

INTERACTIONS, VIEWS

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Interactions

Most datasets are too big to show everything at once

Interacting with your data amplifies cognition

We develop a “feeling” as we touch the data

It is easier to observe causality between data points

The Disciplines of **User Experience Design**



Interaction Methods

How do you plan on interacting with your viz?

Mouse / keyboard

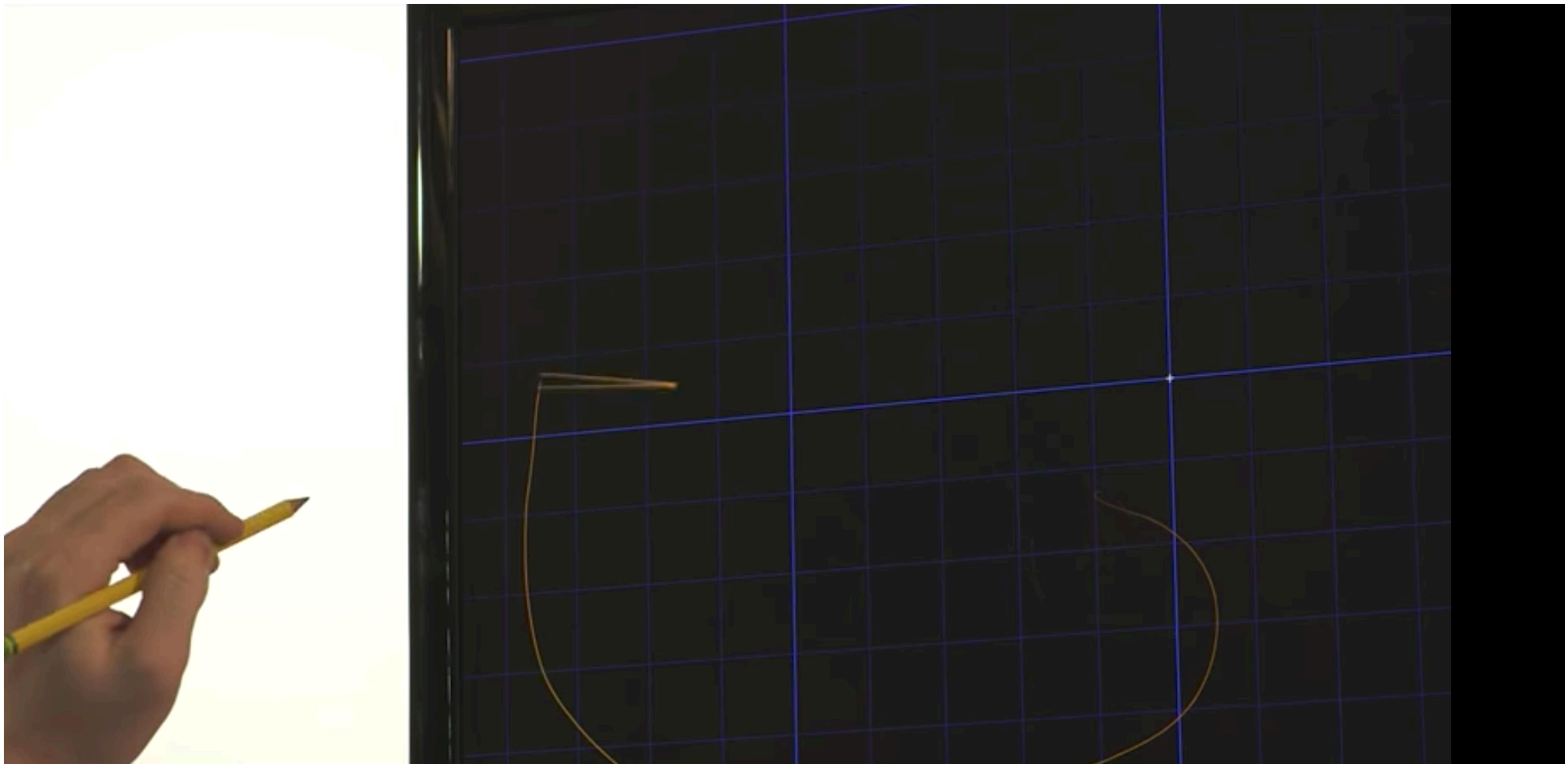
Touch / mobile

Gestures

VR / Kinect / Leap motion







Some definitions

Filtering: showing a part of the dataset via a dynamic query on its properties or attributes

Brushing: selecting a subset of the data items with an input device

Linking: showing how subset of the data items behaves in other views

Aggregation: showing visual representations of subsets of the data



Interaction examples



Faceted (navigational) search

Dynamic queries that use semantic categories organized in a hierarchical structure (taxonomy)

Define criteria for inclusion exclusion (AND, OR, XOR)

Under-the-hood complex database search queries

The screenshot shows a faceted search interface for "Digital cameras". At the top, a header reads "Digital cameras". Below it is a section titled "Refine your results" with a "Manufacturer" facet. The manufacturer facet shows the following values:

- Canon USA (5)
- Sony (2)
- Nikon (2)
- Olympus (6)
- Pentax (2)

Below the manufacturer facet are "Resolution" and "Zoom range" facets, each with their own list of values. To the right, a "More" section lists additional constraints: LCD size, Image stabilizer, Flash memory, Still image format, and Maximum ISO. A "See all >" link is also present. At the bottom, a "Regular search results list" shows 17 results for a search with filters applied: "you selected: \$400 - \$500" and "SLR". The results list includes a camera icon, the product name "Canon EOS Rebel XS (silver, with 18-55mm lens)", the price "\$459 to \$699", and "at 15 stores". Navigation buttons "1 2 next" and a "COMPARE SELECTED" button are also visible.

Manufacturer is a **facet**, a way of categorizing the results

Canon, Sony, and Nikon are **constraints**, or facet values

The **breadcrumb** trail shows what constraints have already been applied and allows for their removal

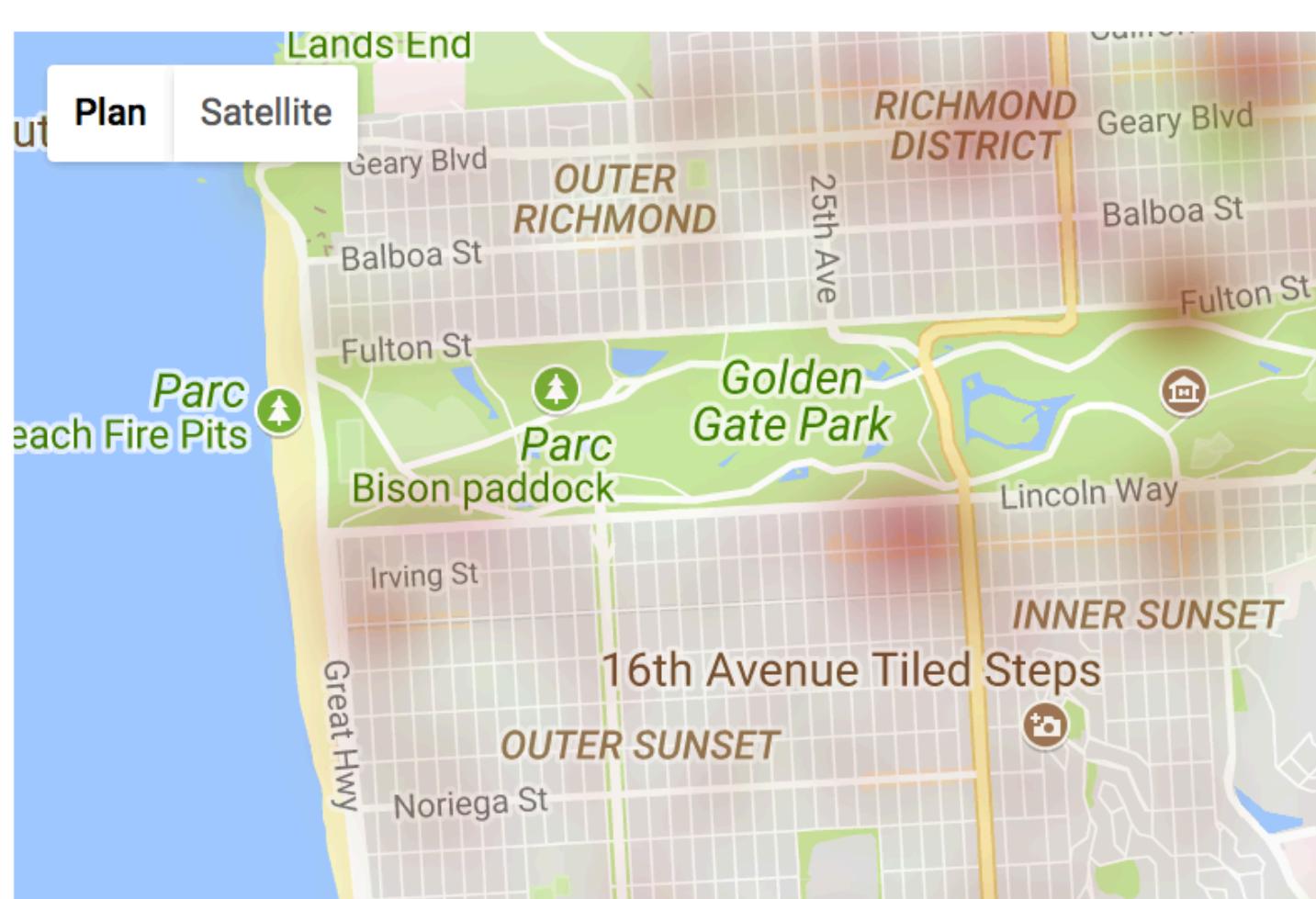
The **facet count** or constraint count shows how many results match each value

Faceted (navigational) search

 **Elasticsearch demo: SF Crime Heatmap**

Play along with our [Elasticsearch Significant Terms](#) demo using [Reporting](#). Add layers and try activating and deactivating Significant Terms: [our blogpost](#) for more details.

