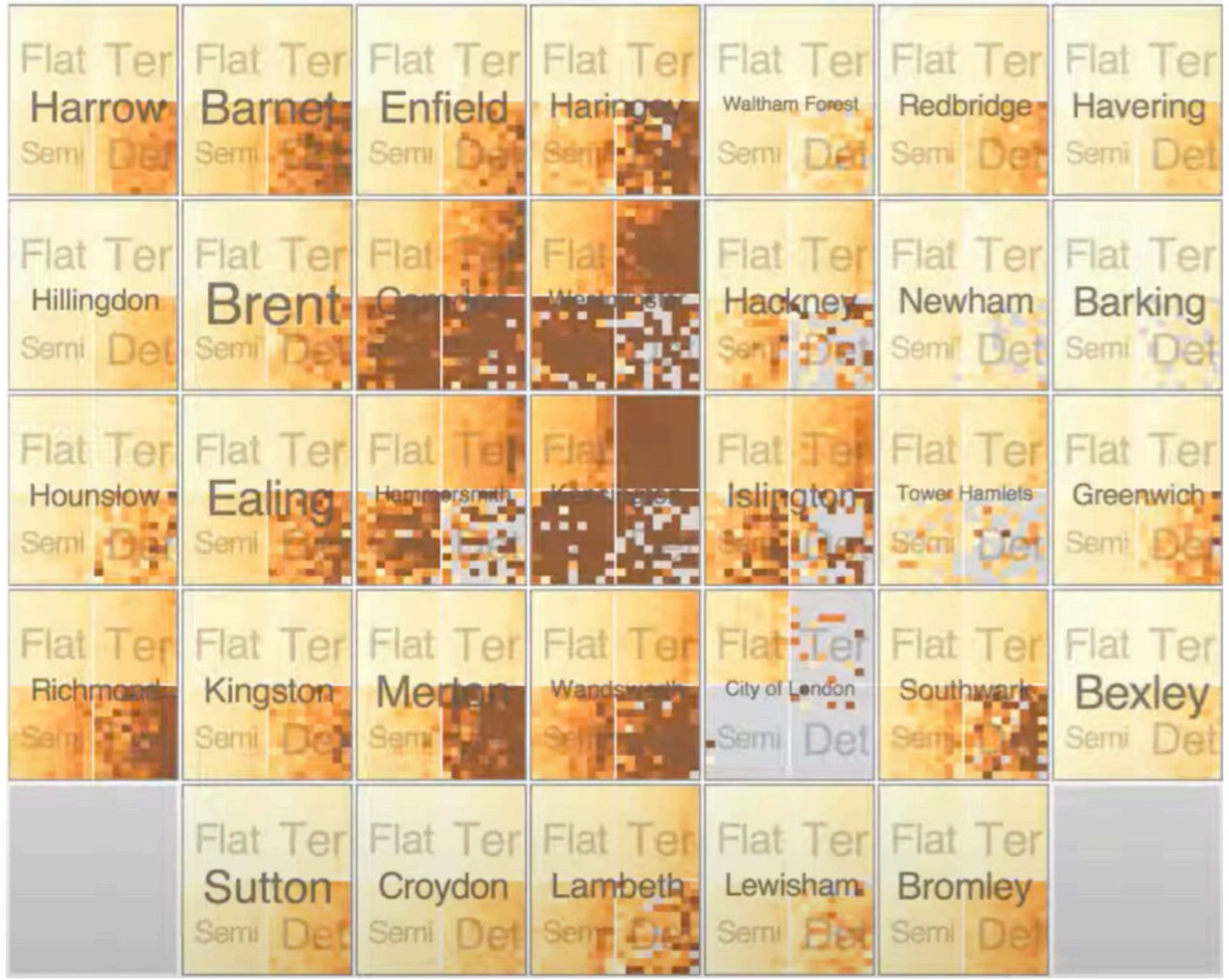
Then by **type**

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

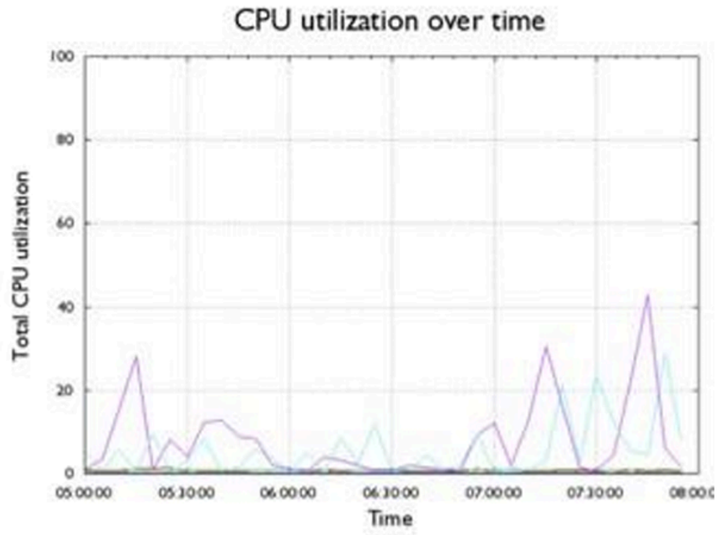
Layering (Superimpose)

