Facet into Multiple Views & Interaction

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Agenda

1. What is Faceting?

2. Juxtapose and Coordinate Views
    2.1. Linked Highlighting
    2.2. Overview-Detail
    2.3. Combinations

3. Partitions & Groups

4. Superimpose Layers

1. What is Faceting?

- to facet (verb): to split

- one of the five major approaches to handling visual complexity. They are:
- juxtaposing coordinated views side by side
- deriving new data and including it in the view
- changing single view over time
- reducing amount of data shown in a view
- embedding focus and context within the same view

Combining views

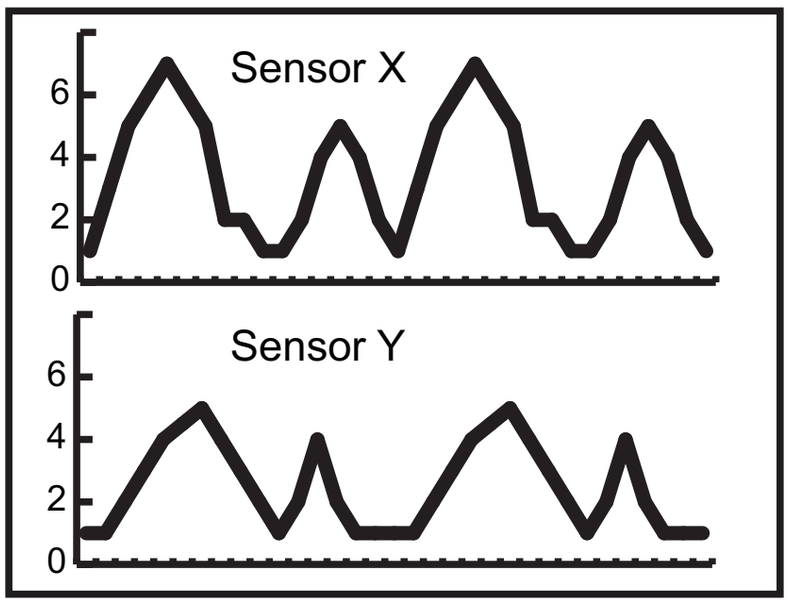
- often information too complex for a single view
- show multiple views side by side
- **Eyes Over Memory**: two simultaneous views have lower cognitive load than remembering previous view
- real-estate trade-off: popup view vs. static side-by-side
- OR - single view that is changed through interaction (filtering, aggregation, navigation)

2. Juxtapose and Coordinate Views

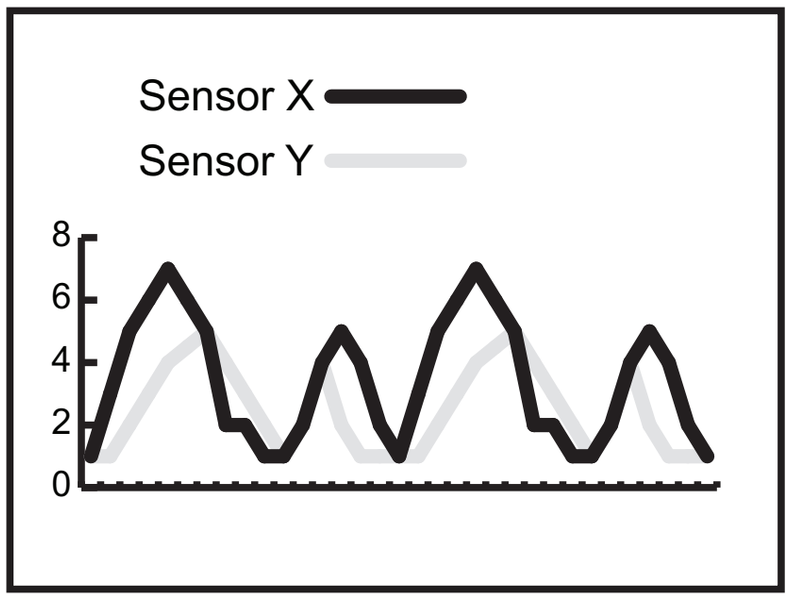
- juxtapose: place or deal with close together for contrasting effect

- Linked views, multiple views, coordinated views, coordinated multiple views, and coupled views: synonyms for the same fundamental idea

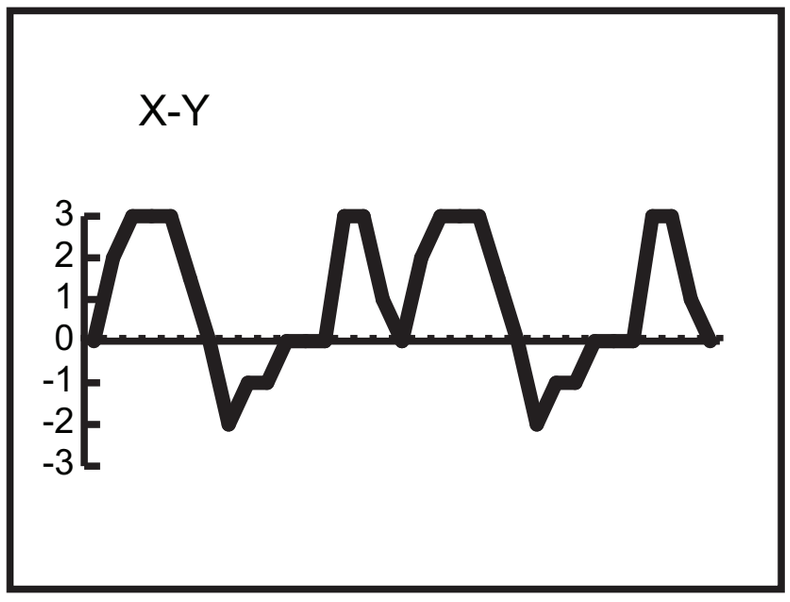
How to show multiple views



a) Juxtaposition



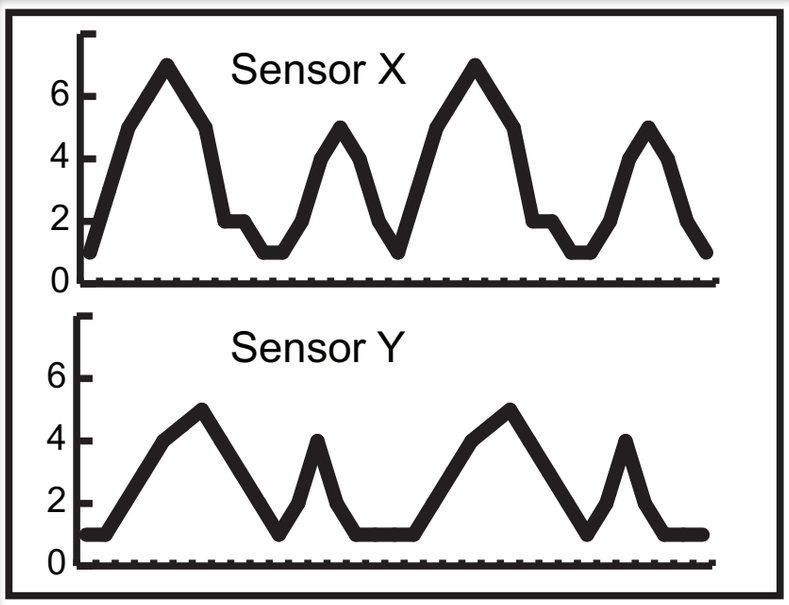
b) Superposition



c) Explicit Encoding: Difference

Visual Comparison for Information Visualization , Gleicher et al. 2011

Partitioning



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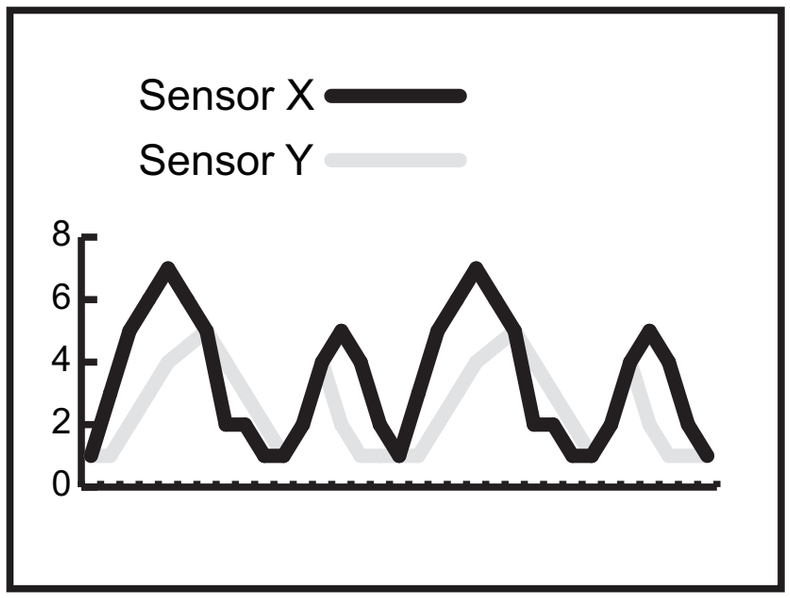

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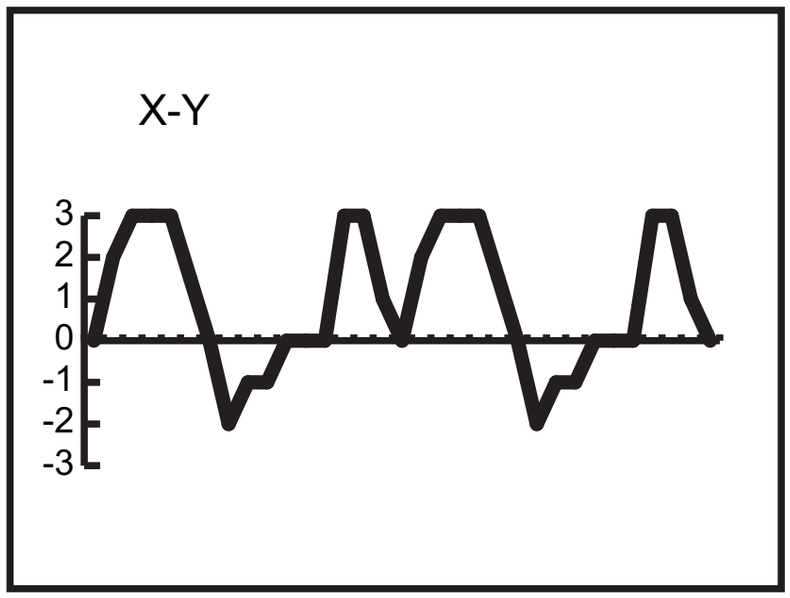