Year: 2015



Category

- Larceny/Theft
- Other Offenses
- Non-Criminal
- Assault
- Drug/Narcotic**
- Vehicle Theft
- Vandalism
- Warrants
- Burglary
- Suspicious Occ
- Missing Person
- Robbery
- Fraud
- Forgery/Counterfeiting
- Secondary Codes
- Weapon Laws
- Prostitution
- Trespass
- Stolen Property
- Sex Offenses, Forcible
- Drunkenness
- Disorderly Conduct

PD Crime Incident X

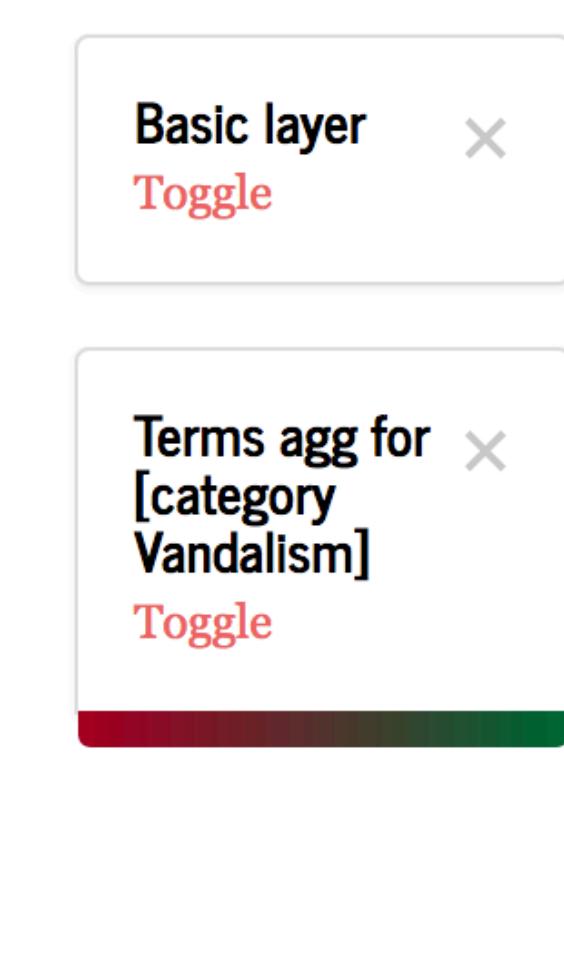
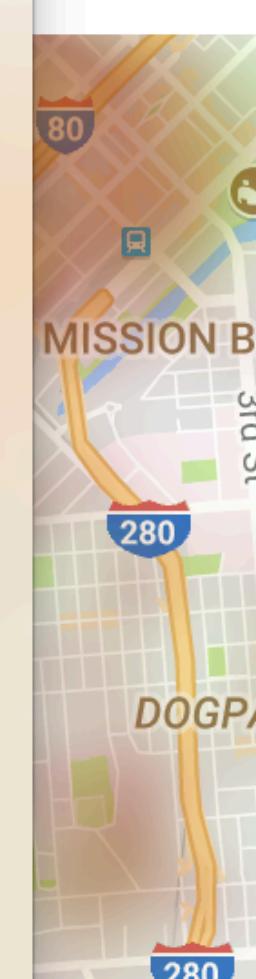
Significant Terms: Add layer

Basic layer X

Toggle

Terms agg for [category Vandalism] X

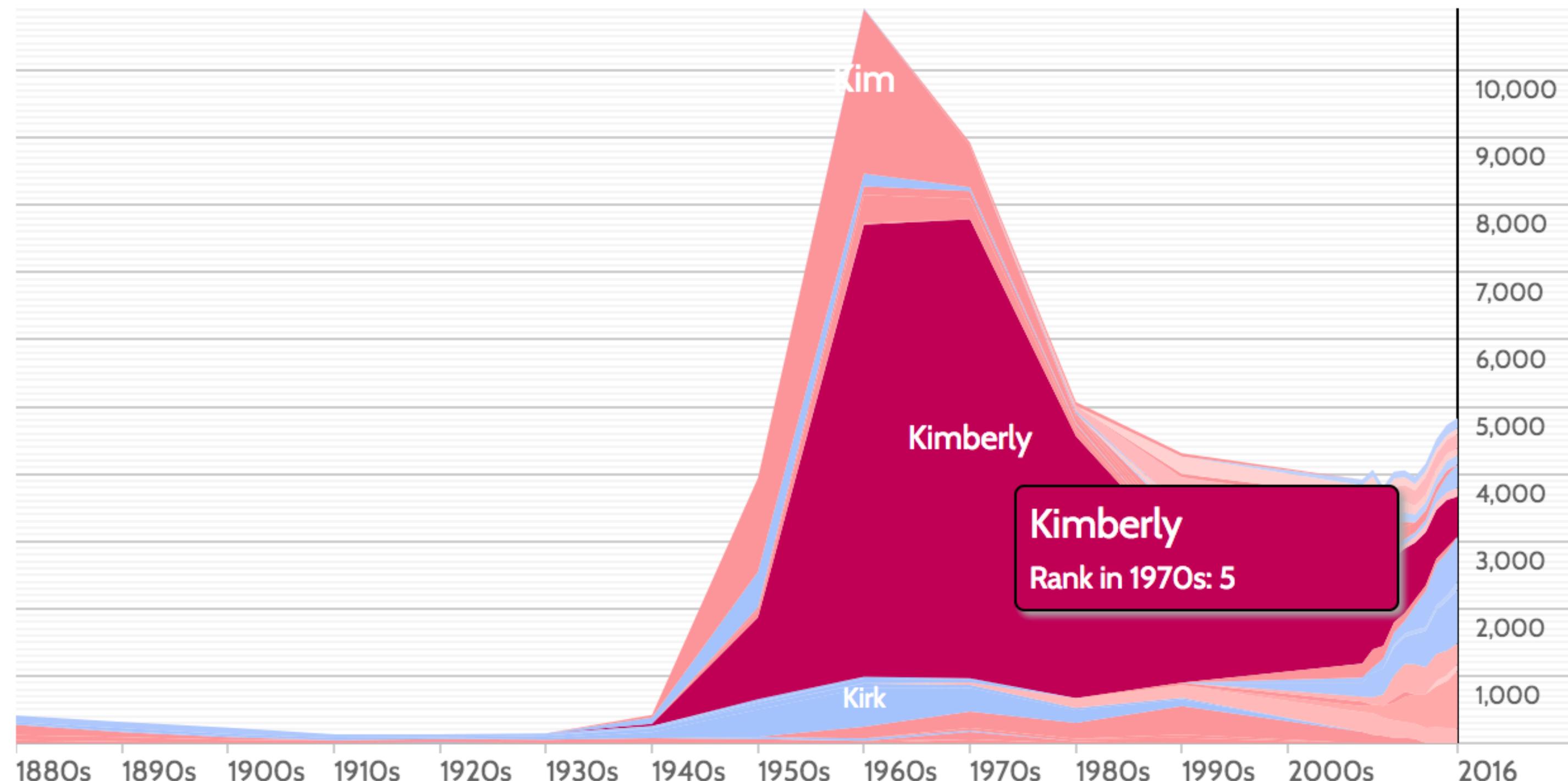
Toggle



Incremental text-search

Baby Name > Both Boys Girls

Names starting with 'KI' per million babies



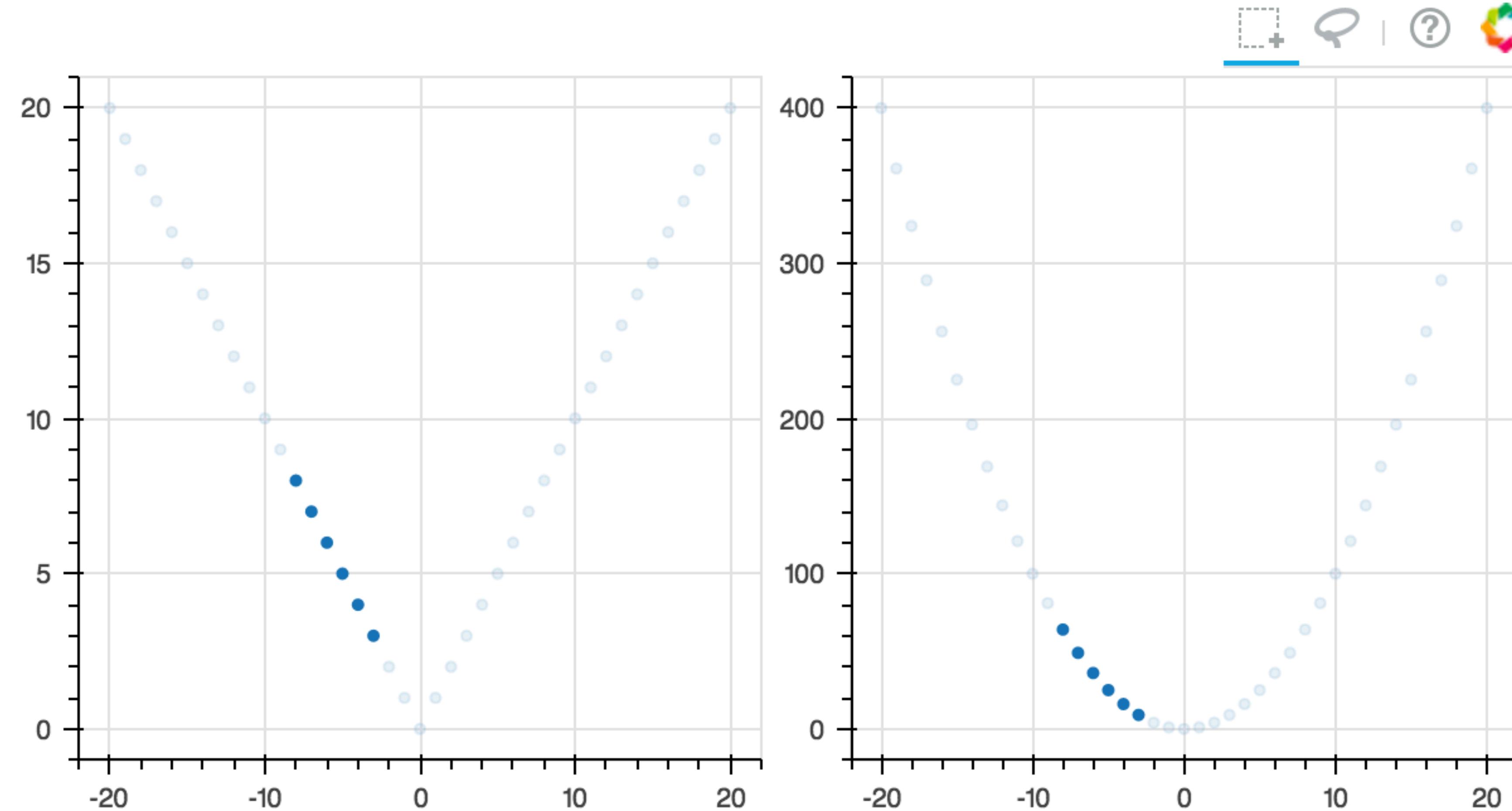
Current rank:

Baby Name > Both Boys Girls

No names 'KIRELL' ranked in the top 1,000 in any time period.
Please type backspace and try a new search!

No names 'KIRELL' ranked in the top 1,000 in any time period.
Please type backspace and try a new search!