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

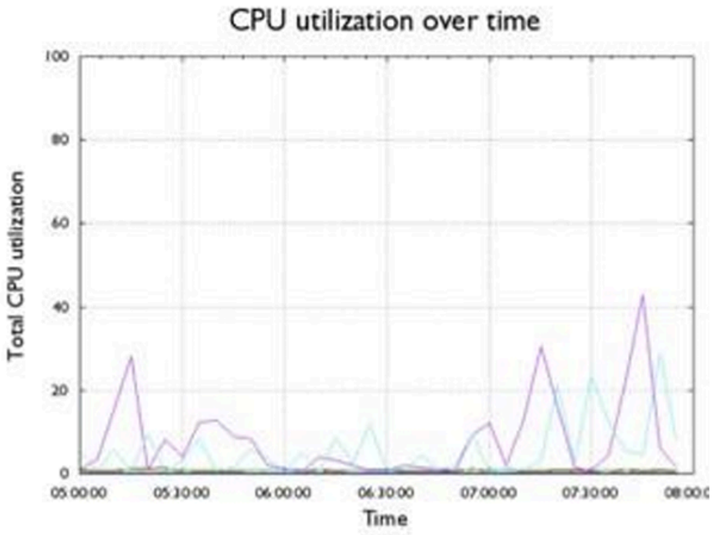
- supports a larger, more-detailed view than using multiple separate views

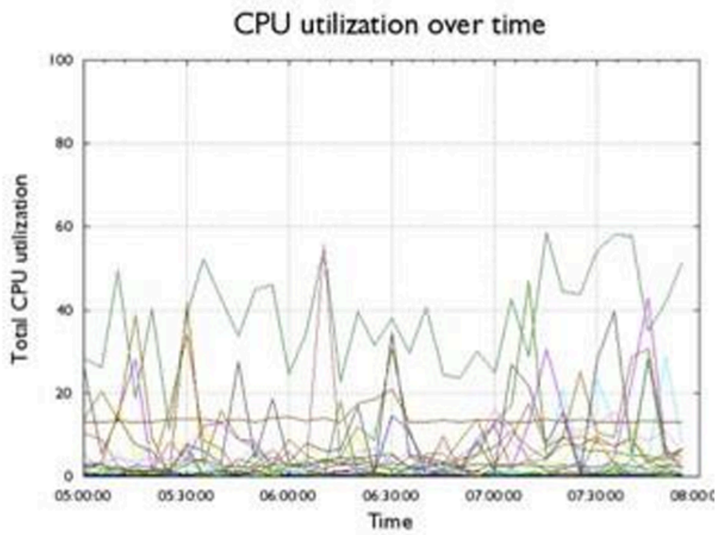
Trade-off: Visual encodings and number of layers are constrained