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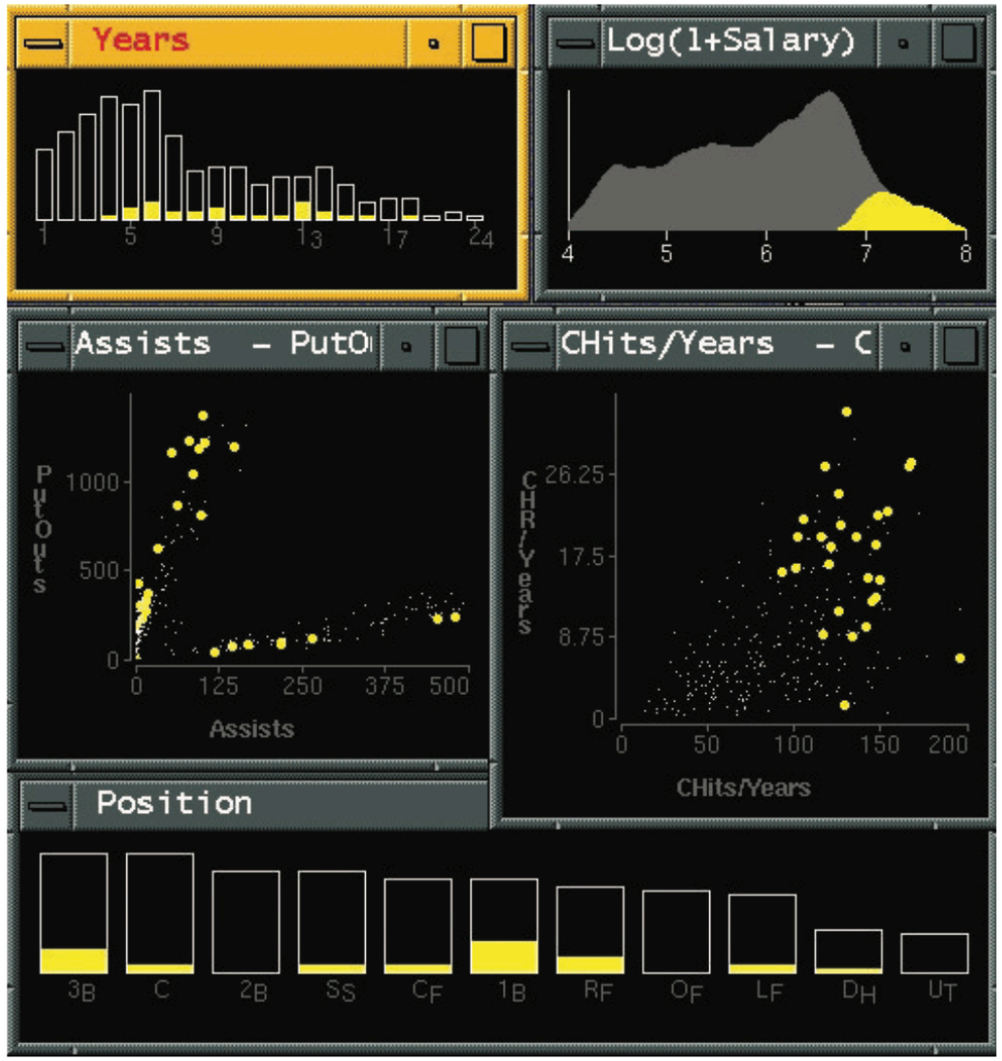
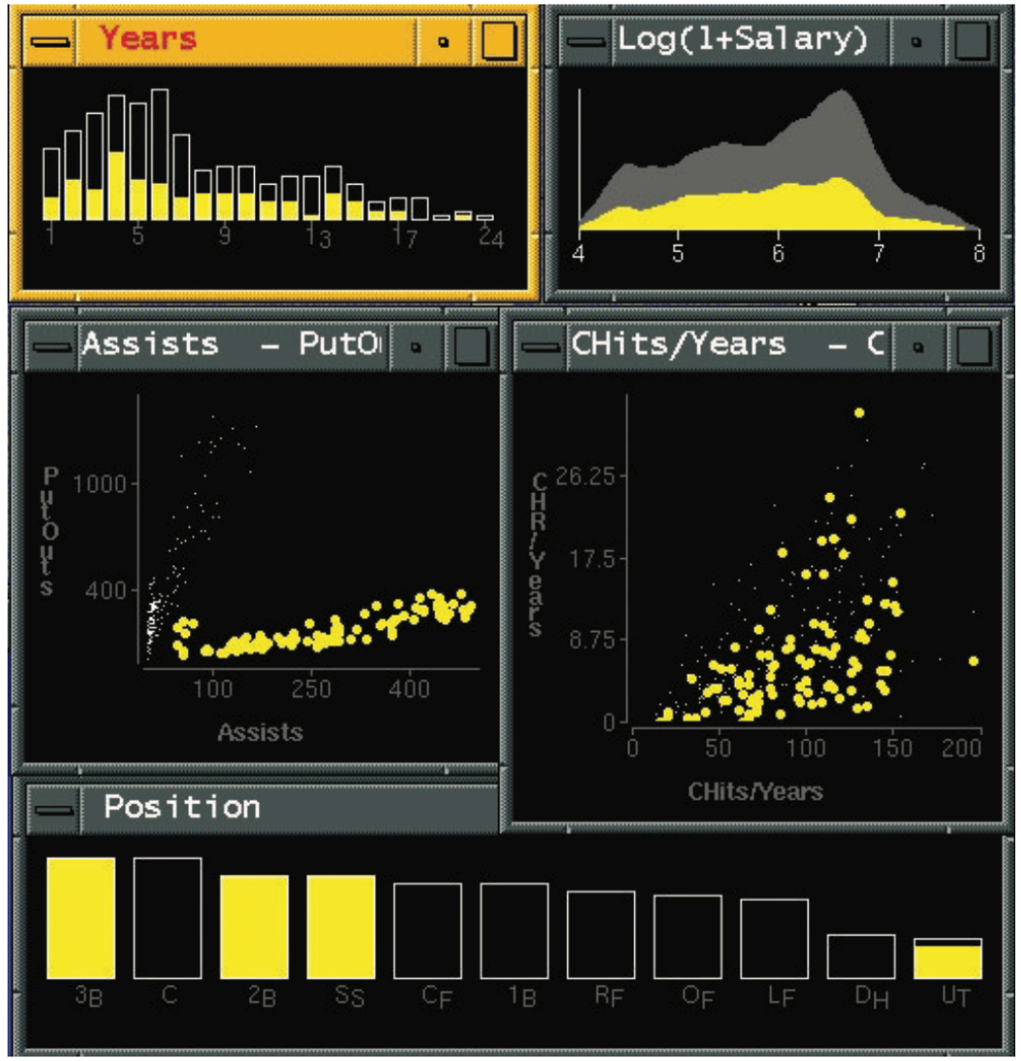
2.1. Linked Highlighting



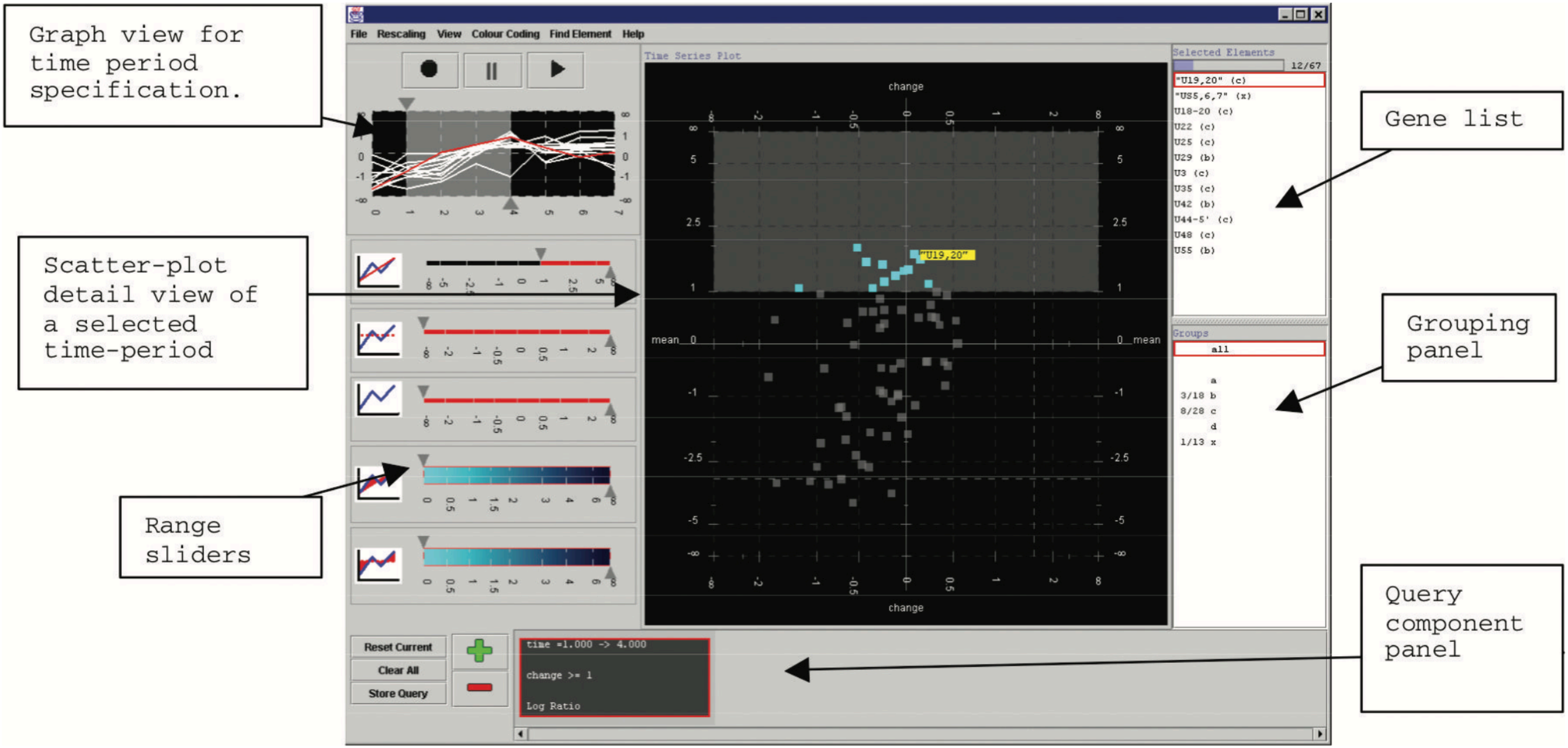
(a)



(b)