Linked plots, brushing

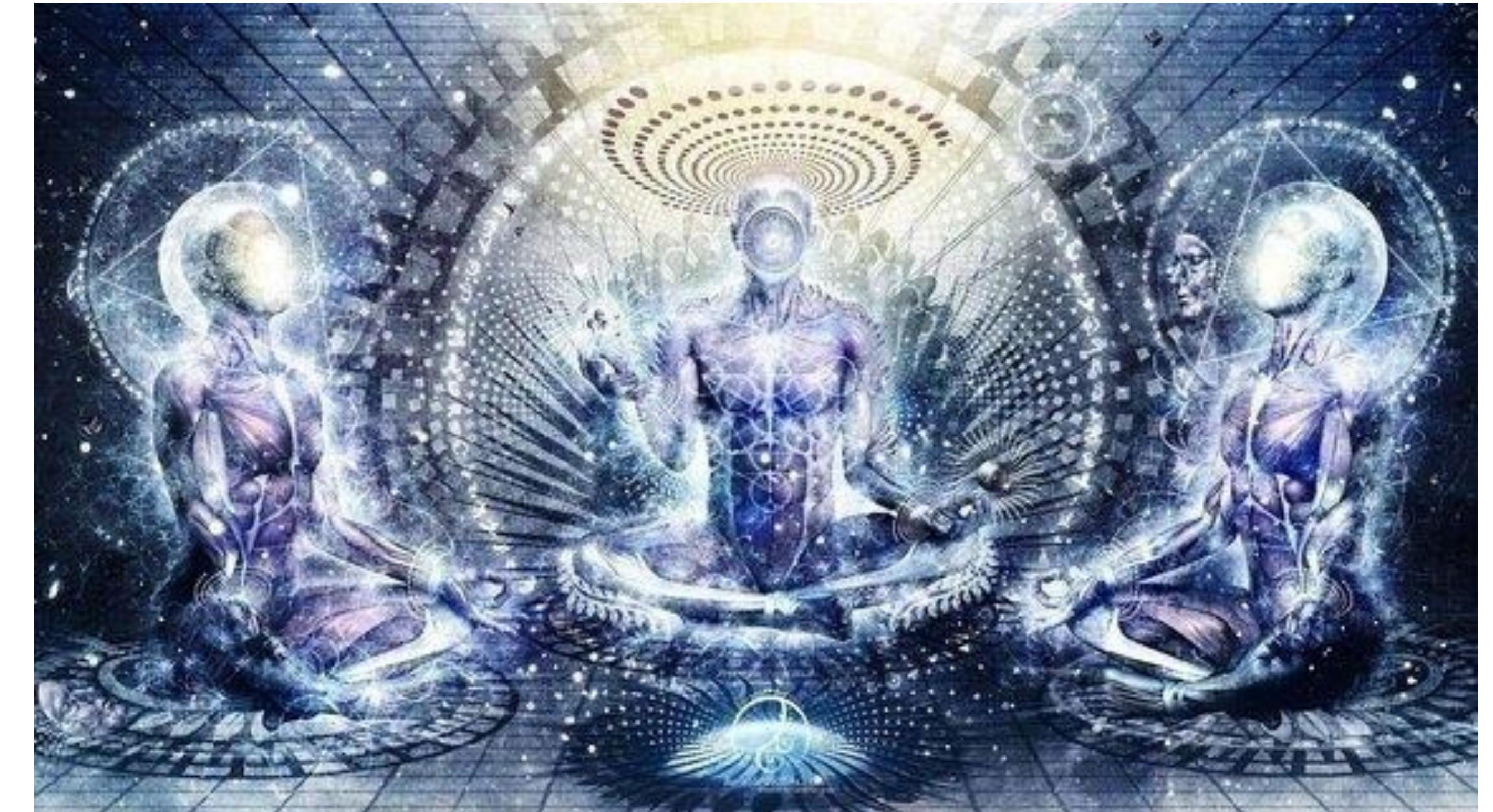


Live example

Visual Information Seeking Mantra

1. Overview first
2. Zoom and filter
3. Details on demand

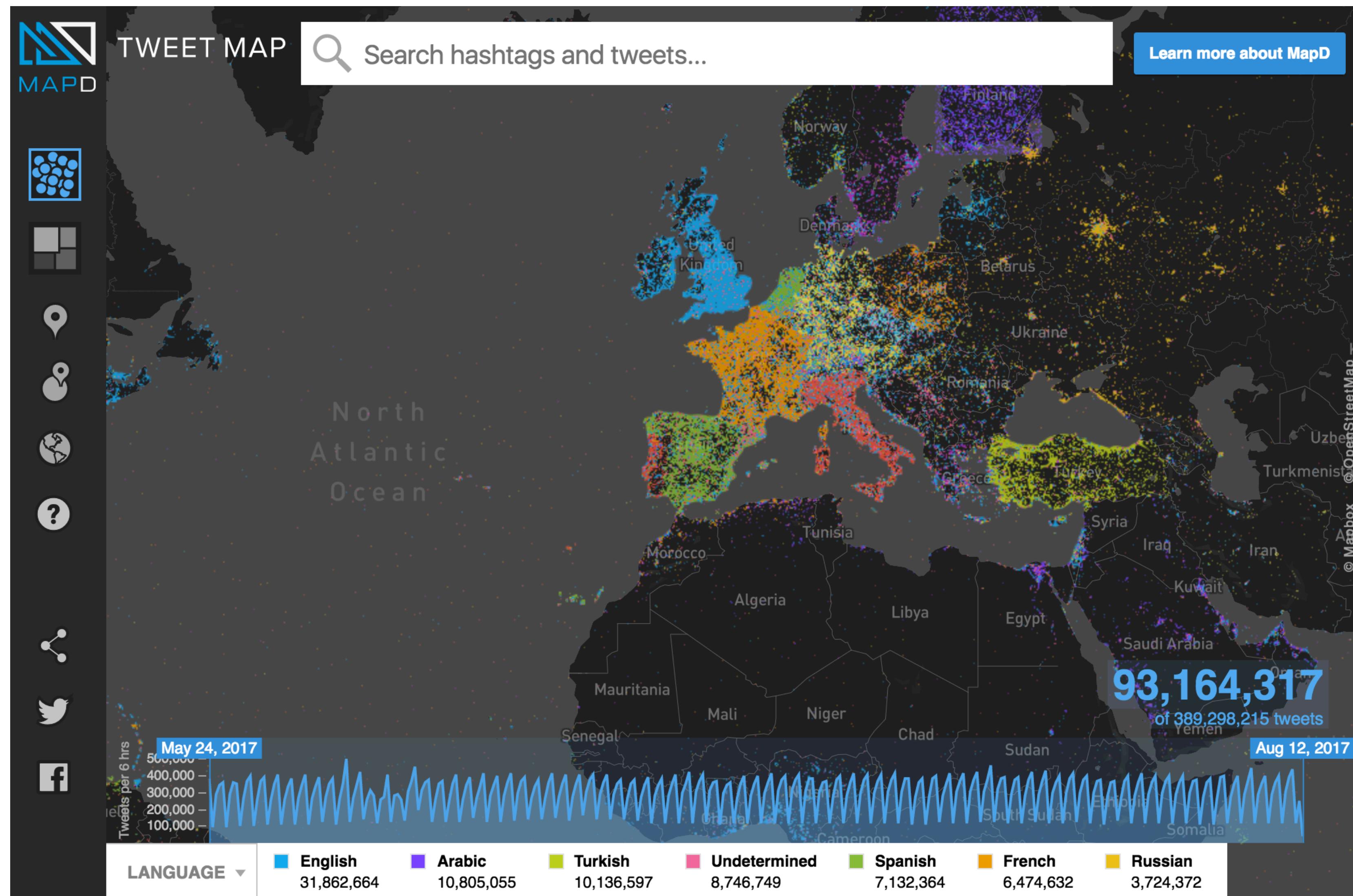
relate, history, extract



The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations

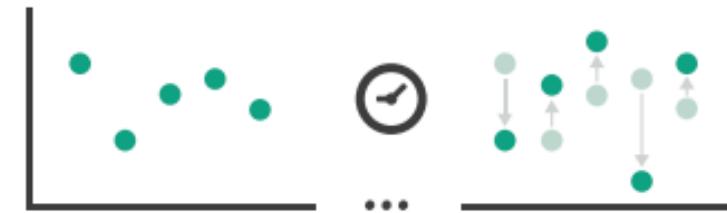
[B Shneiderman - 1996]

MapD Tweet map



Faceting the display

④ Change over Time



④ Select



④ Navigate

→ Item Reduction

→ *Zoom*
Geometric or *Semantic*



→ *Pan/Translate*



→ *Constrained*



Single views

→ Attribute Reduction

→ *Slice*



→ *Cut*



→ *Project*



④ Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

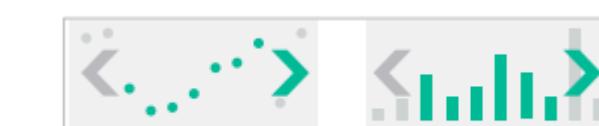
→ *Linked Highlighting*



→ Share Data: All/Subset/None



→ Share Navigation



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

④ Partition into Side-by-Side Views

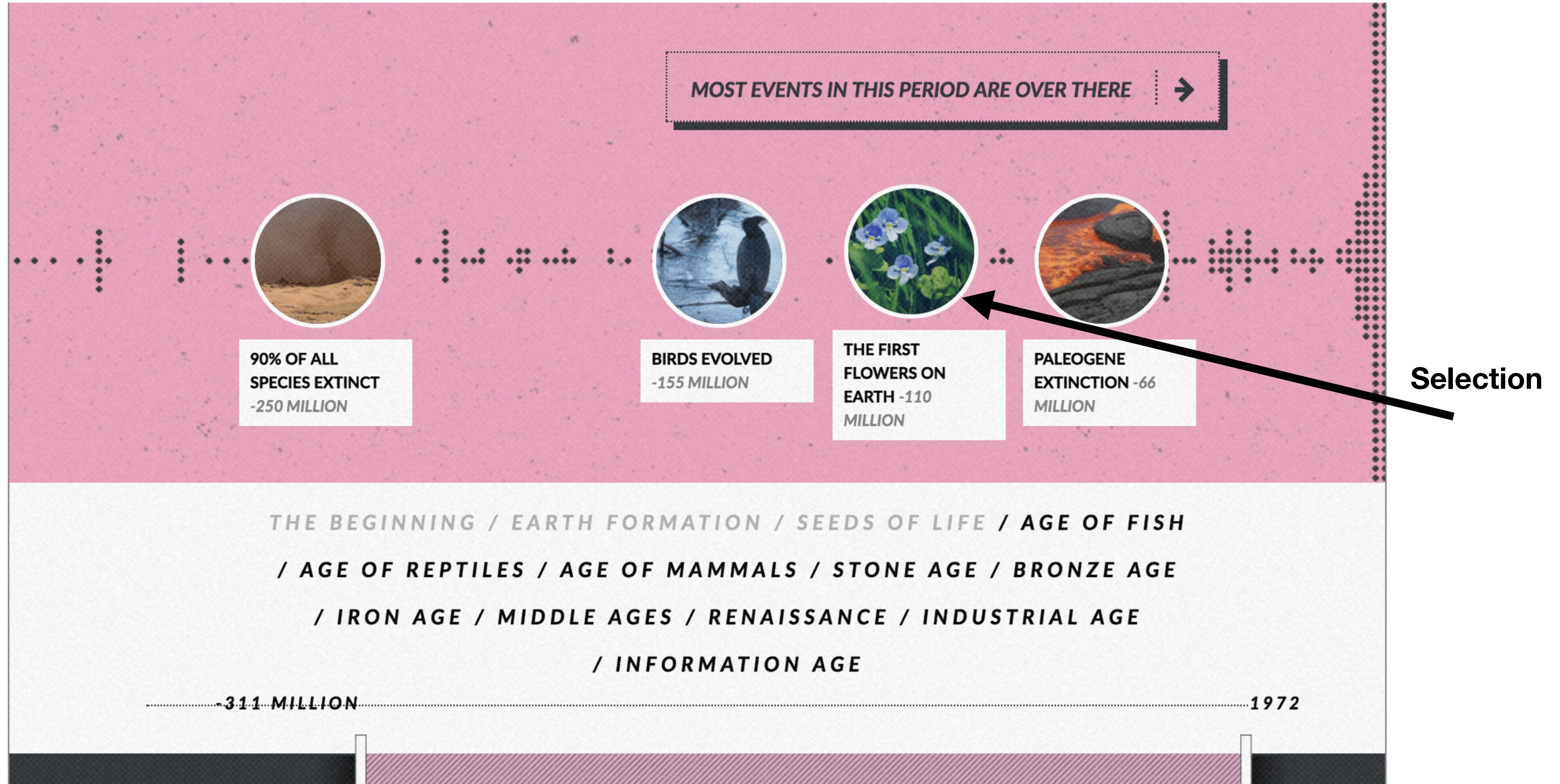


Multiple views

④ Superimpose Layers



Single view example



Slider + transitions / animations

Mouse wheel interaction: semantic zooming

Why use transitions?