Static Layering: Overlays

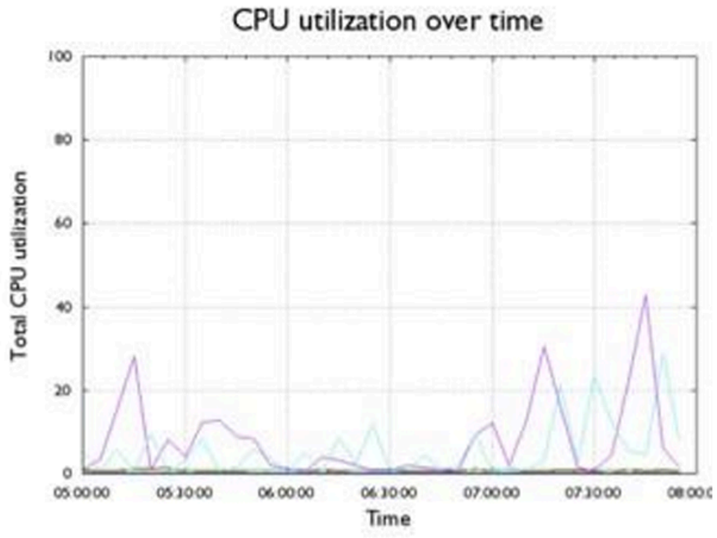


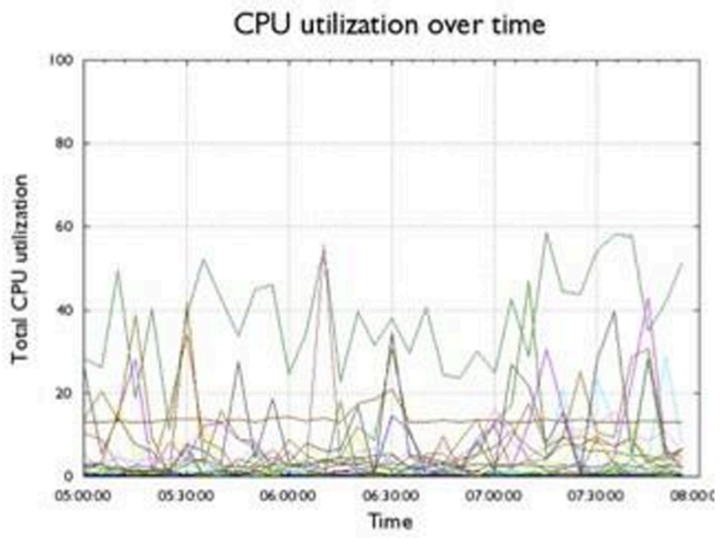
Static Layering: Overlays