Exploratory Data Visualizer (EDV), Wills. 1995

2.2. Overview-Detail

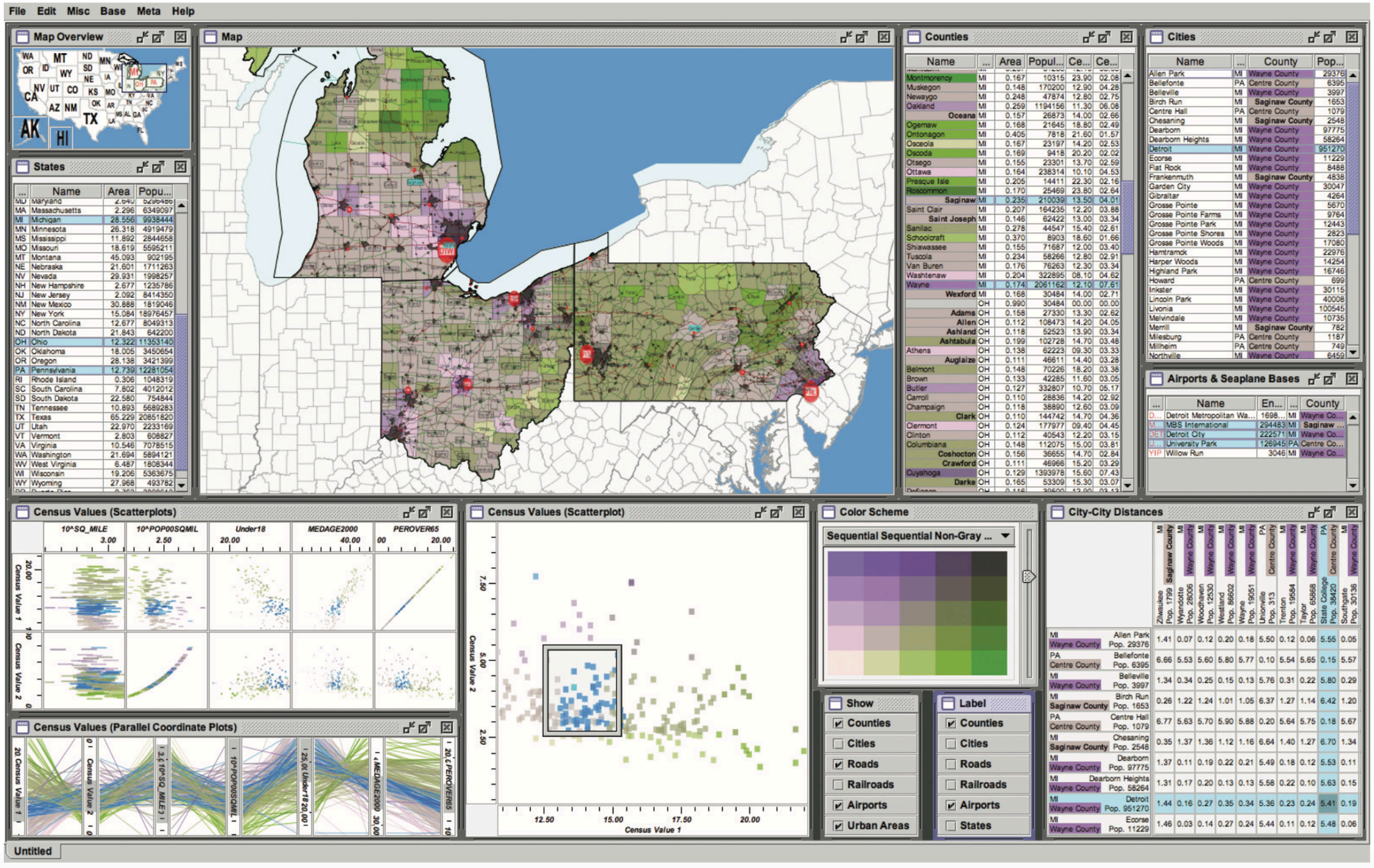


Coordinated Graph and Scatter-Plot Views for the Visual Exploration of Microarray Time-Series Data, Craig and Kennedy. 2003

Overview-and-detail

- Example: tooltips -- show details about a data item on demand (*detail-on-demand*)
- Example: Geographic birdseye

2.3. Combinations



The Improvise toolkit, Weaver. 2004

Business Intelligence (BI) Dashboards

The term **dashboard** has it roots in the automotive industry as an **instrumentation** and **information** panel for controlling the vehicle.

Source: https://www.caigauge.com/blog/history-of-the-dashboard

Business Intelligence (BI) Dashboards

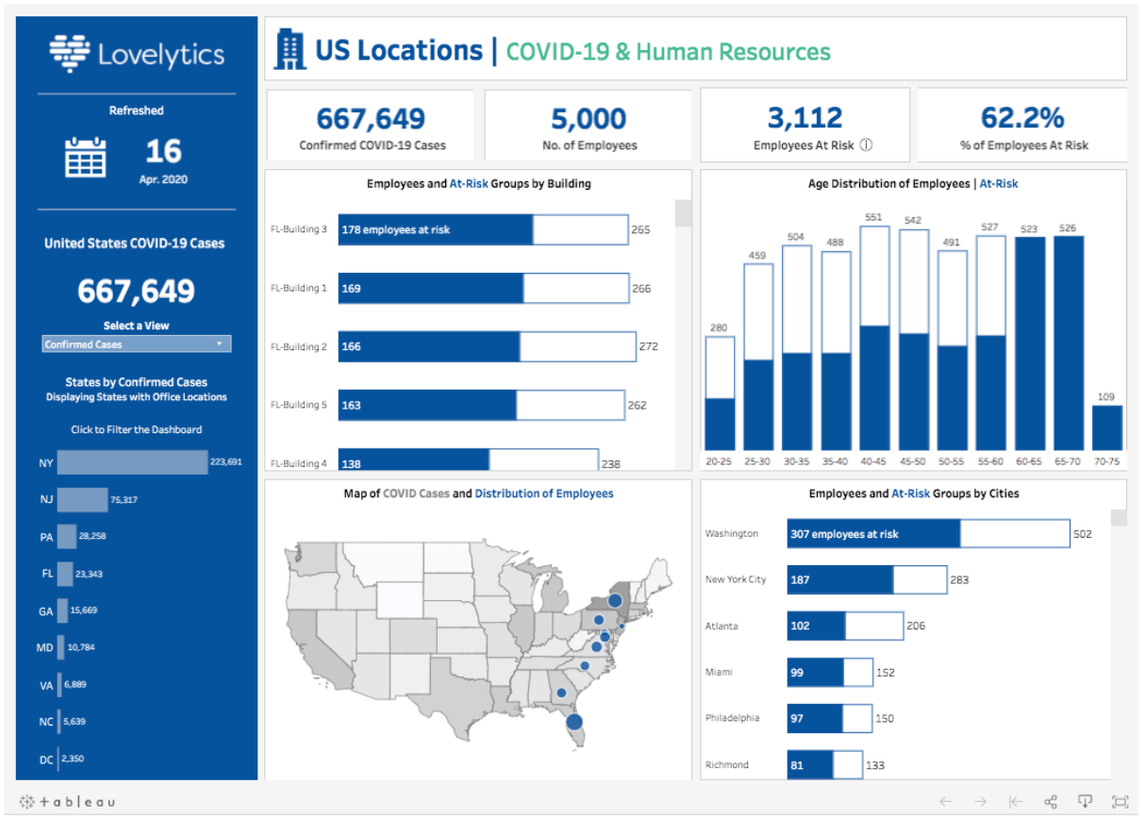
United States: Control stand in an M8 railcar operated by Metro-North.

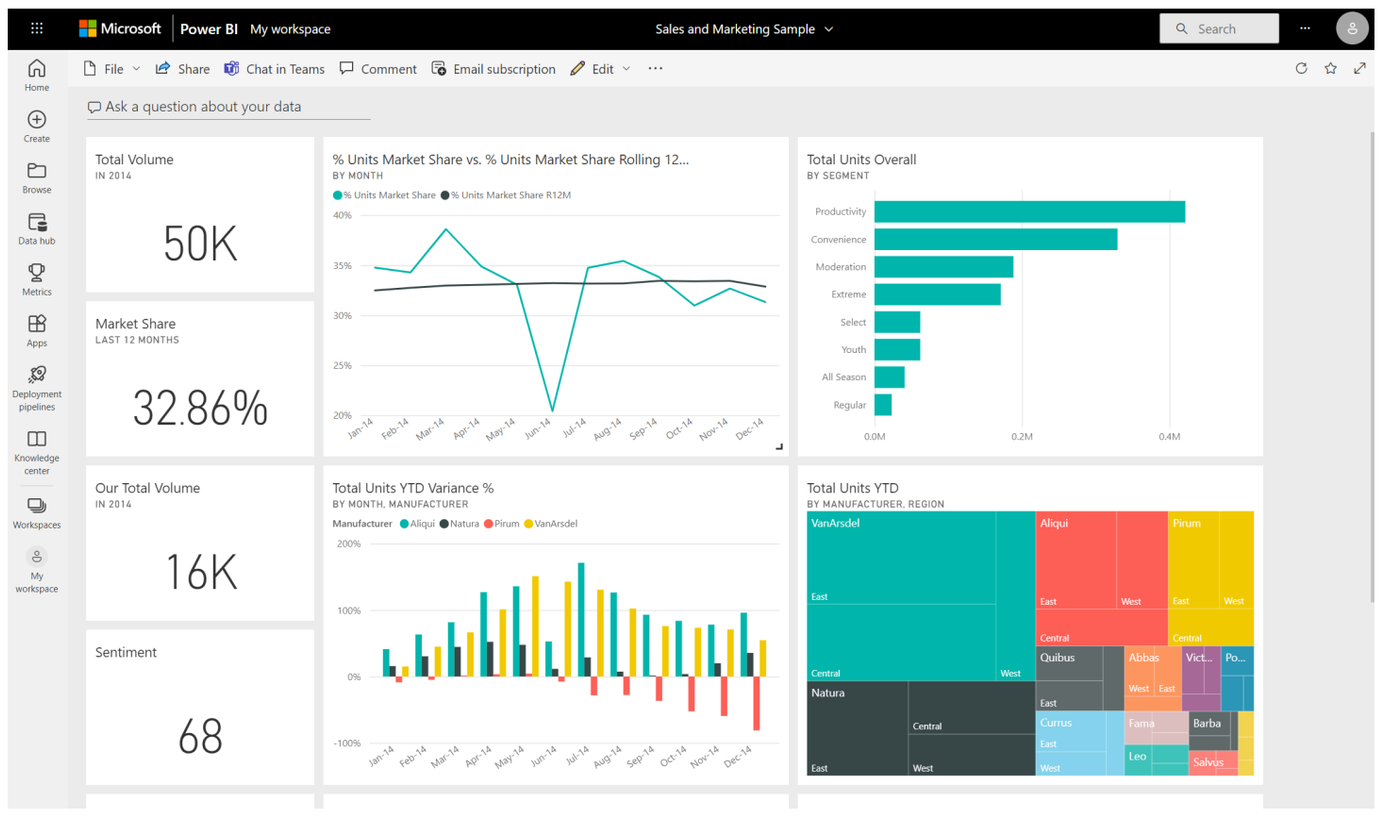
Dashboard in Mercedes-Benz S-Class (W222) S63 AMG.

Dashboards, or electronic instrument clusters, are nowadays the central control consoles for various devices, vehicles and systems containing **multi-function displays** and a broad array of **gauges** and **controls**.

Sources: https://commons.wikimedia.org/w/index.php?curid=30572868
https://commons.wikimedia.org/w/index.php?curid=17878634

Business Intelligence (BI) Dashboards





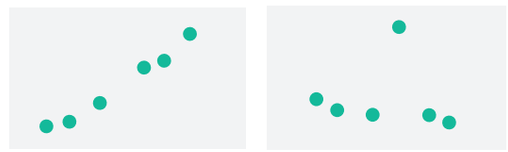
Business intelligence (BI) dashboards are single-page visualization consoles allowing users to view, filter, analyze and report on key performance indicators and metrics.

Combinations of various **faceting methods** (such as linked highlighting, overview-and-detail, partitioning and layering) are utilized for building effective dashboards.