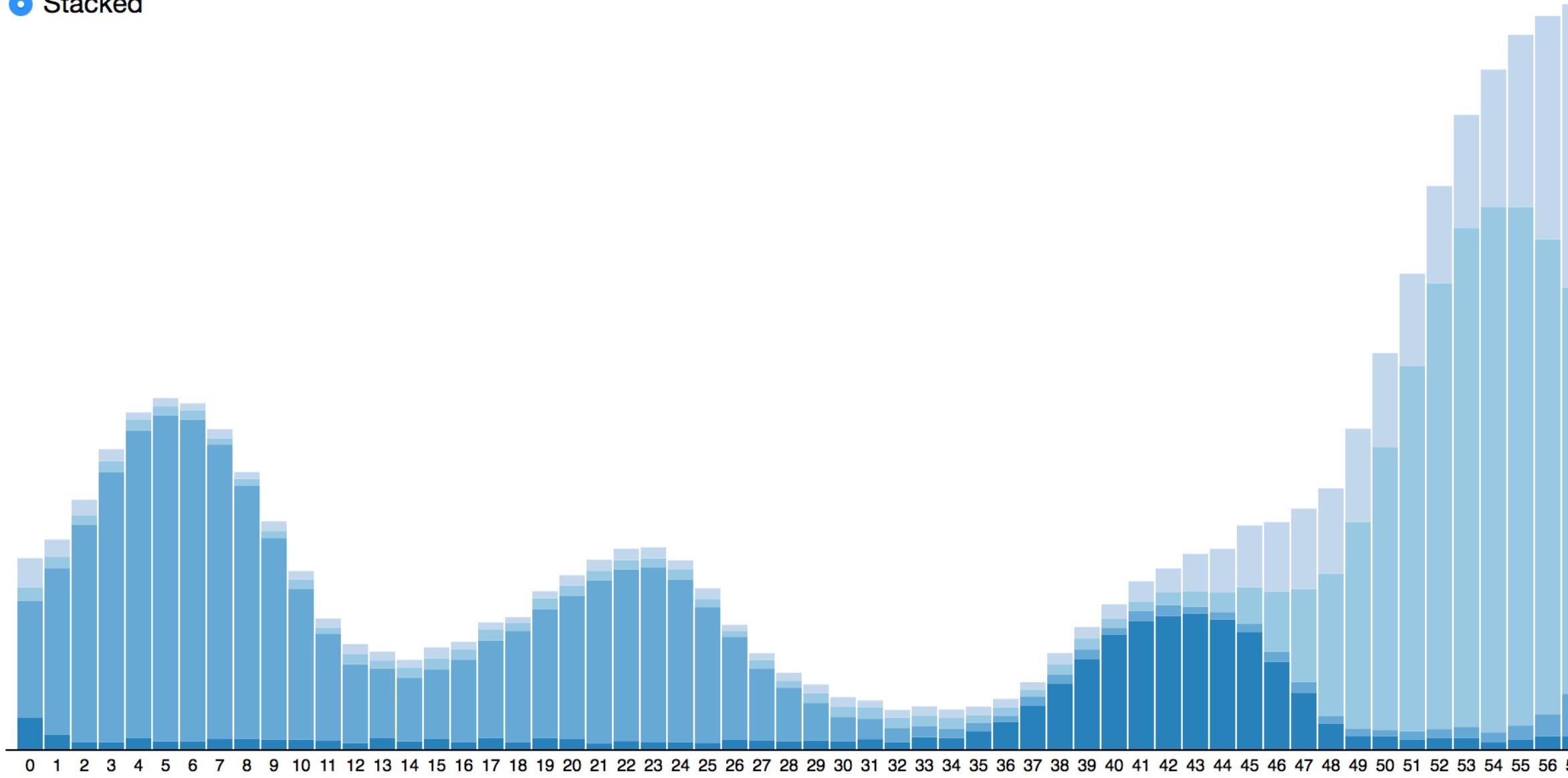
Animated transition: smooth interpolation between visualization states or techniques

Caveats: changes can be hard to track

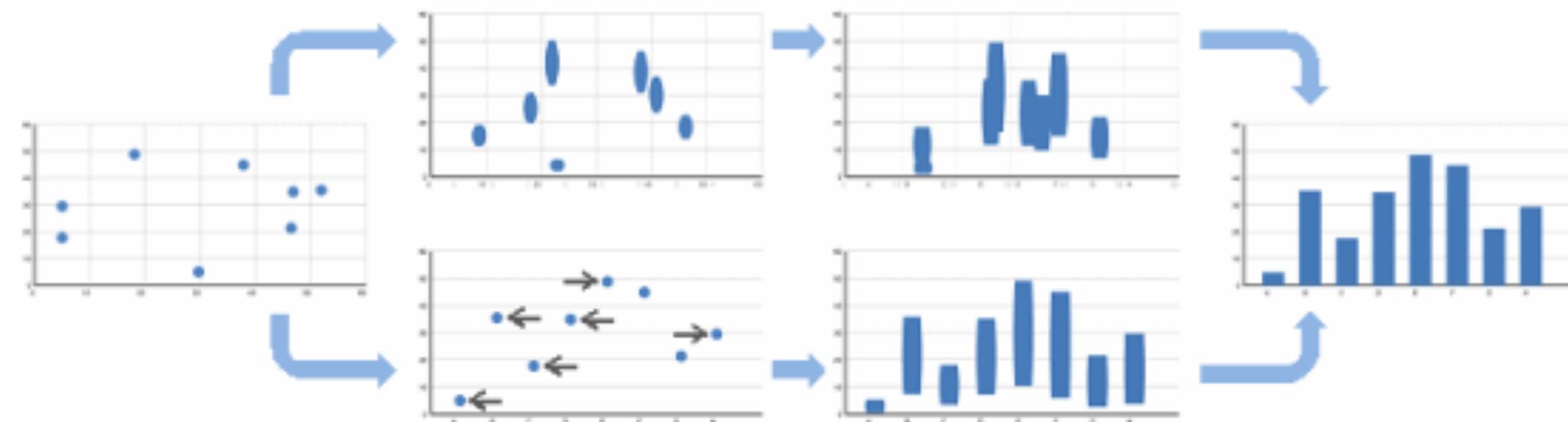
Makes it possible to track what is happening!

Better to rely on the eyes with multiple views than with a memory of the previous state

○ Grouped
● Stacked



Animated Transitions in Statistical Data Graphics



[Jeffrey Heer, George Robertson]

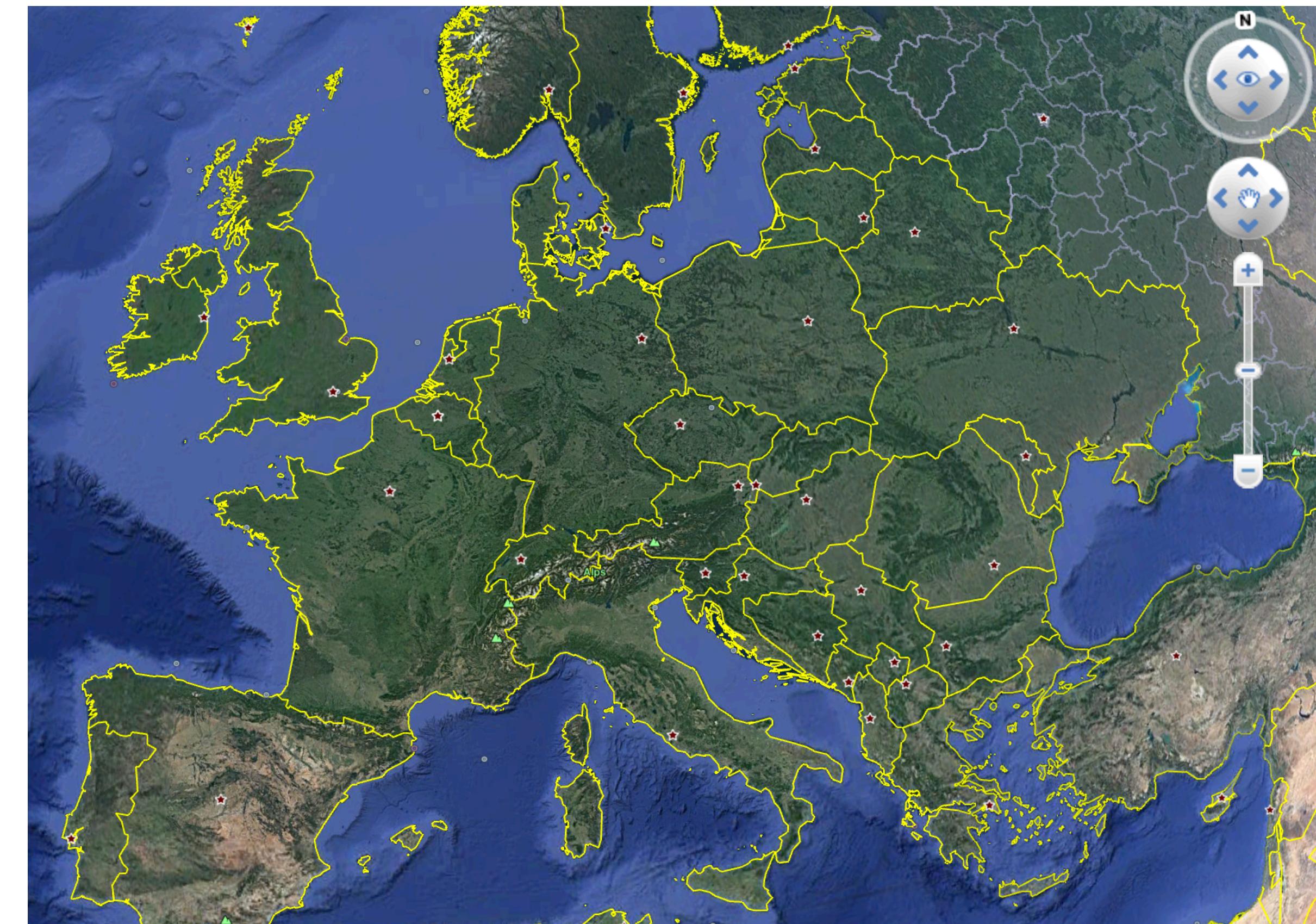
Navigation

Pan: move around in the plane

Geometric zoom: move camera far to close

Rotate

Tilt: Look from another angle (3D)



Geometric vs semantic zooming

Geometric (standard) zooming: The view depends on the physical properties of what is being viewed.