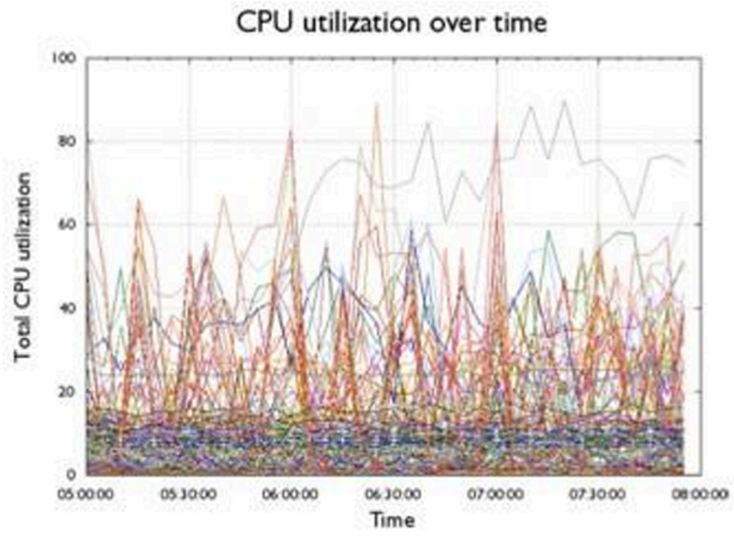




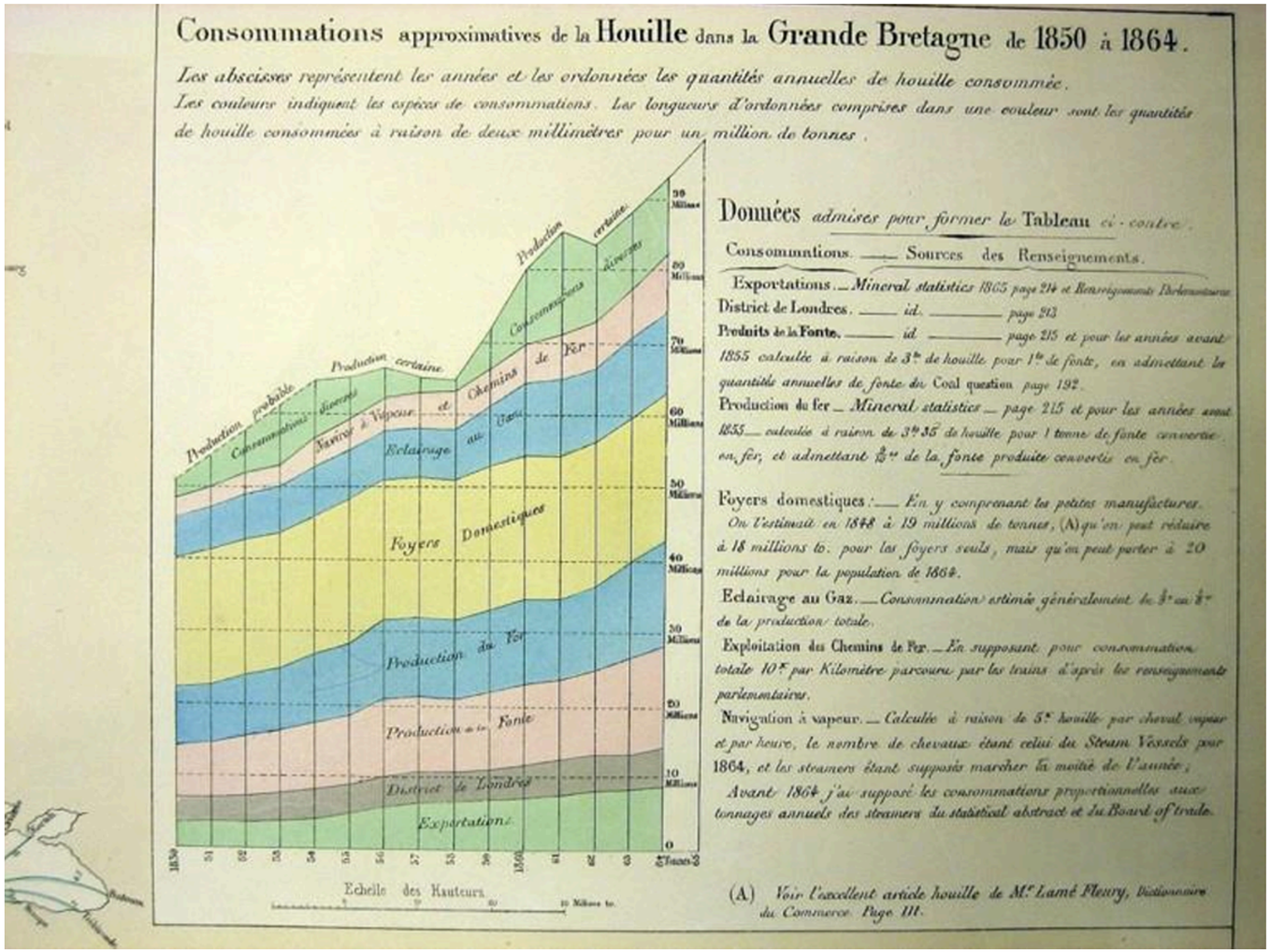
Static Layering: Overlays







Static Layering: Item-Level Stacking