Sources: https://www.tableau.com/blog/6-dashboards-tableau-partners-help-you-mitigate-covid-19-impacts
https://learn.microsoft.com/en-us/power-bi/consumer/end-user-dashboards

Multiple side-by-side views

- visual encoding, data, subsets
- navigation synchronized
- linked by explicit marks

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

Small multiple

- shared encoding, different partition
- views have a common reference frame
- facilitates comparison
- often used as a better alternative to animation
- drawback -- screen real-estate

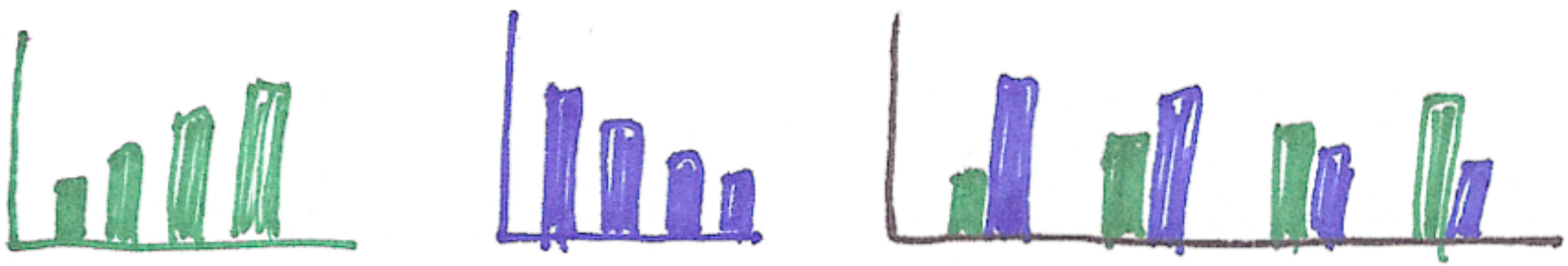
Animation vs. Small Multiplies

- Tversky argument: intuition that animation helps is wrong
  - meta-review of previous studies
  - often more info shown in animation view so not a fair comparison
  - carefully chosen segmentation into small multiples better than animation if equivalent information shown

[Animation: Can It Facilitate? Barbara Tversky, Julie Morrison, Mireille Betrancourt. International Journal of Human Computer Studies 57:4, pp 247-262, 2002.]

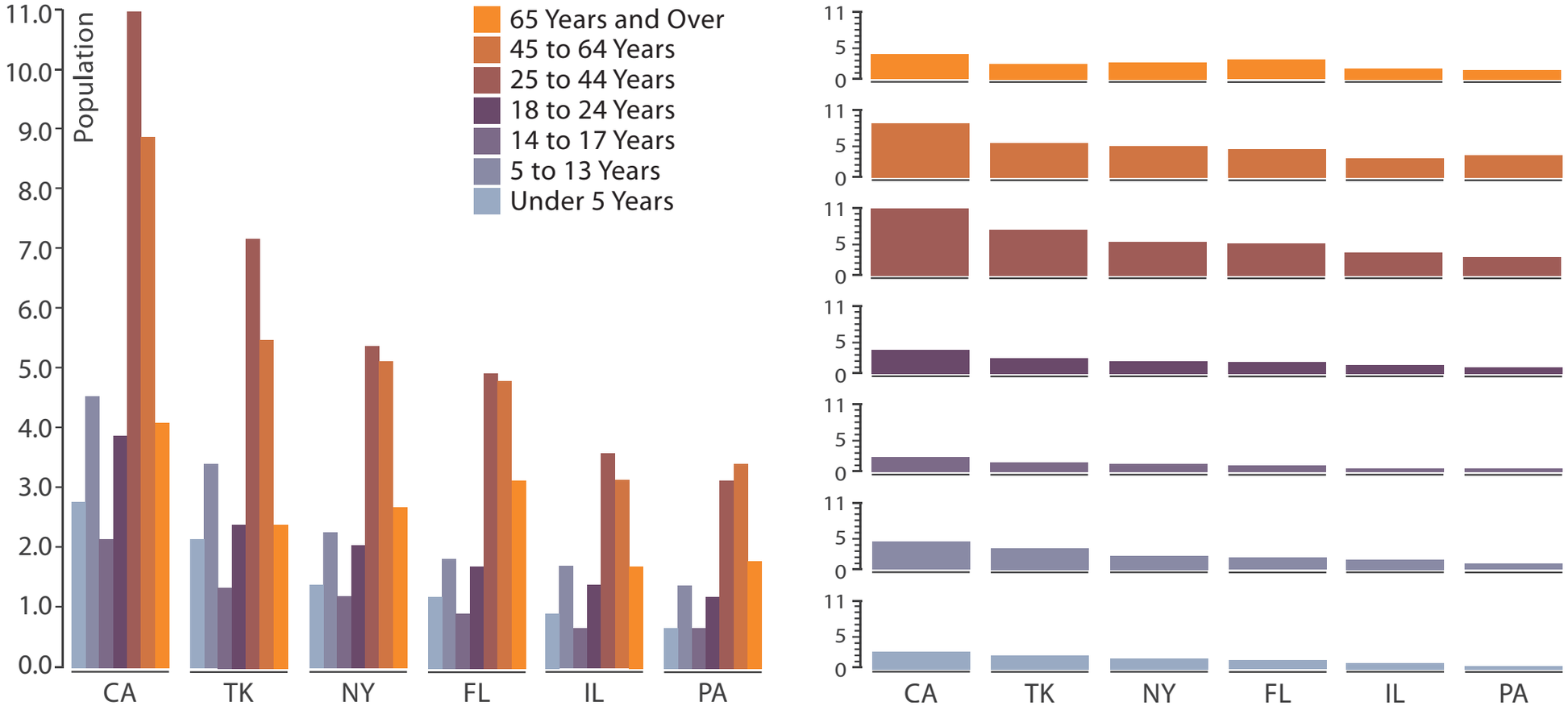
3. Partitions & Groups

- e.g. 2 keys
  - use two perpendicular axis OR
  - use alignment on one axis
    - separate by A first and then by B (left)
    - separate by B first and then by A (right)
- also known as dimensional stacking



Partitioning — Multiple keys

- we have a choice of order of stacking
- typically should be based on some order



Partitioning — Trellis diagrams

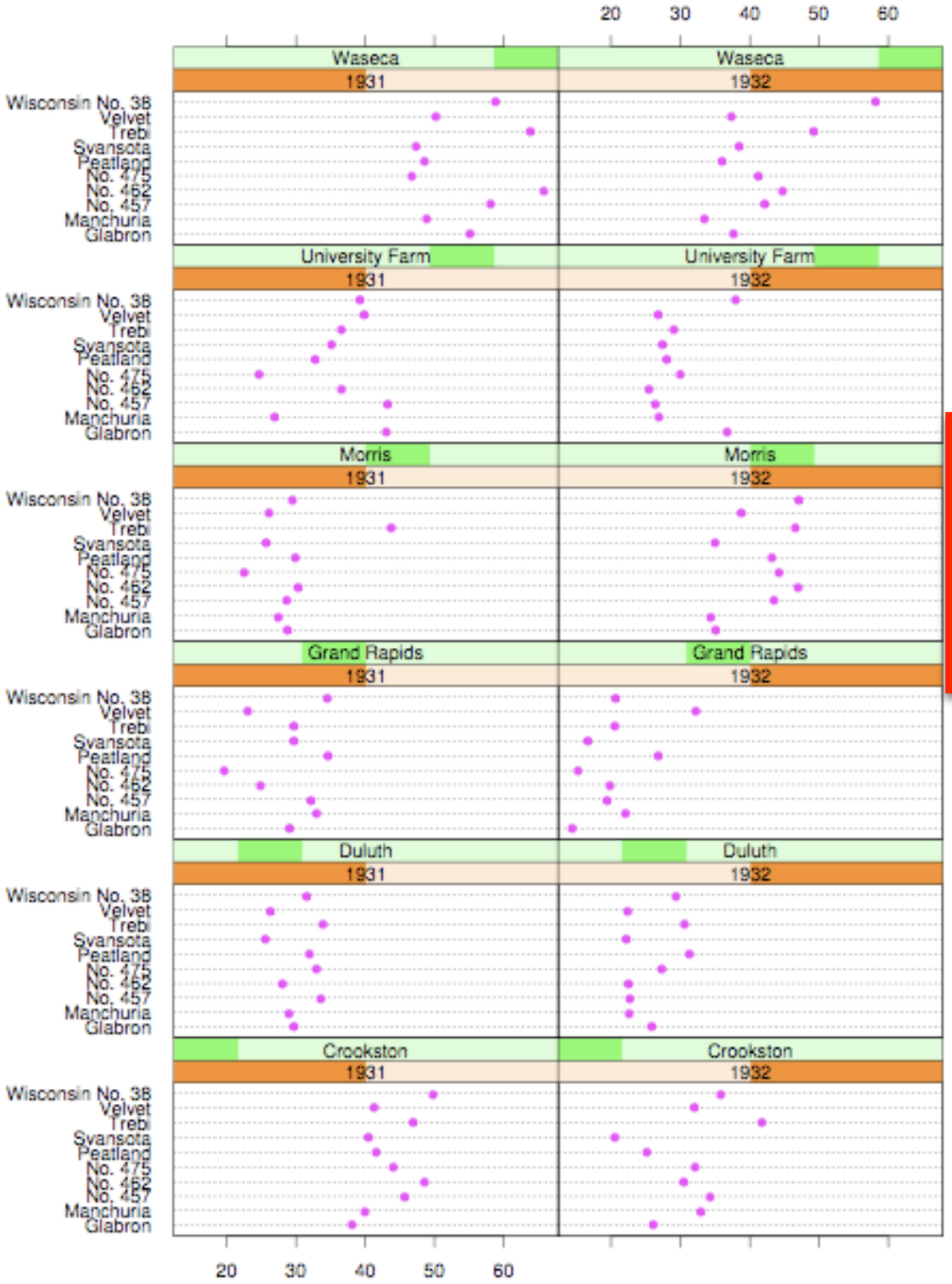
- What you see depends on the order
- Alphabetical or mean value?

Alphabetical


Median value
20
30
40
50
60
Waseca
1932
1931
Crookston
Morris
University Farm
Duluth
Grand Rapids
Trebi
Wisconsin No. 38
No. 457
Glabron
Peatland
Velvet
No. 475
Manchuria
No. 462
Svansota
Barley Yield (bushels/acre)

The Visual Design and Control of Trellis Display. Becker, Cleveland, and Shyu. JCSG 5:123-155 1996