Semantic zooming: Different representations for different spatial scales. When zooming away, instead of seeing a scaled down version of an object, see a different representation. The representation shown depends on the meaning to be imparted

[Watson 2004]

CALMA APPARENTE

« BACK

Calma apparente

EROS RAMAZZOTTI

La nostra vita

L'equilibrista

Bambino nel tempo

Tu sei

Solarità

Sta passando novembre

Una nuova età

Nomadi d'amore

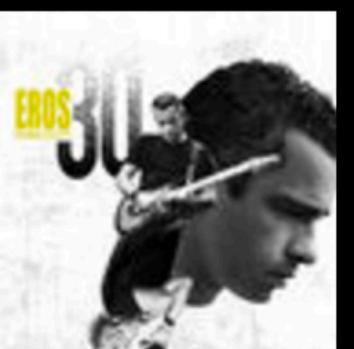
Non è amore

L'ultimo metrò

I Belong to You (Il ritmo della passione)

Beata solitudine

Calma apparente



Focus + context

A principle of InfoViz that combines visual encoding and interaction design

“See the trees and the forest at the same time”

Display most important data in details without forgetting about the big picture (the context)

Provide context with: **reduction, layering, distortion**

↪ Embed

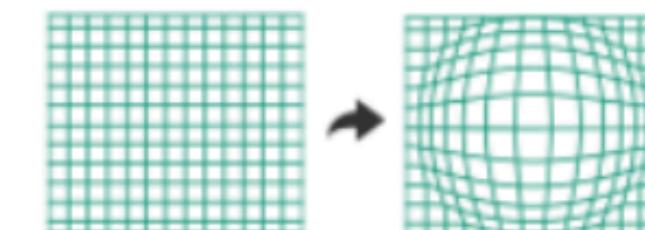
→ Elide Data



→ Superimpose Layer

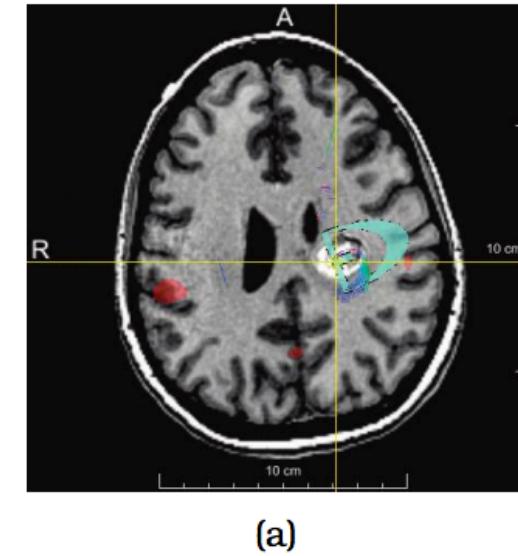
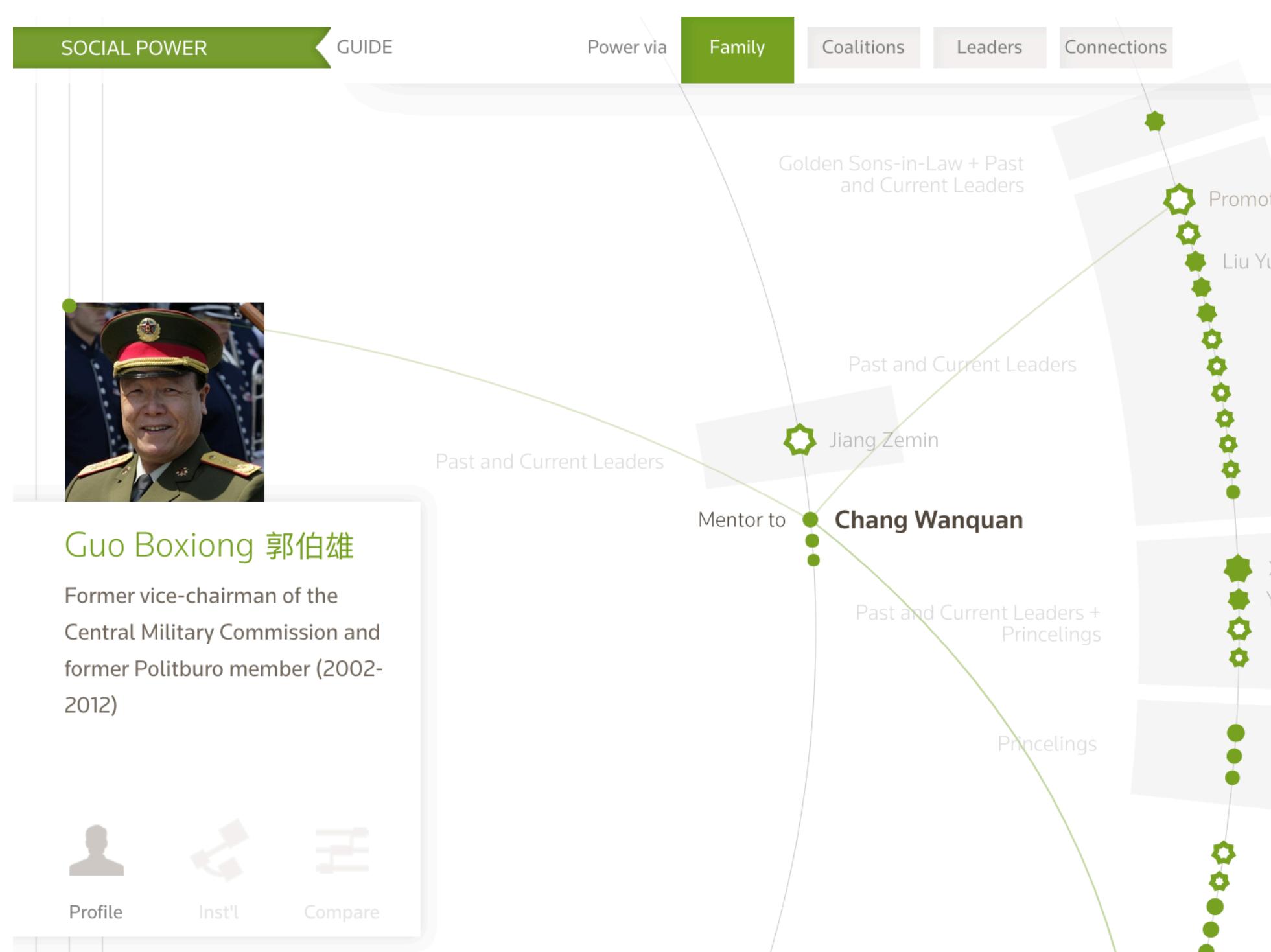


→ Distort Geometry

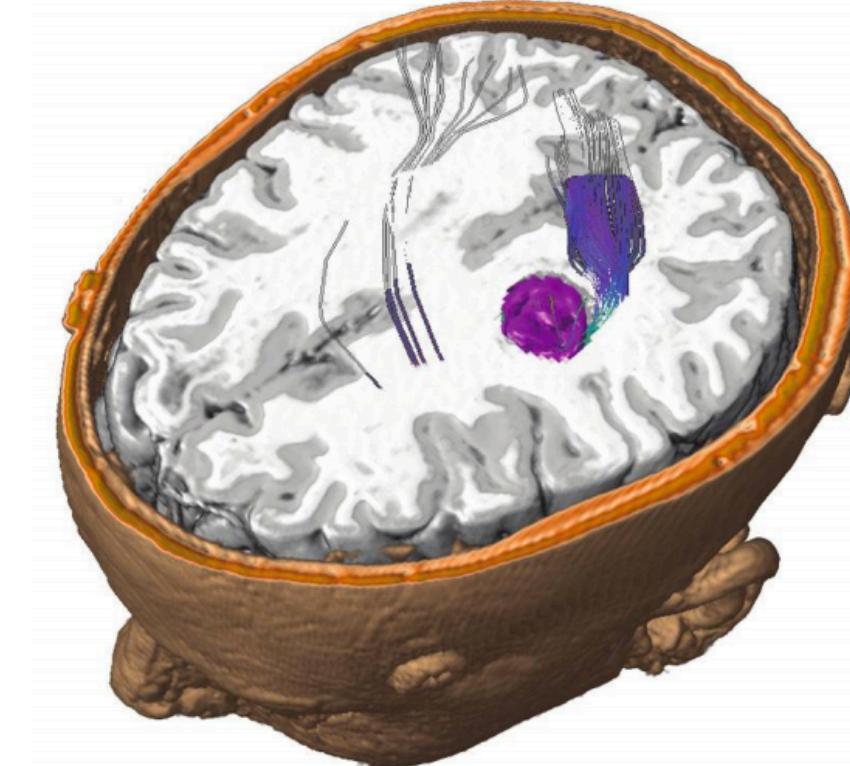


Attribute reduction

Slice: eliminates a dimension/attribute by extracting only the items with a chosen value in that dimension.