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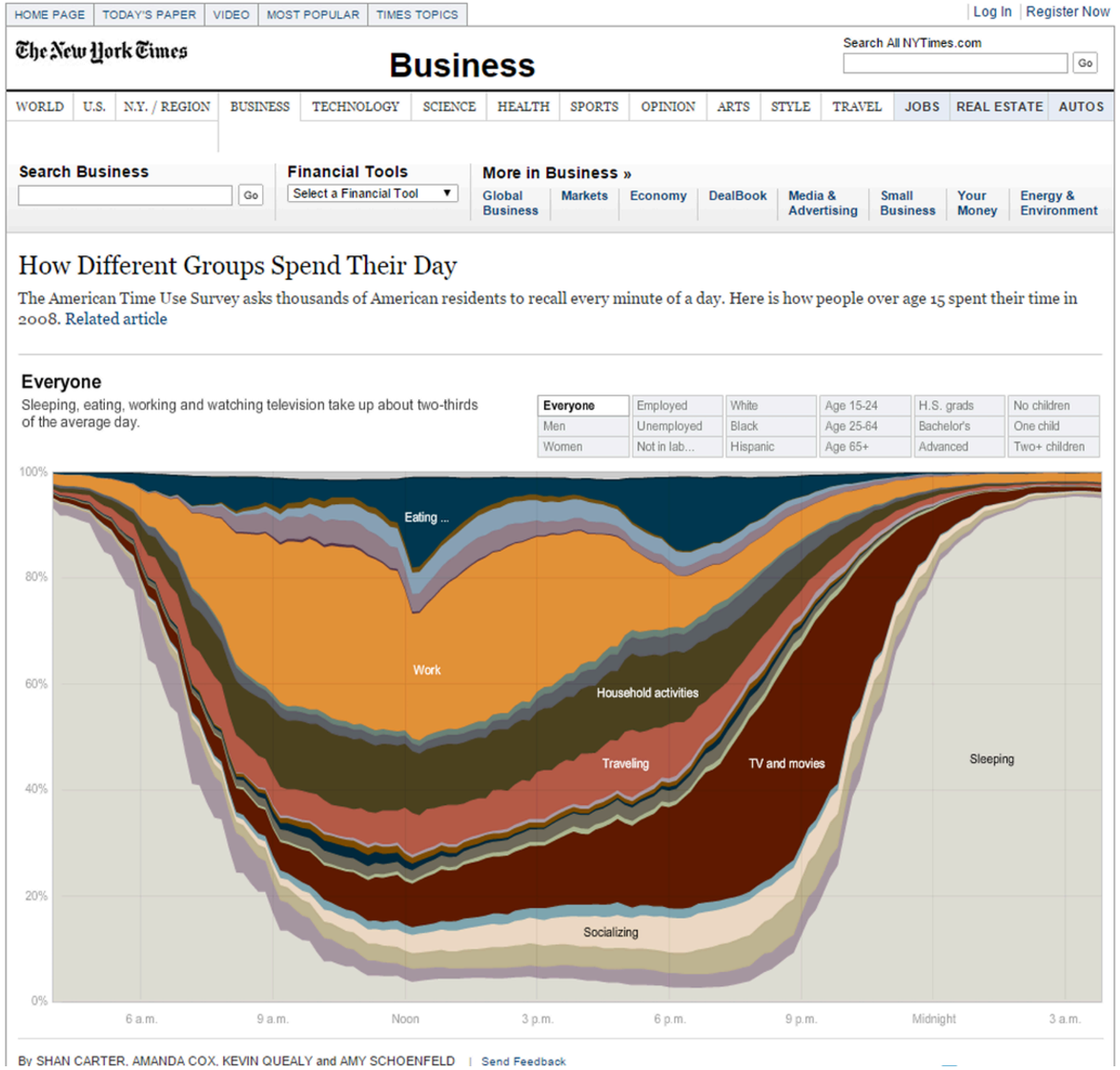
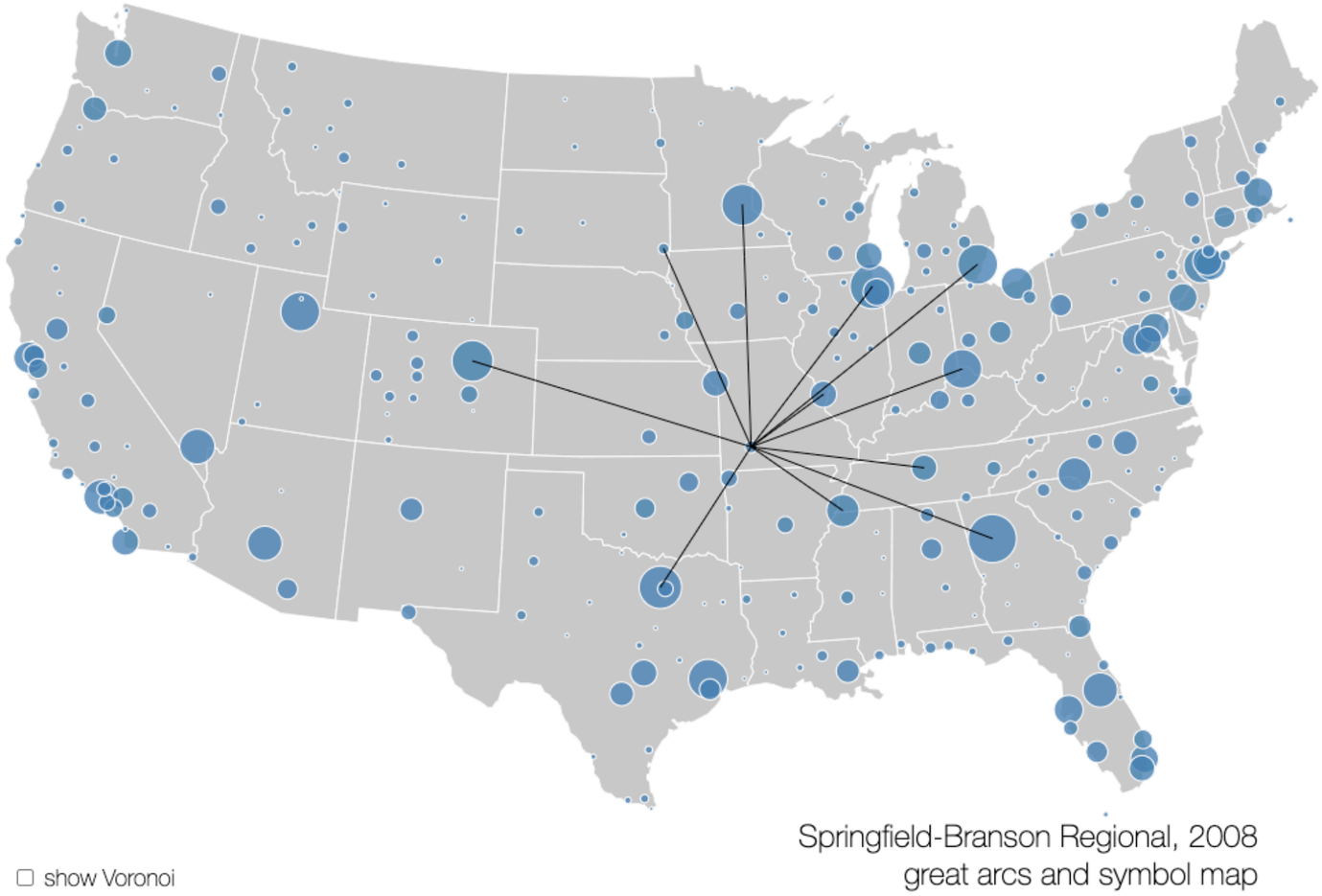


Dynamic Layering (On Demand)