Alphabetical



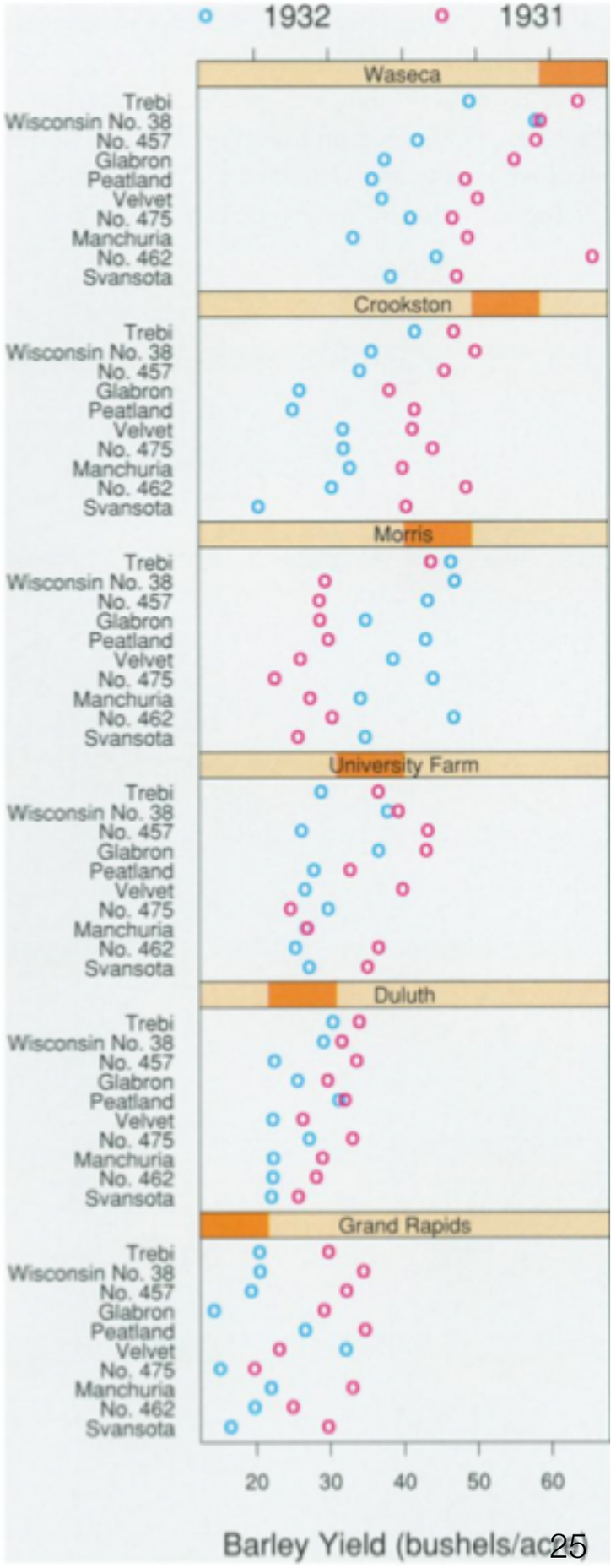
Median value

Trellis structure

- conditioning/trellising: choose structure
  - pick how to subdivide into panels
  - pick x/y axes for indiv panels
  - explore space with different choices
    - multiple conditioning
- ordering
  - large-scale: between panels
  - small-scale: within panels
  - main-effects: sort by group median
    - derived space, from categorical to ordered

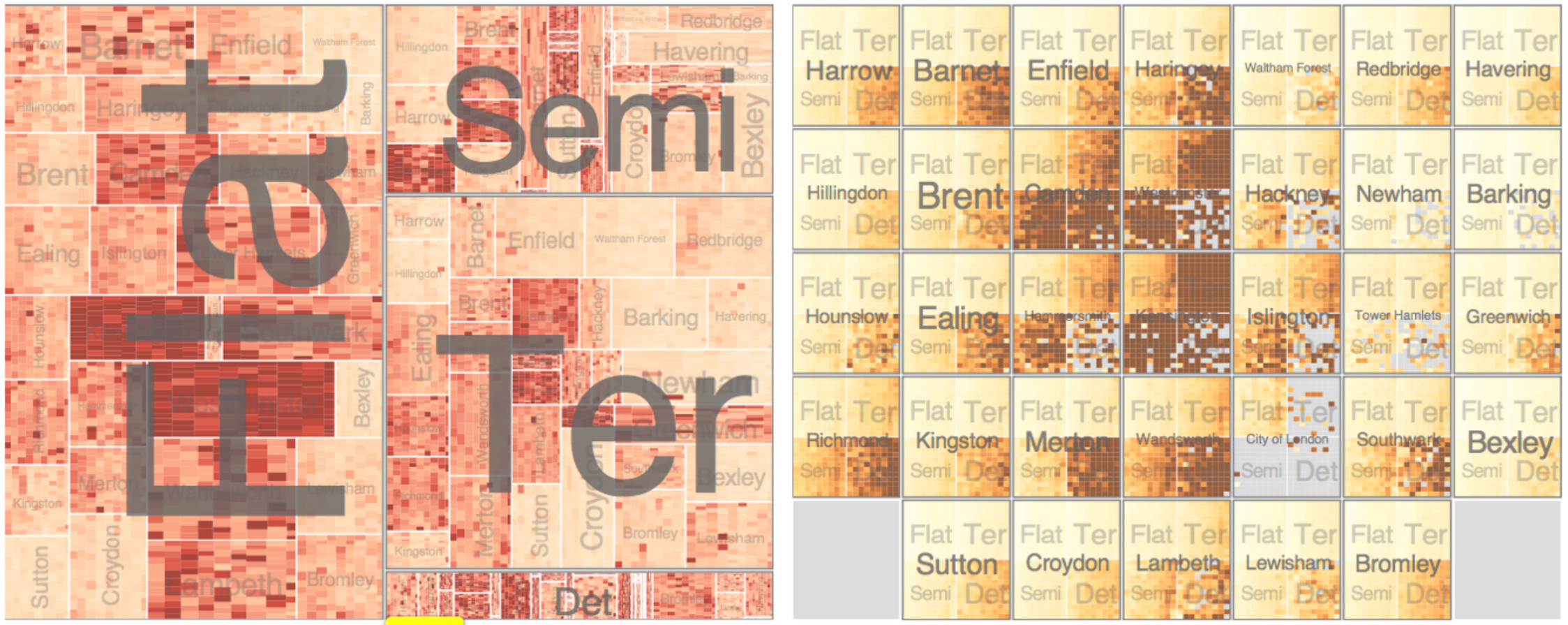
confirming hypothesis

- dataset error with Morris switched?
- old trellis: yield against variety given year/site
- new trellis: yield against site and year given variety
  - exploration suggested by previous main-effects ordering



HiVE

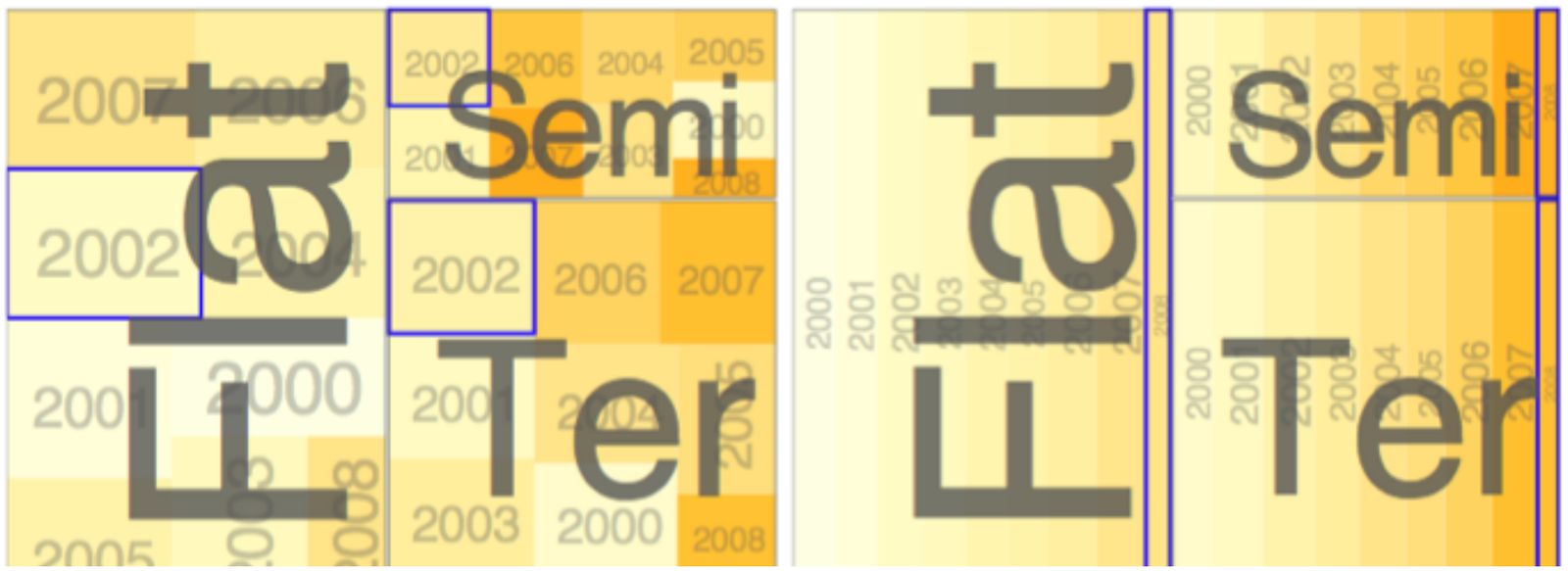
- London property transactions
  - first split into subsets by house type (left)
  - first split by neighborhood (right)



Slingsby, A., Dykes, J. and Wood, J. 2009. Configuring Hierarchical Layouts to Address Research Questions. IEEE TVCG 2009

HiVE: conditioning

- reconfigure conditioning hierarchies to explore data space
- treemaps as spacefilling rectangular layouts
  - each rectangle is conditioned subset of data
  - nested graphical summaries
    - size, shape, color used to show subset properties
    - ordered by conditioning variable
- dimensional stacking:
  - discretization and recursive embedding of dimensions



Slingsby, A., Dykes, J. and Wood, J. 2009. Configuring Hierarchical Layouts to Address Research Questions. IEEE TVCG 2009

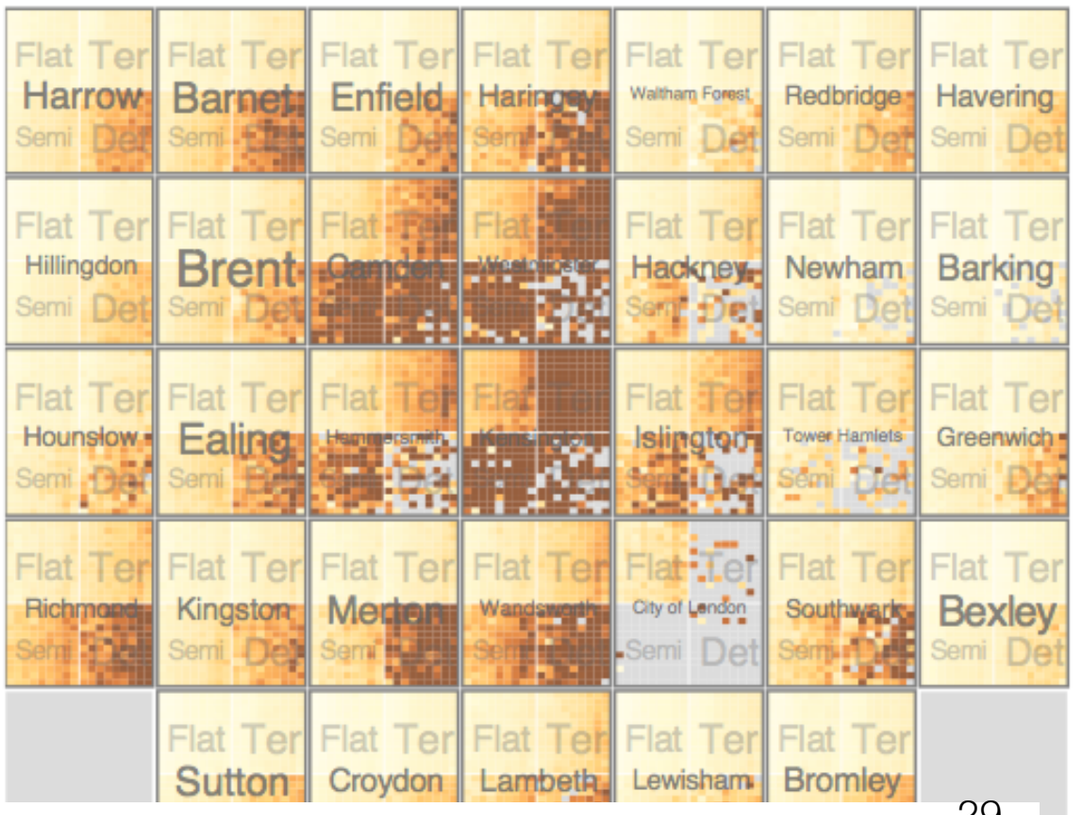
HiVE Example: London Property

- top split: house type. next: neighborhood. next: time
- color: price variance. size: number of sales
- resulting patterns:
  - between neighborhood have different house distribution
  - within neighborhoods have similar prices