(a)



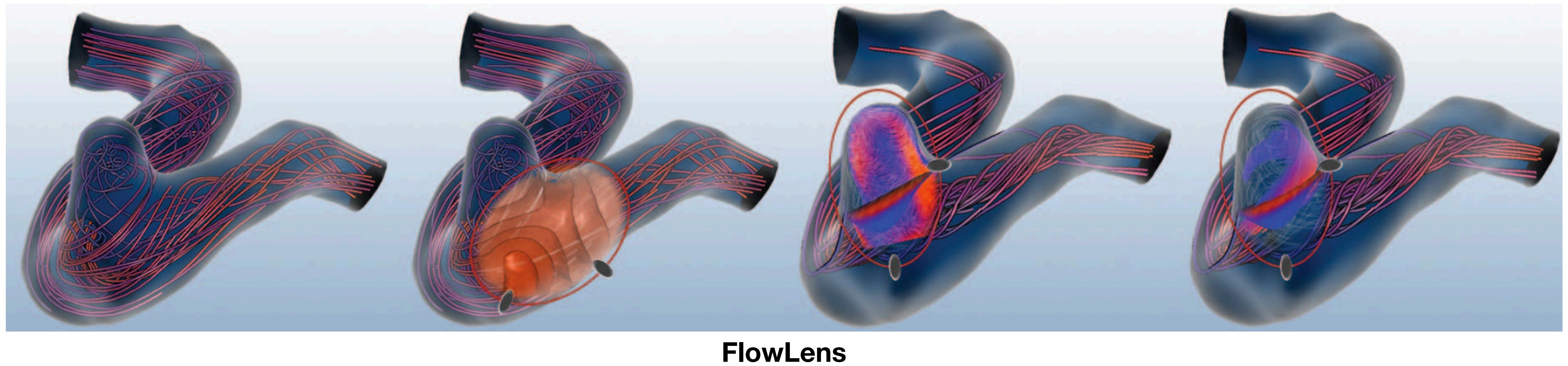
(b)

Elision: focus item is detailed, the rest is summarized for context

Superimpose

Focus layer on a local region

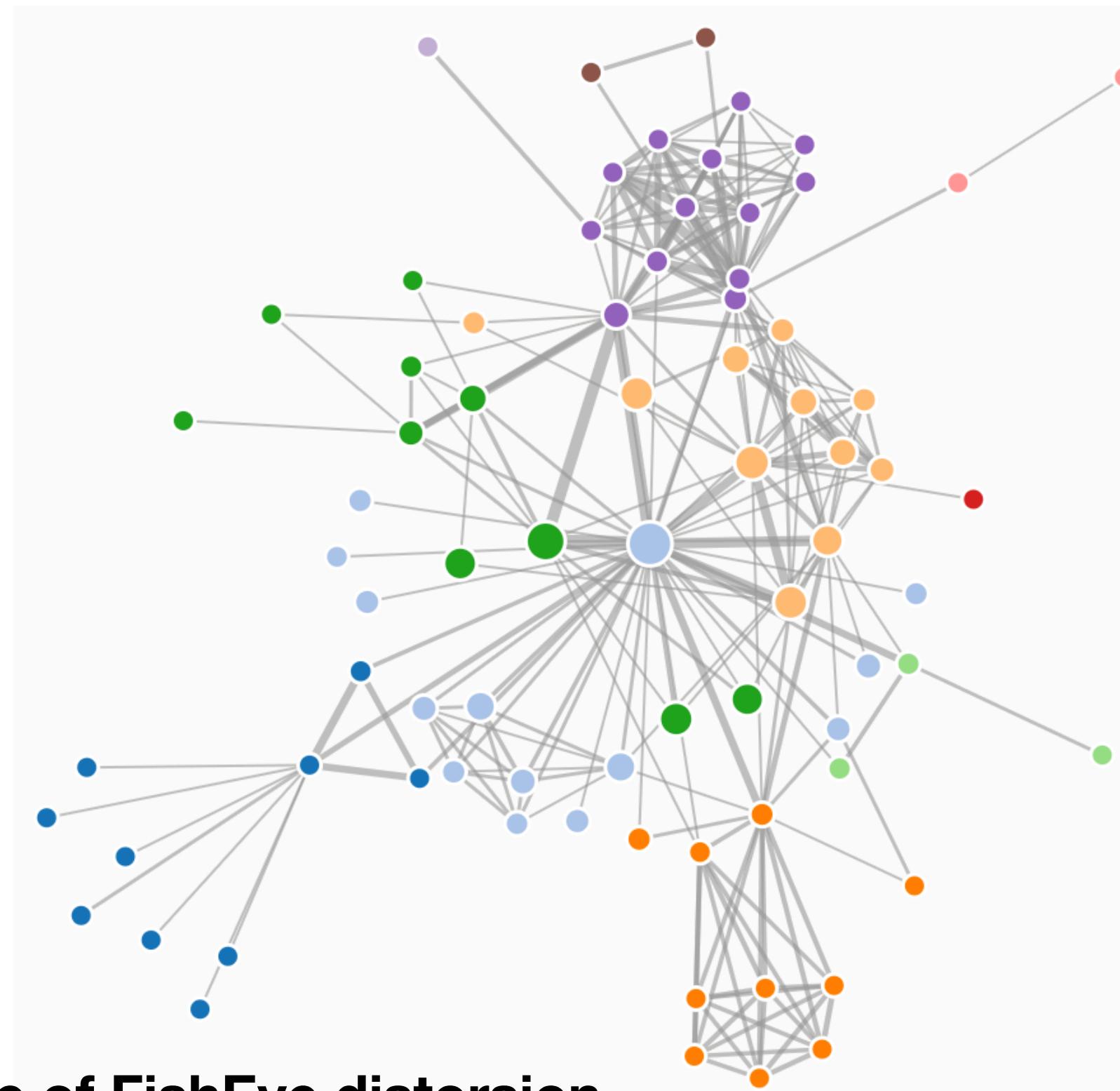
Context is given by the less detailed object



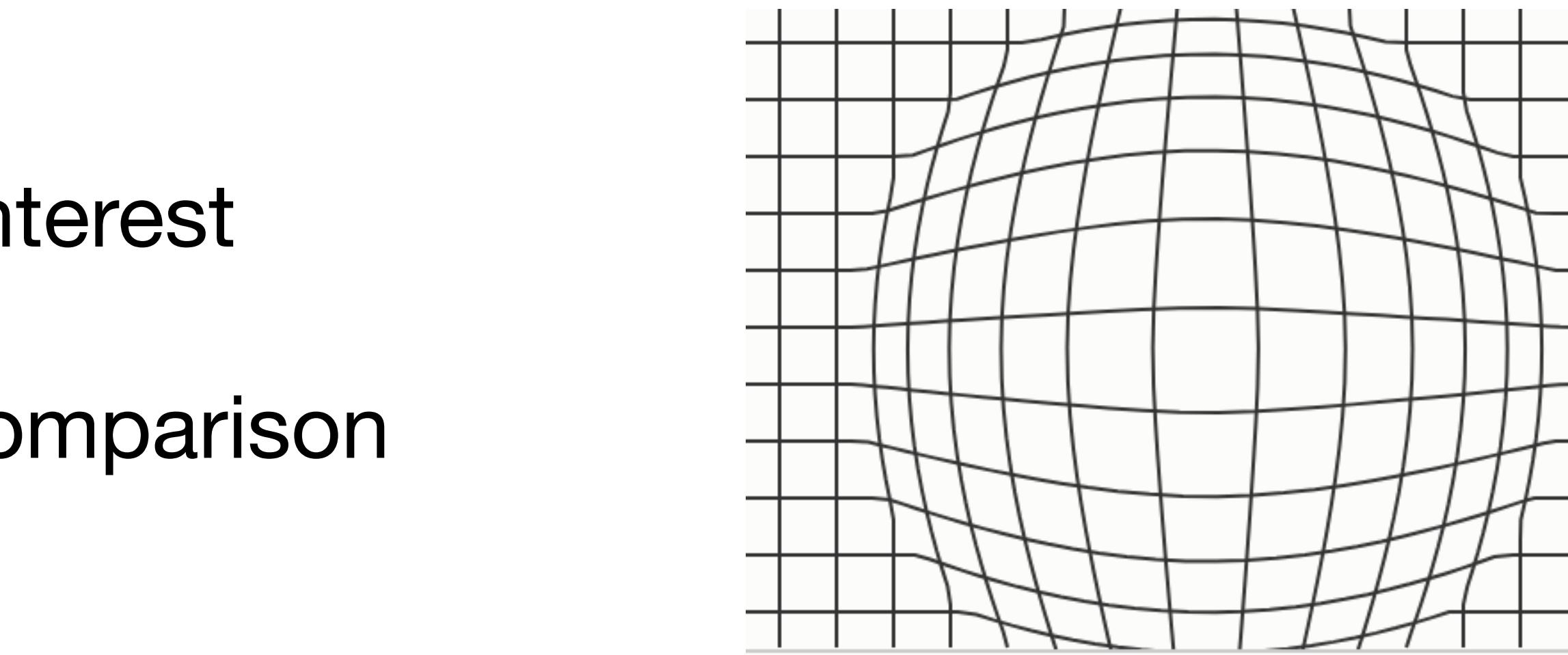
Geometry distortion

Allows details to appear in the region of interest

Caveat: Cannot perform relative spatial comparison



Live example of FishEye distortion

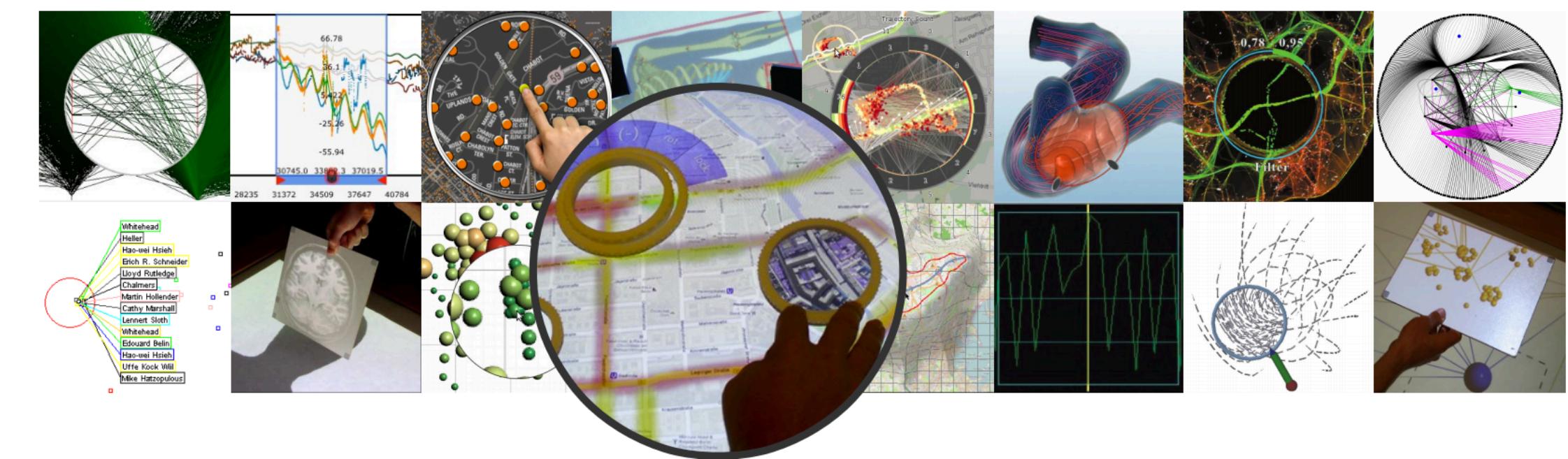


A Survey on Interactive Lenses in Visualization

C. Tominski¹, S. Gladisch¹, U. Kister², R. Dachselt² & H. Schumann¹

¹Institute for Computer Science, University of Rostock

²Interactive Media Lab, Technische Universität Dresden



Linked views

Linked views: action on one view affects the other(s)

Better to rely on your eyes with multiple views than with a memory of the previous state