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

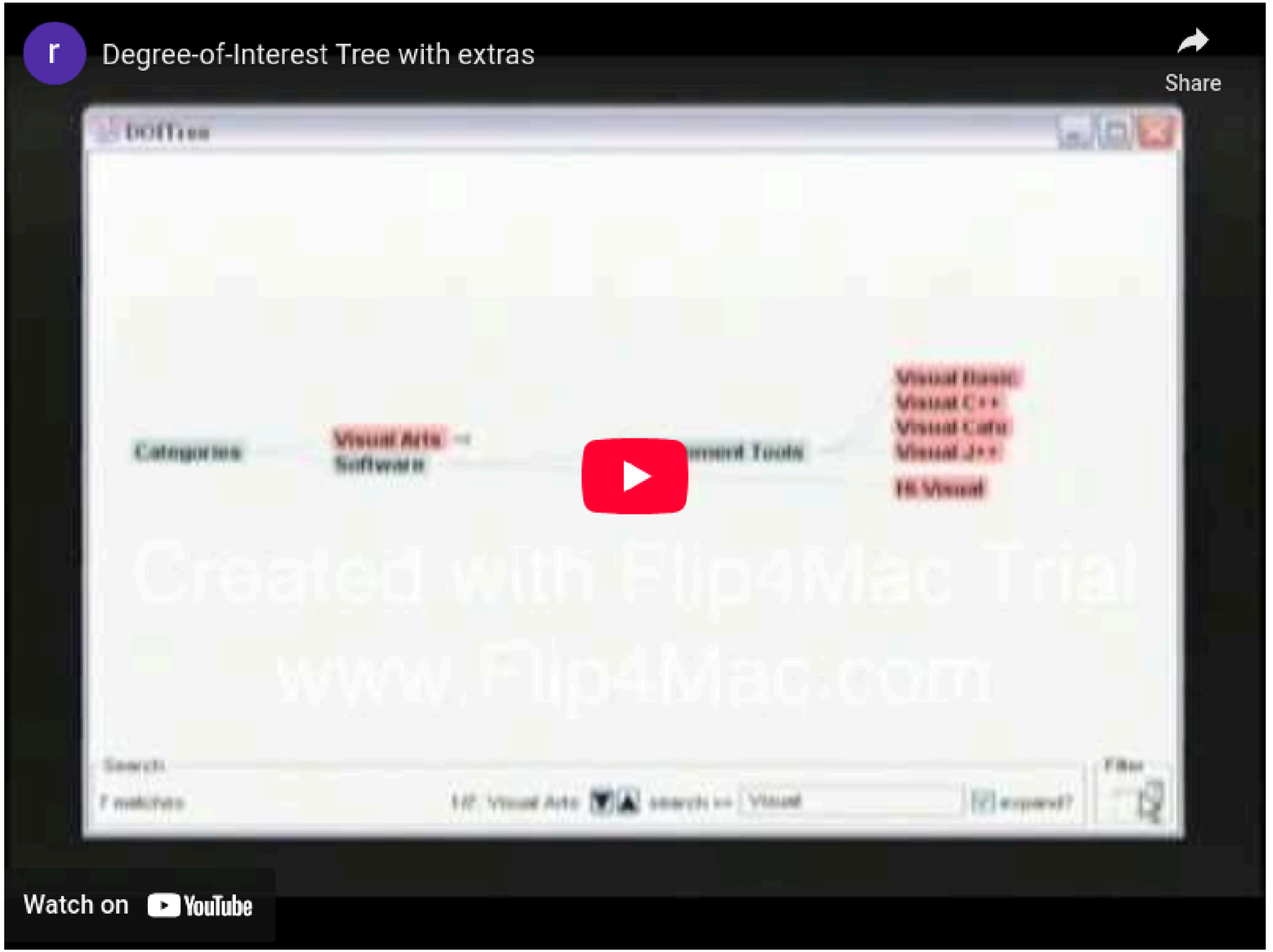
Elide (or Suppress) Data

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**

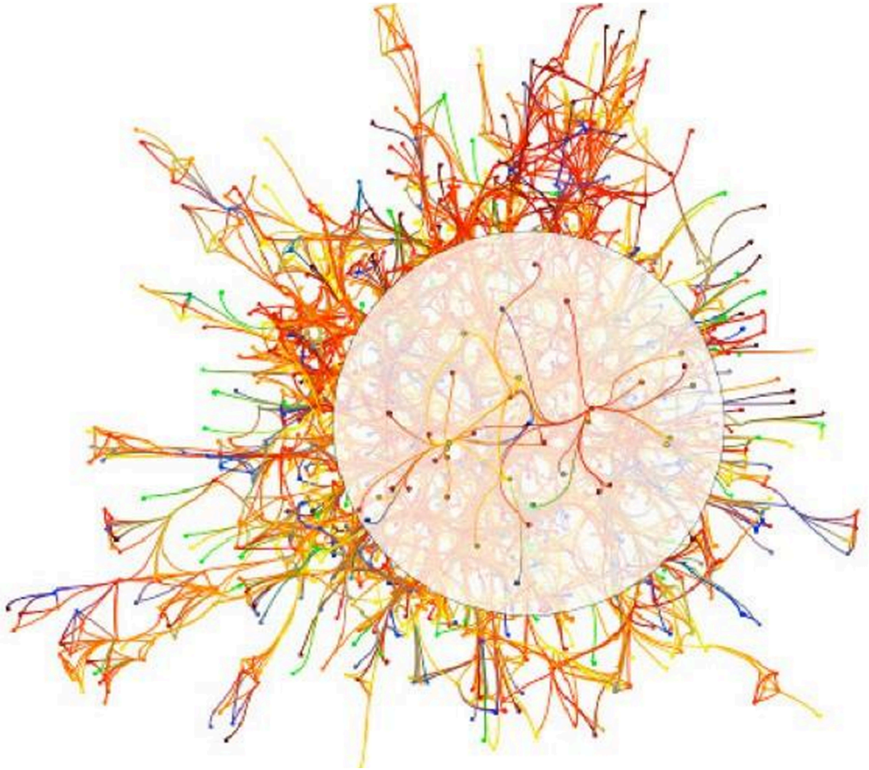
Elision


r
Degree-of-Interest Tree with extras