Slingsby, A., Dykes, J. and Wood, J. 2009. Configuring Hierarchical Layouts to Address Research Questions. IEEE TVCG 2009

HiVE Example: London Property

- top split: neighborhood. next: house type. next: sale time (year). next: sale time (month)
- color: average price. size: fixed
- resulting patterns:
  - expensive neighborhoods near center



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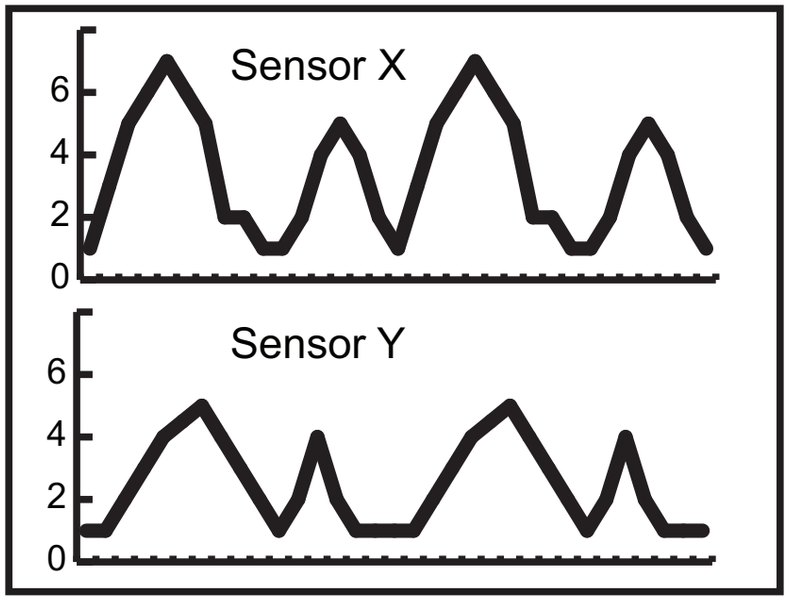
4. Superimpose Layers



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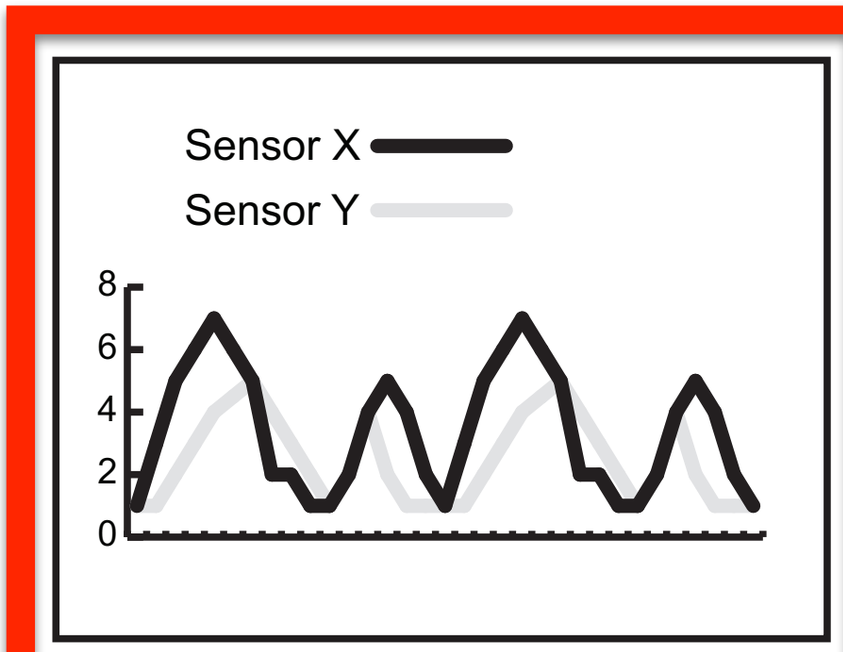
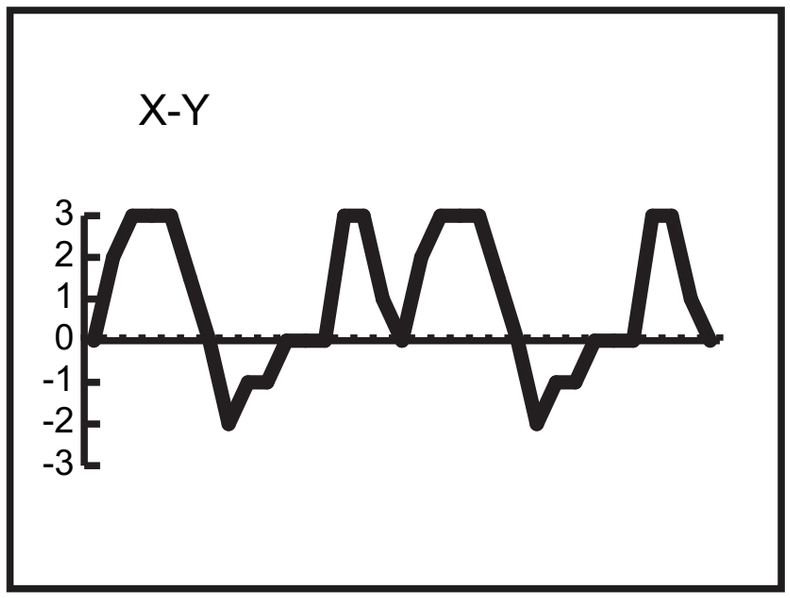
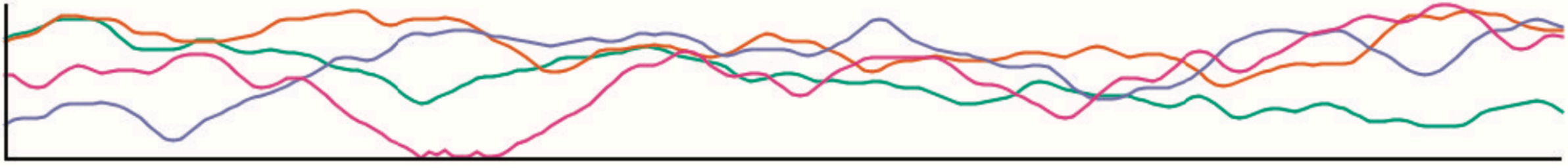


b) Superposition

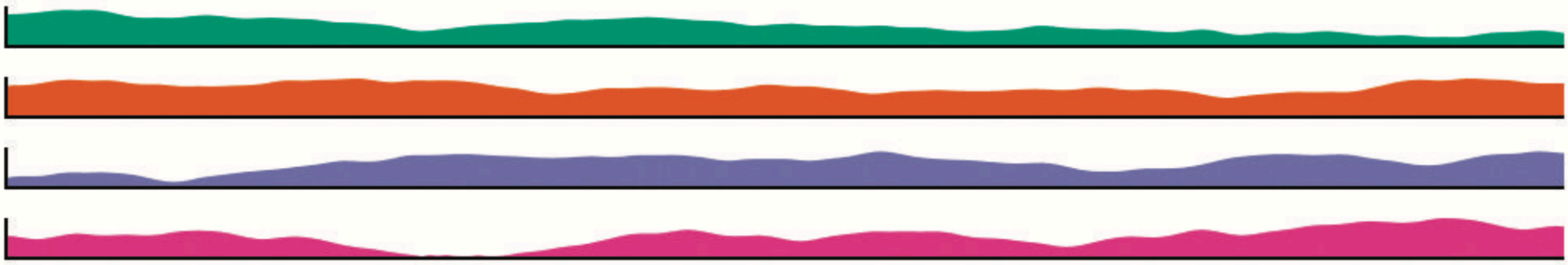


c) Explicit Encoding: Difference

Superimpose Layers



(a)



(b)

Graphical Perception of Multiple Time Series, Javed et al., 2010

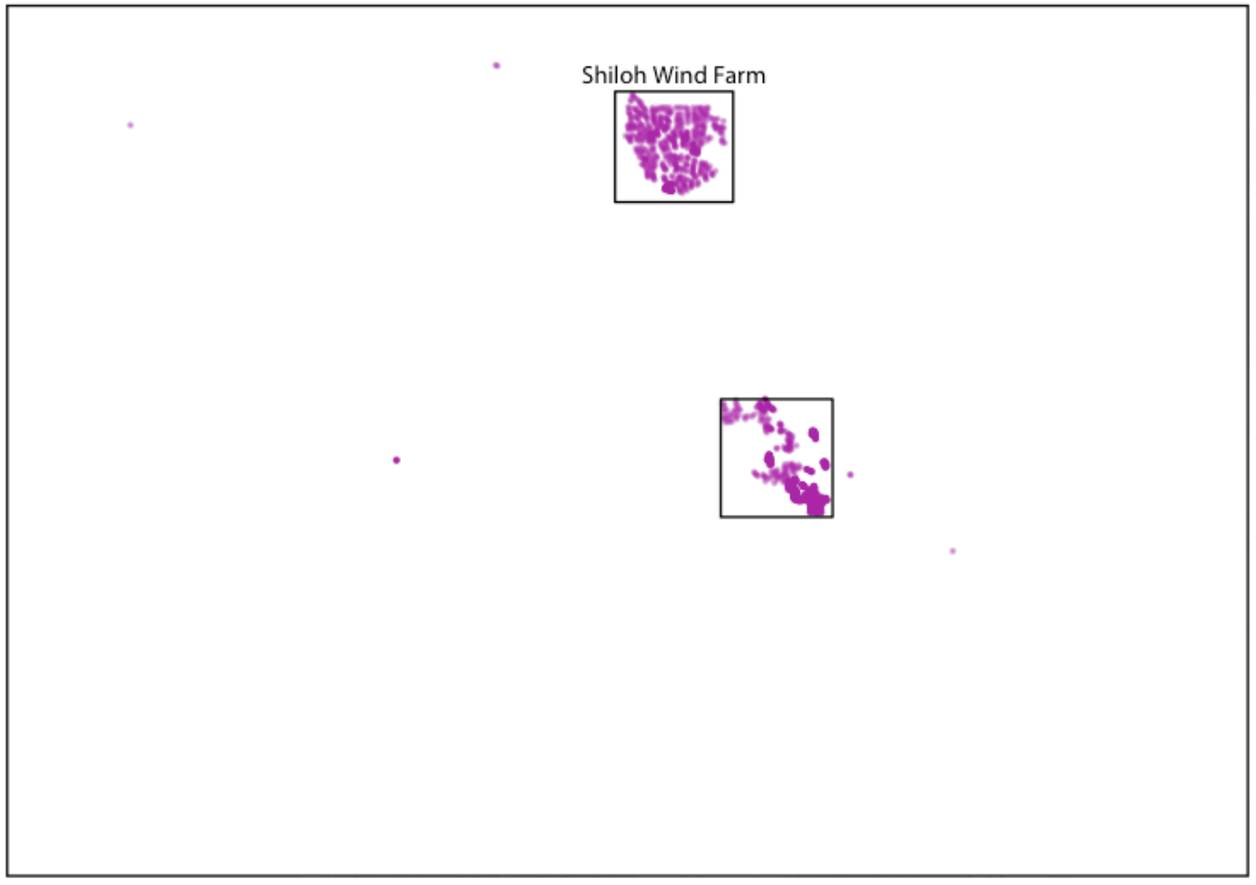
Visual layering

- beyond simple use of visual channels
- method variants
  - global compositing: everything superimposed
  - item-level stacking
- major consideration
  - static layers: disjoint ranges in channels safest
  - dynamic/interactive layers: more freedom