We can still animate linked views

④ Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

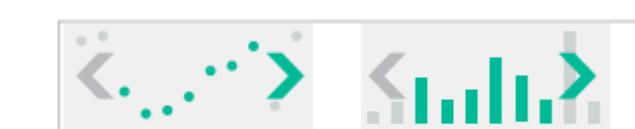
→ *Linked Highlighting*



→ Share Data: All/Subset/None



→ Share Navigation



| | | Data | | |
|----------|-----------|-----------|-----------------|-----------------|
| | | All | Subset | None |
| Encoding | Same | Redundant | Overview/Detail | Small Multiples |
| | Different | Multiform | | |

④ Partition into Side-by-Side Views



④ Superimpose Layers



Linked views options

Visual encoding: same or multiform (scatter plot linked to scatter plot, or to bar chart)

Share: all, share a subset or don't share any data between the views

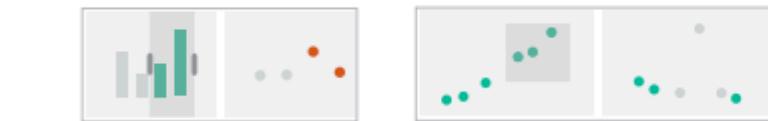
Highlighting: choose to highlight in all views, or not

Navigation: shared or not

④ Juxtapose and Coordinate Multiple Side-by-Side Views

→ Share Encoding: Same/Different

→ *Linked Highlighting*



→ Share Data: All/Subset/None



→ Share Navigation



| | | Data | | |
|----------|-----------|-----------|--------|------|
| | | All | Subset | None |
| Encoding | Same | Redundant | | |
| | Different | | | |

④ Partition into Side-by-Side Views



④ Superimpose Layers



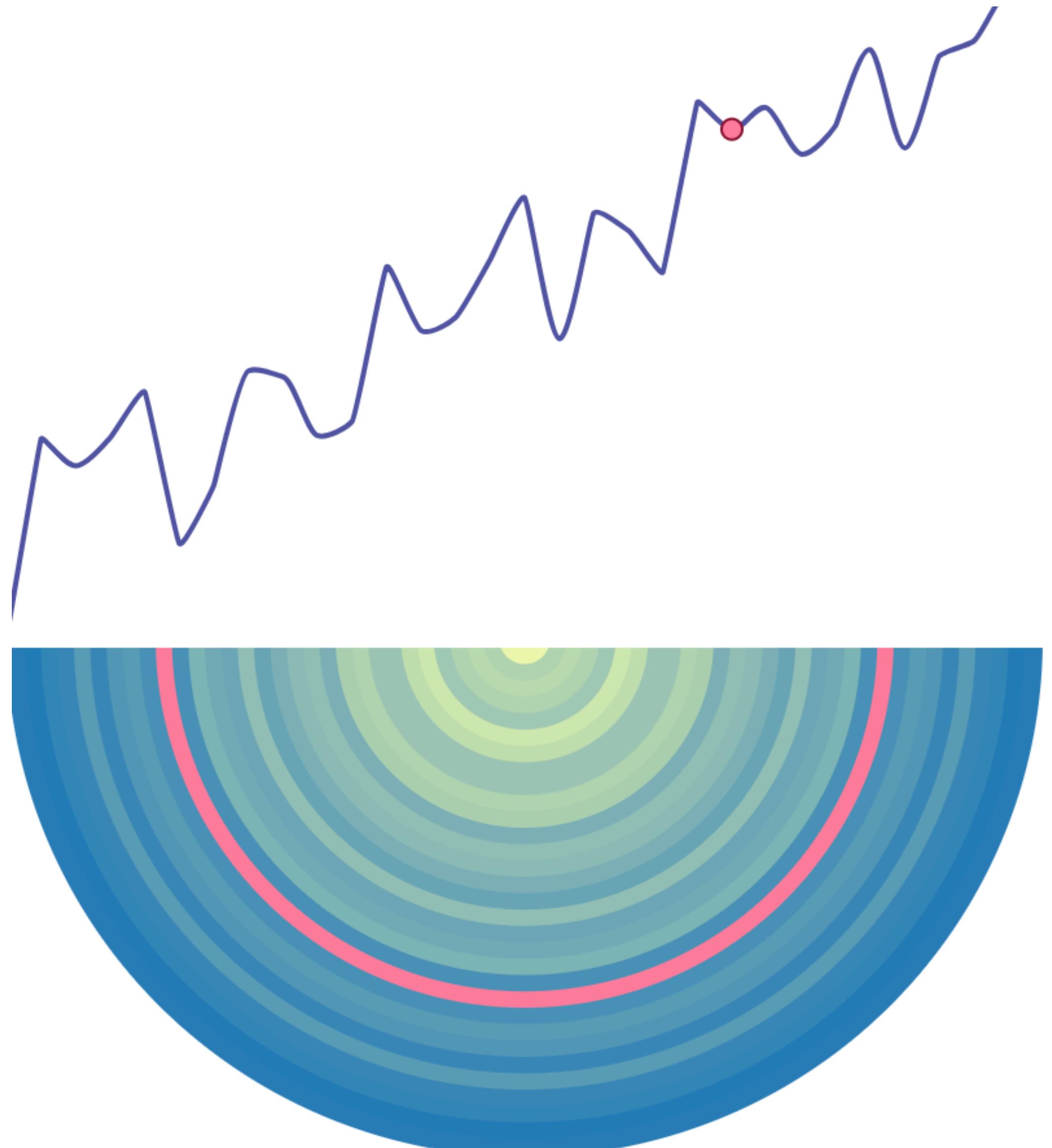
Multiform share-all linked highlighting

Share-all: interactions on one view is reflected on the others

Multiform: different visual encodings are used between the views

Why multiform?

A single view can be limited on the number of visible attributes



Overview + details

A single view cannot display everything if the data is too big or too complex

Here, general aggregated overview information +

A view for finer details on the whole or subset of data



Partitioning

Separates the data into groups, typically according to categorical attributes

Questions:

How to choose the number of views?

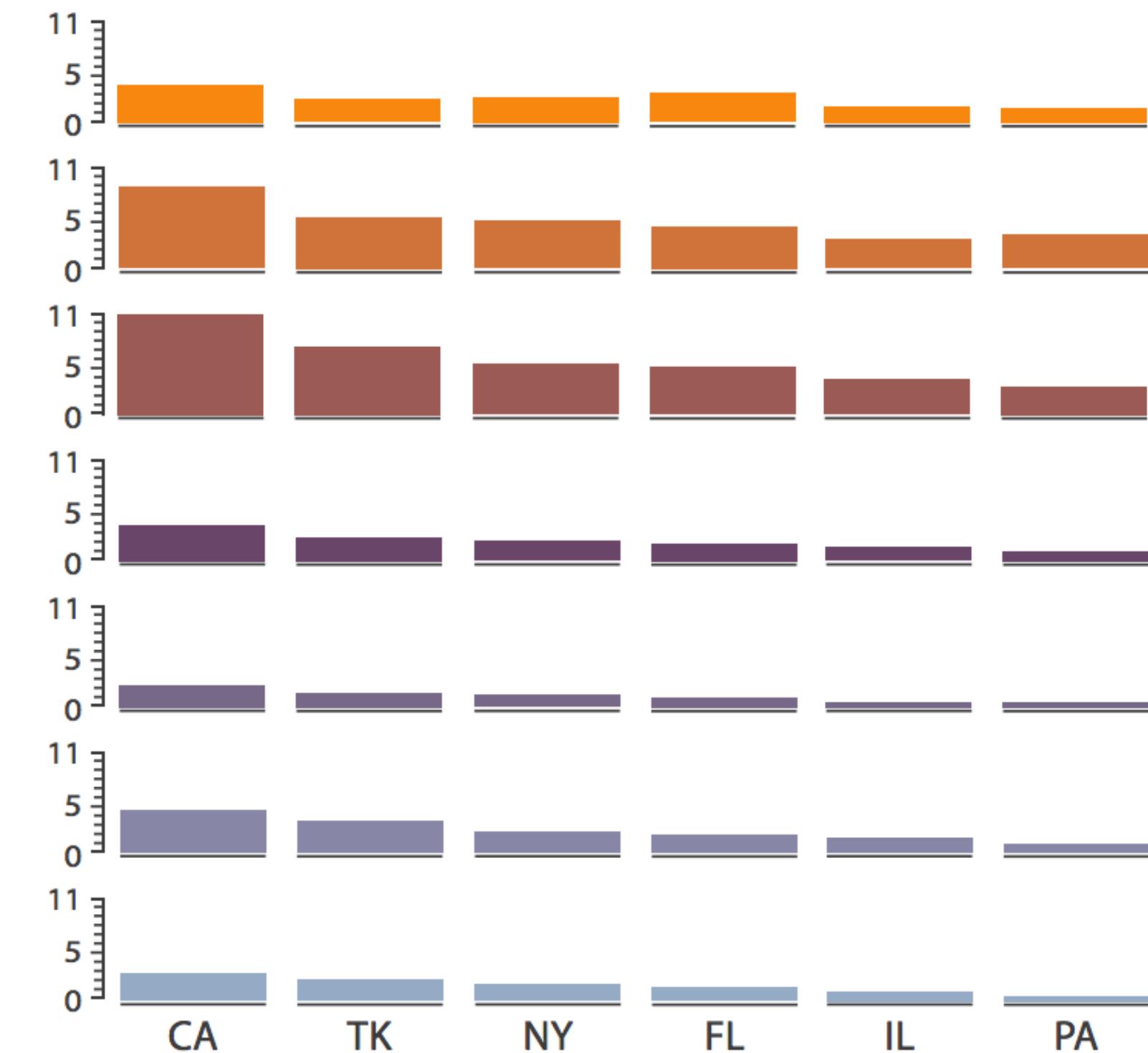
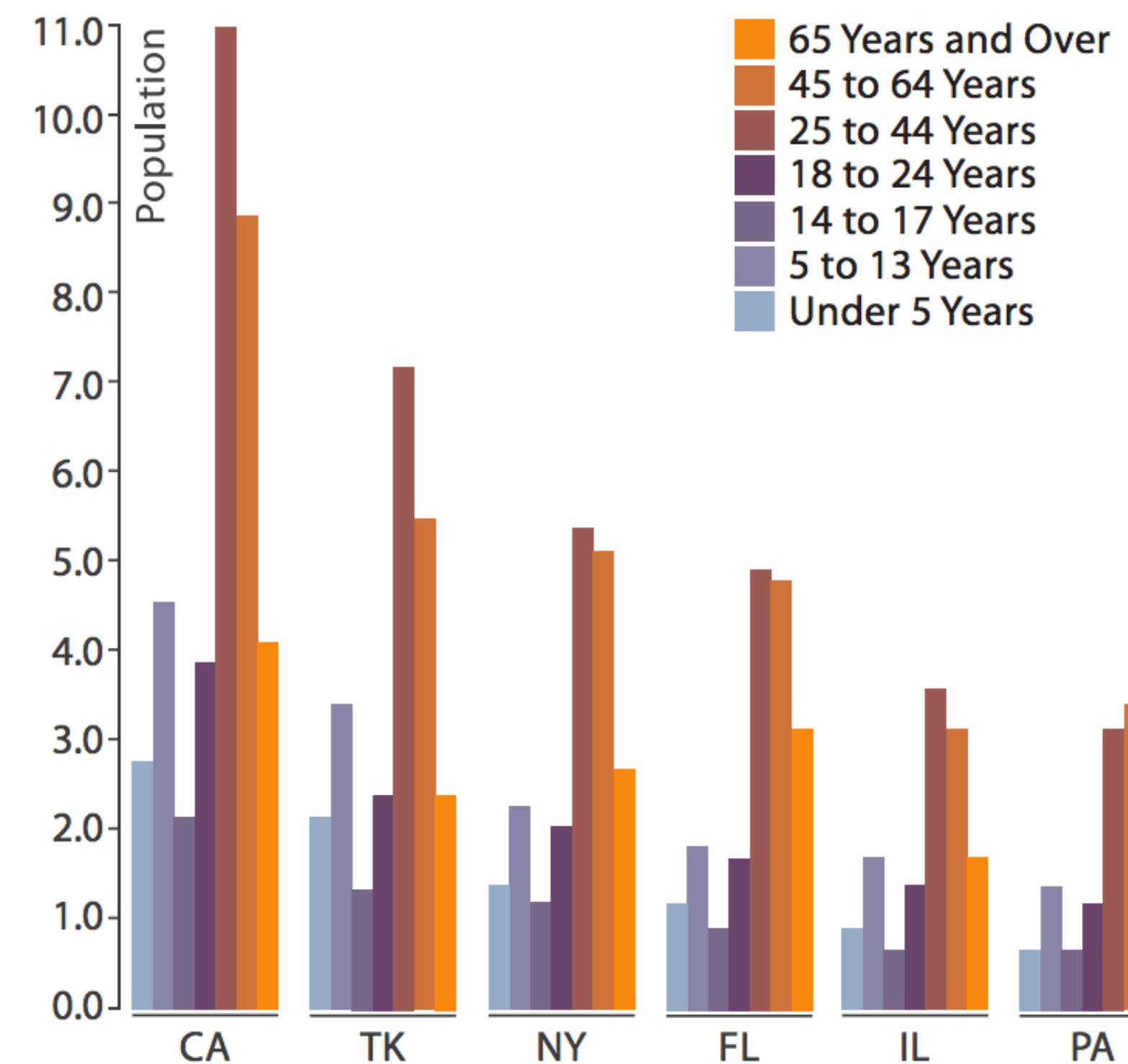
How many splits, in which order?