Share
Watch on YouTube

Superimposed “Focus” Layer

Focus on a single layer (region) of the view

Magnification



Highlight / Suppress

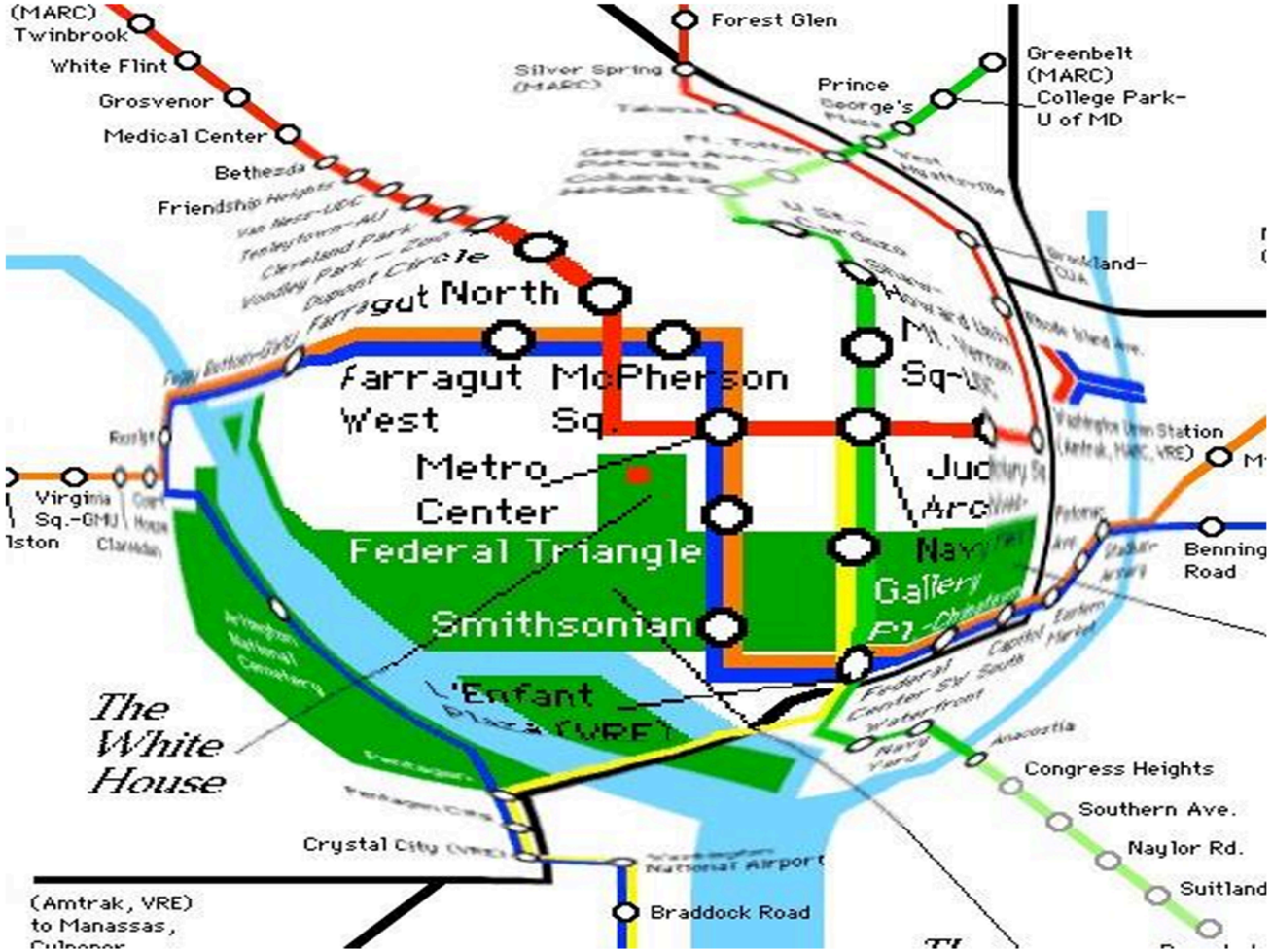
Distort Geometry

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