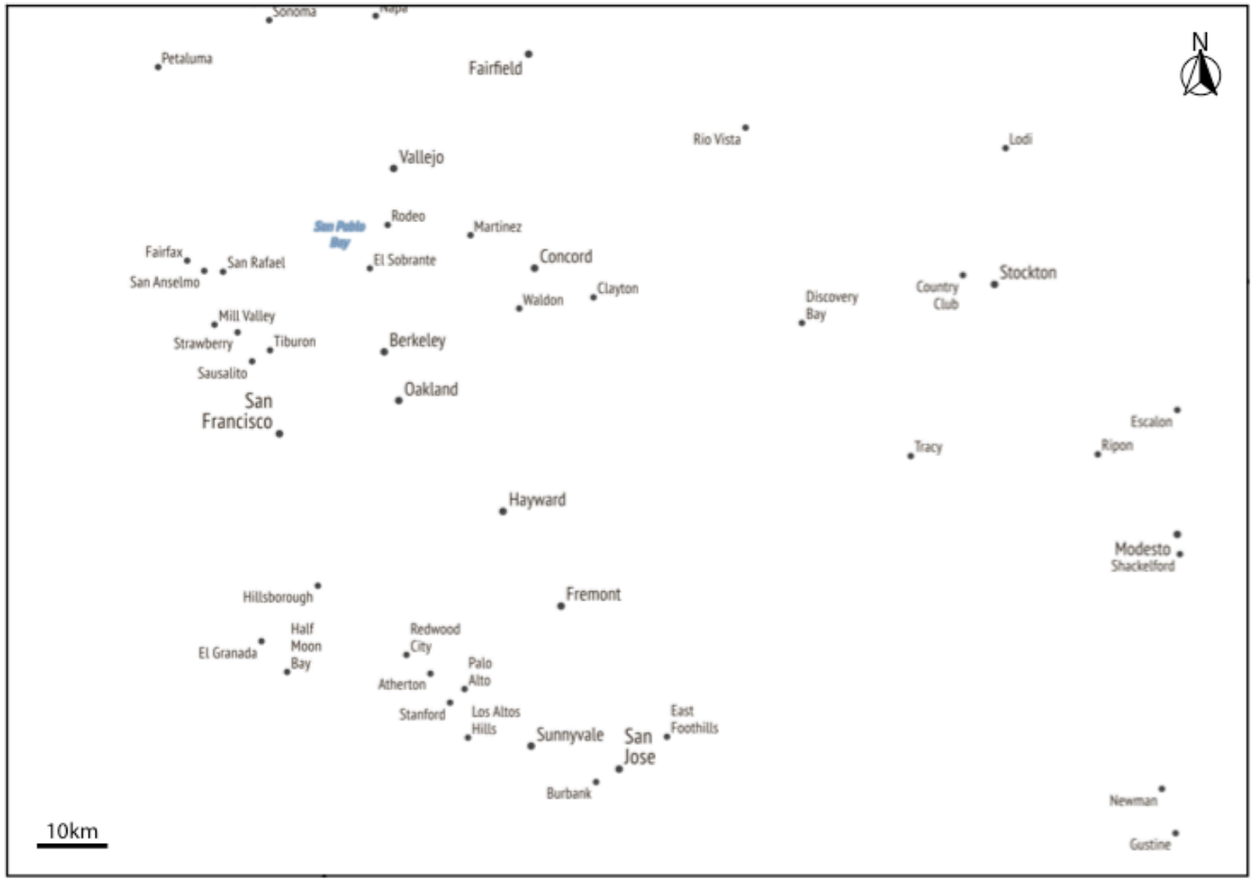
terrain

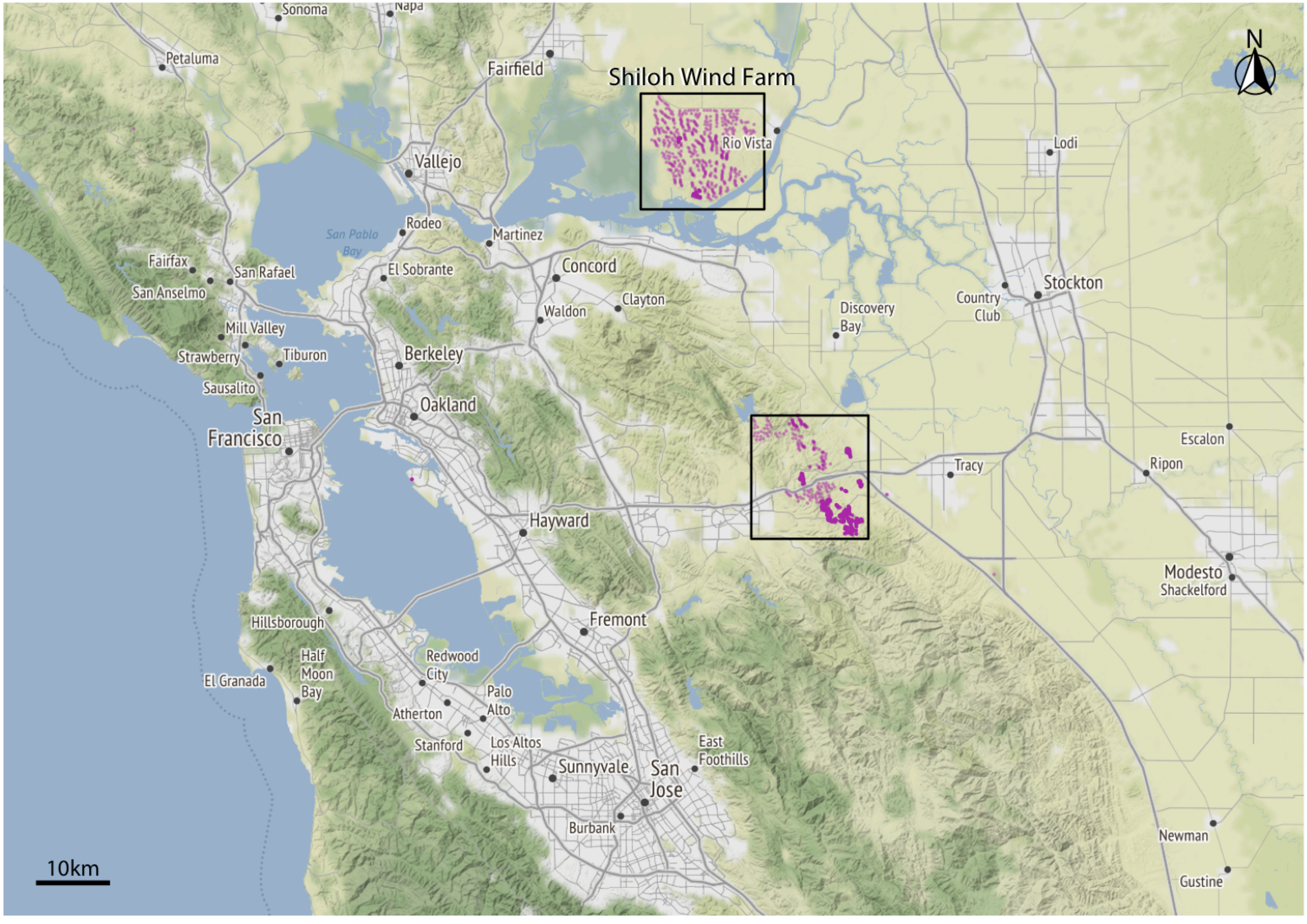
roads

wind turbines

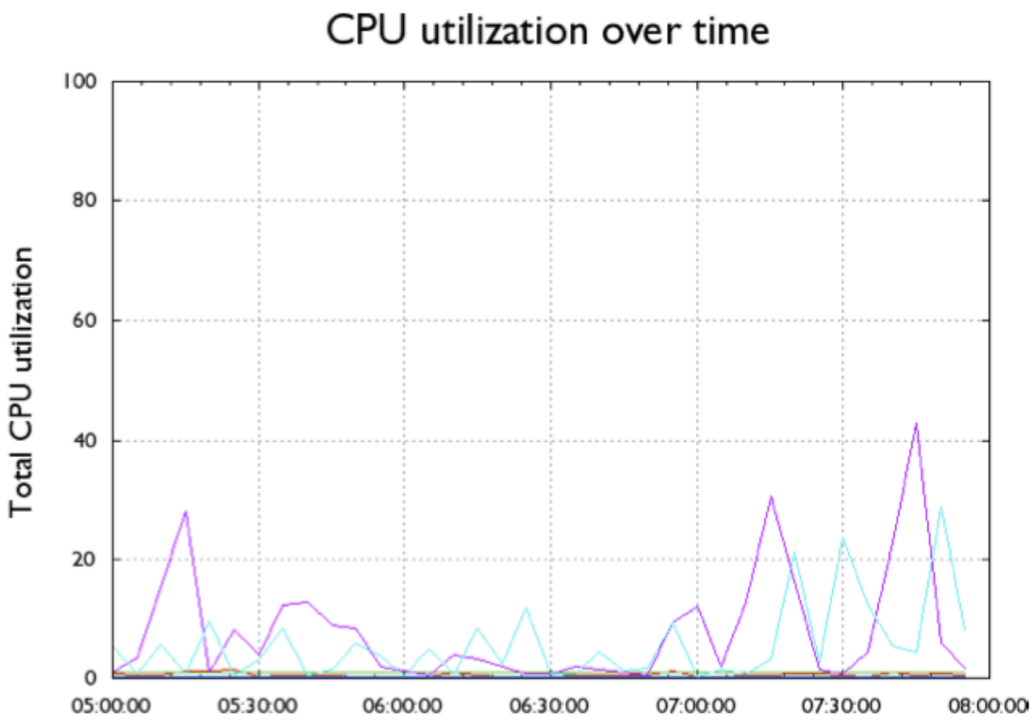


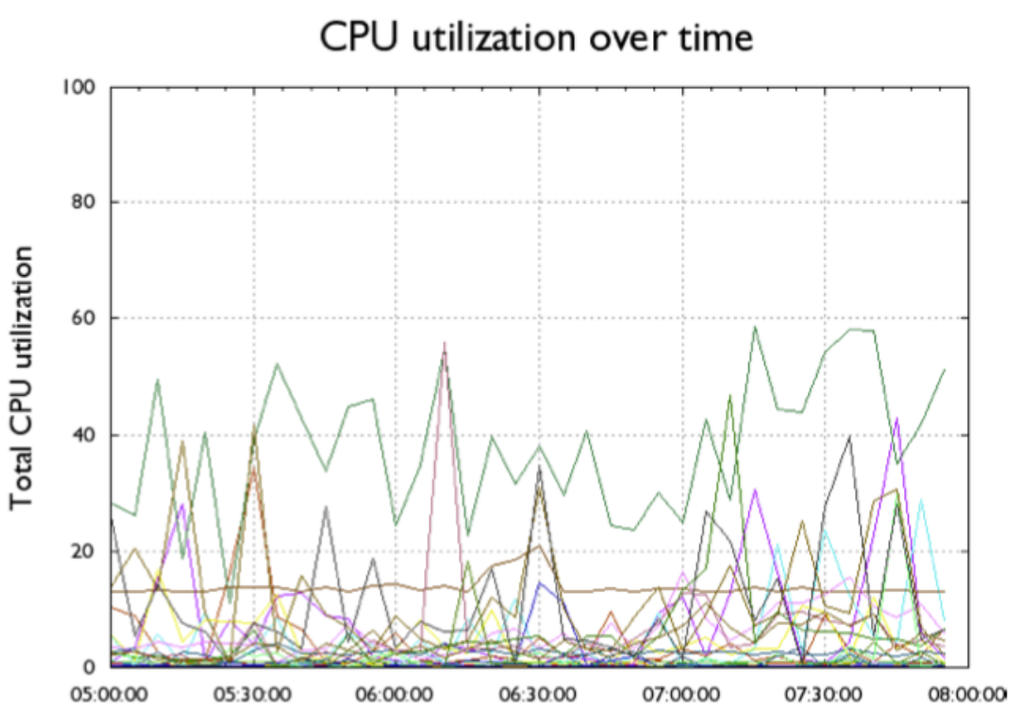
city labels, scale bar

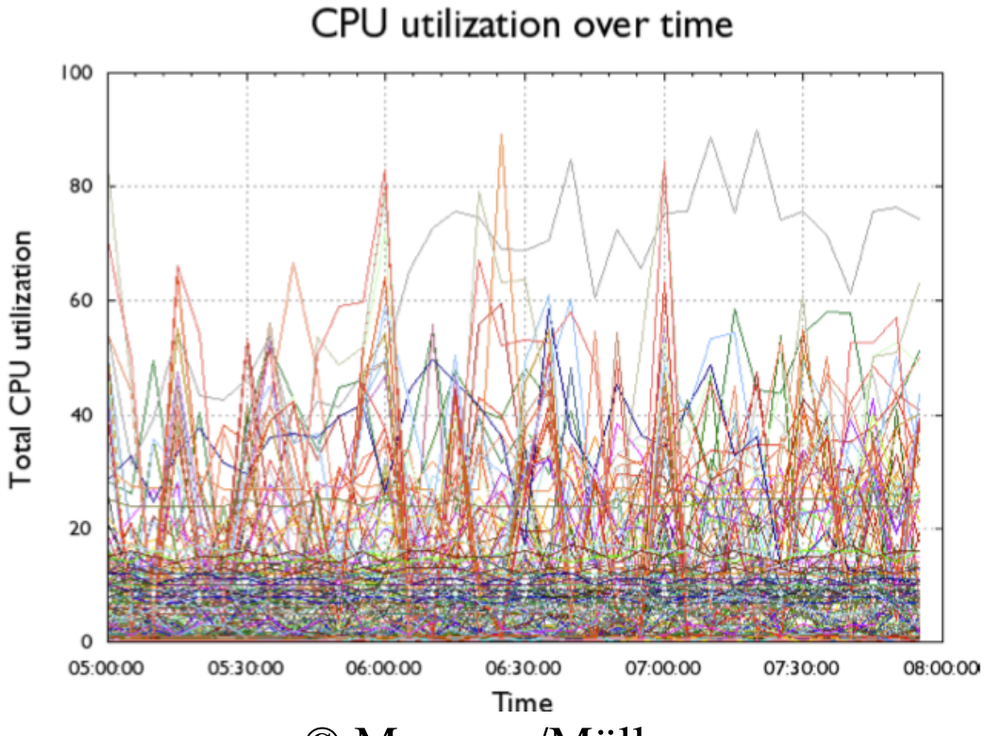



Shiloh Wind Farm
N
Sonoma
Napa
Petaluma
Fairfield
Rio Vista
Lodi
Vallejo
Rodeo
San Pablo Bay
Martinez
Fairfax
San Rafael
El Sobrante
Concord
San Anselmo
Clayton
Waldon
Discovery Bay
Country Club
Stockton
Mill Valley
Strawberry
Tiburon
Berkeley
Sausalito
Oakland