Small multiples

Same visual encoding
but show different
dimensions of the
dataset altogether

Eyes beat memory:
easier to compare



[VAD Figure 12.8.]

Trellis plots

Attributes encoded in individual views

Attributes partitioning in columns, rows, and pages

Order of the partition based on derived data

Allows to perceive trends and structure in the dataset

Columns: Persona (profile)
Rows: Affiliate, product line
Each chart: profit and sales by year

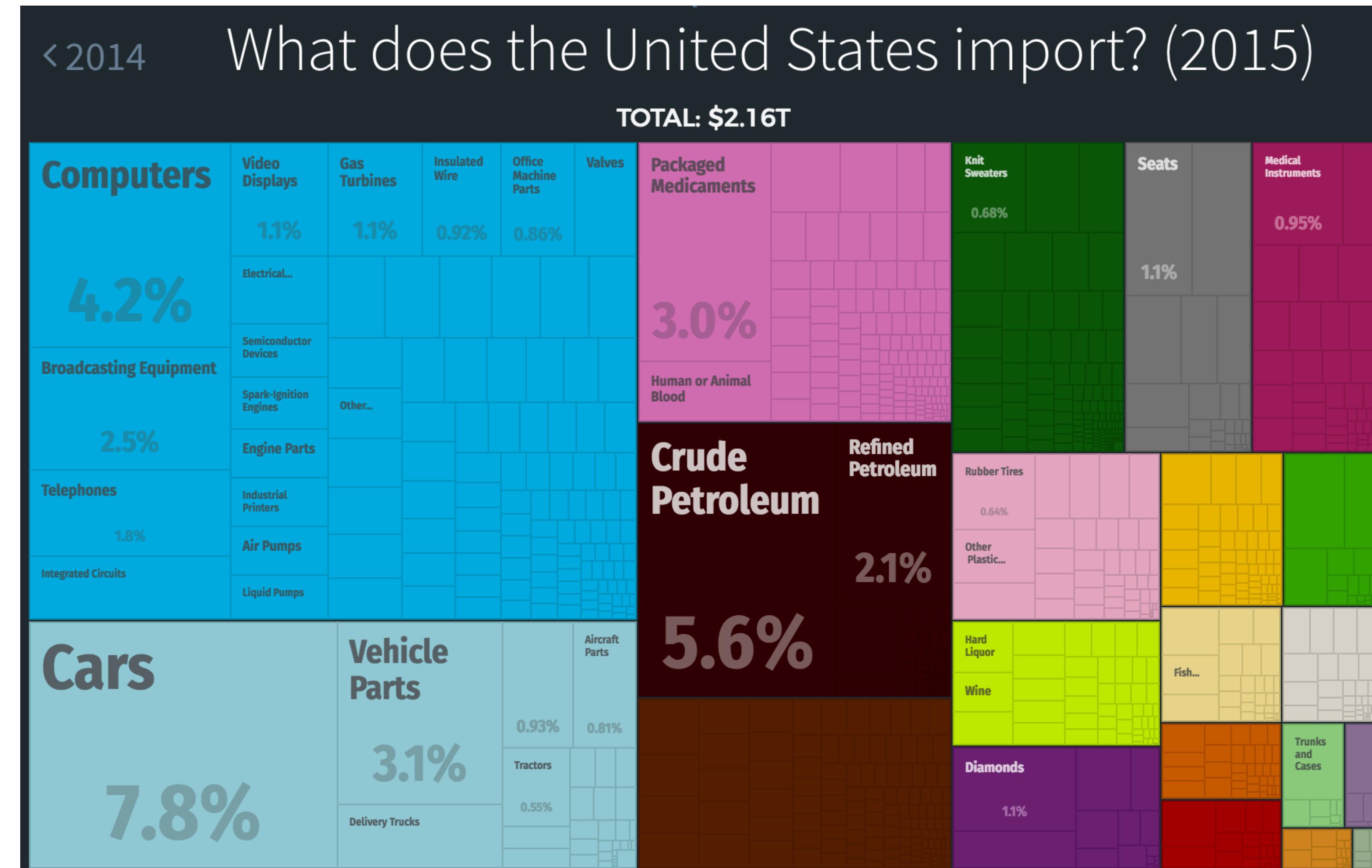


Recursive subdivision

Create a hierachical structure based on attributes

Use Treemap viz: fill the partionned space with rectangles

More on this in the following lectures

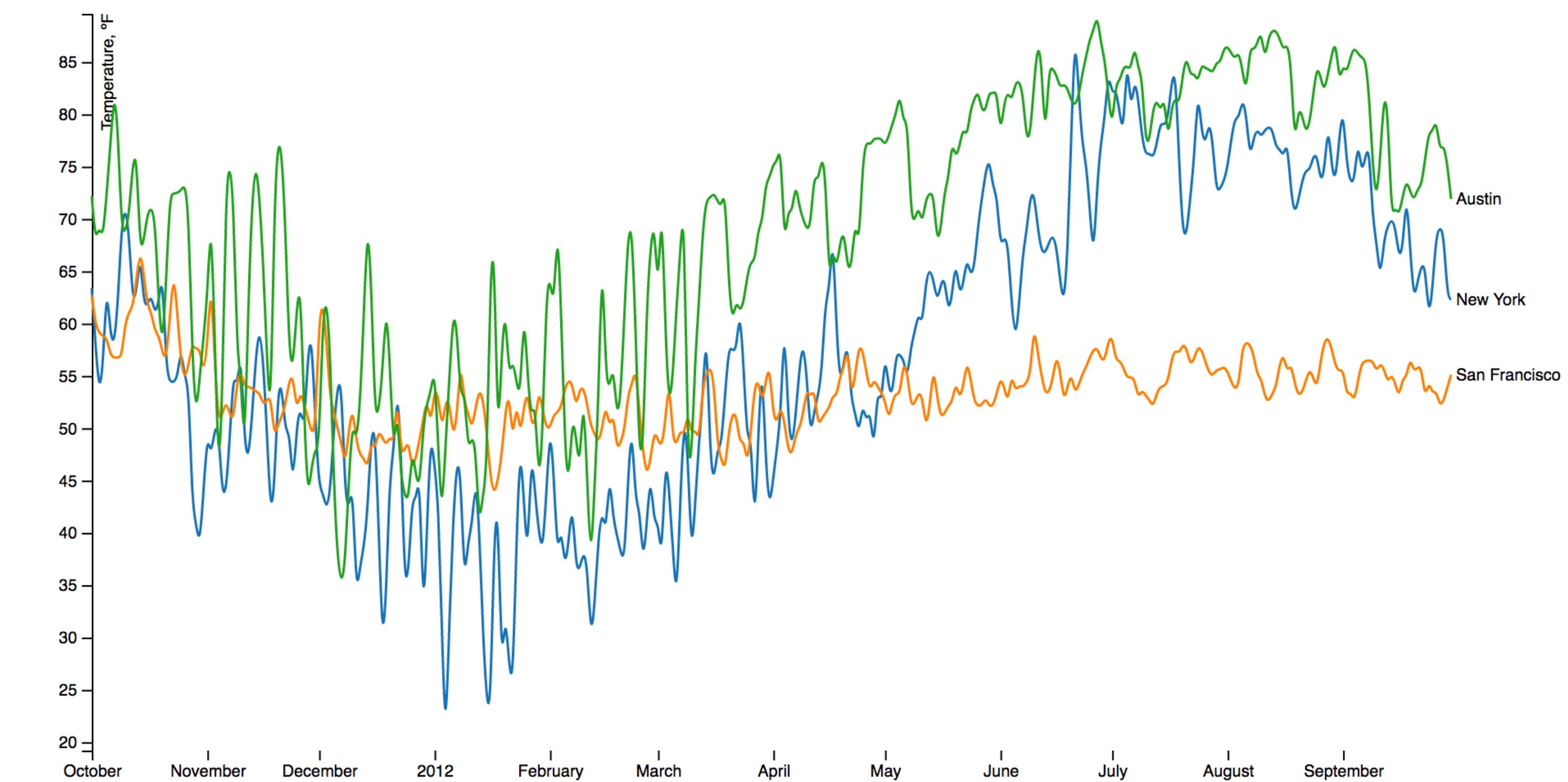


Layering

Create a composite view by stacking different views on top of each other

Pro: support a larger, more detailed view

Con: cannot use any visual encoding, not too many layers



Grafana live example