Note: Distortion is unsuitable for comparing relative spatial differences

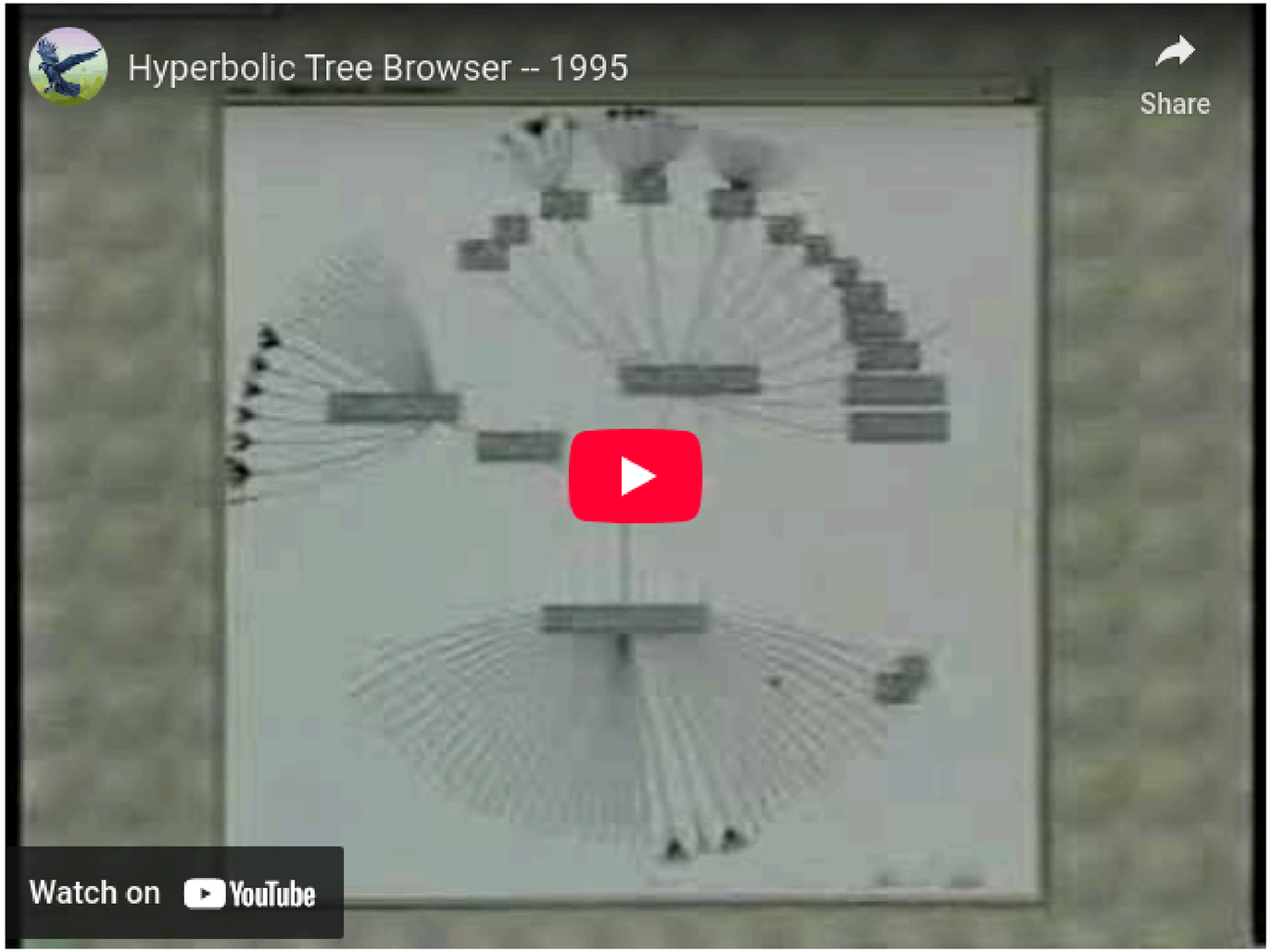
Distort Geometry

Fisheye



Distort Geometry

Hyperbolic Geometry



FIN

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