San Francisco
Escalon
Tracy
Ripon
Hayward
Modesto
Shackelford
Hillsborough
Fremont
Half Moon Bay
Redwood City
El Granada
Palo Alto
Atherton
Stanford
Los Altos Hills
East Foothills
Sunnyvale
San Jose
Burbank
Newman
Gustine
10km

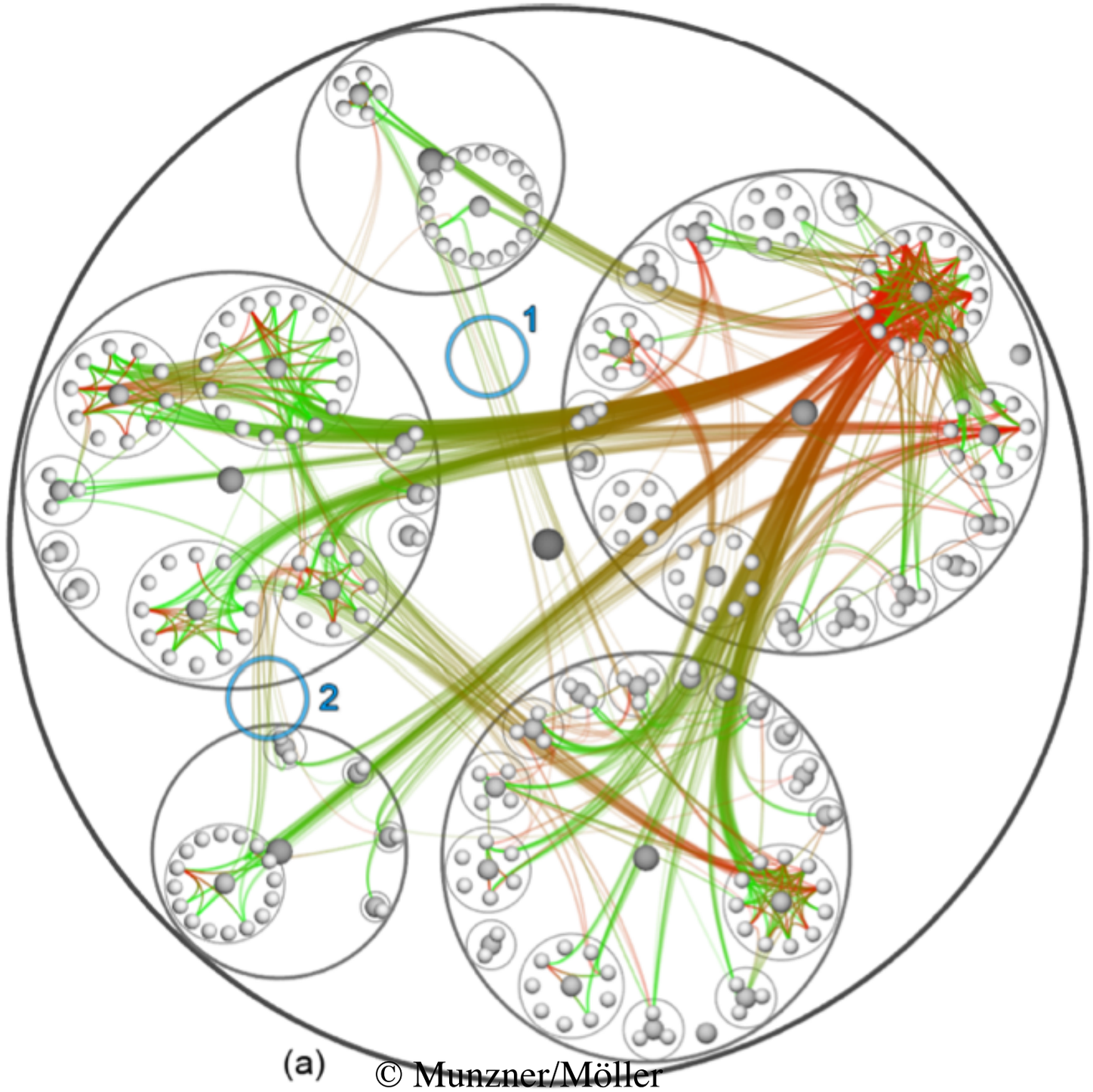
Static layers





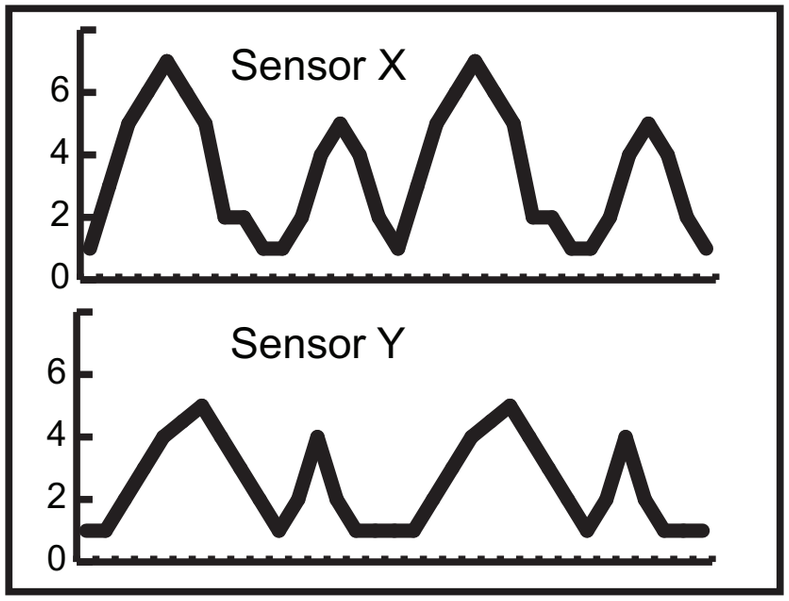


Hierarchical edge bundles



(a)

Difference views



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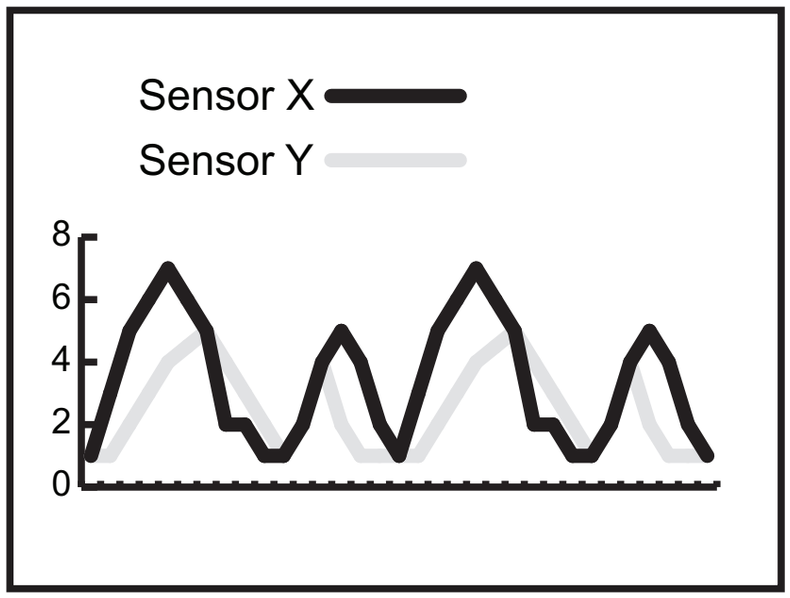

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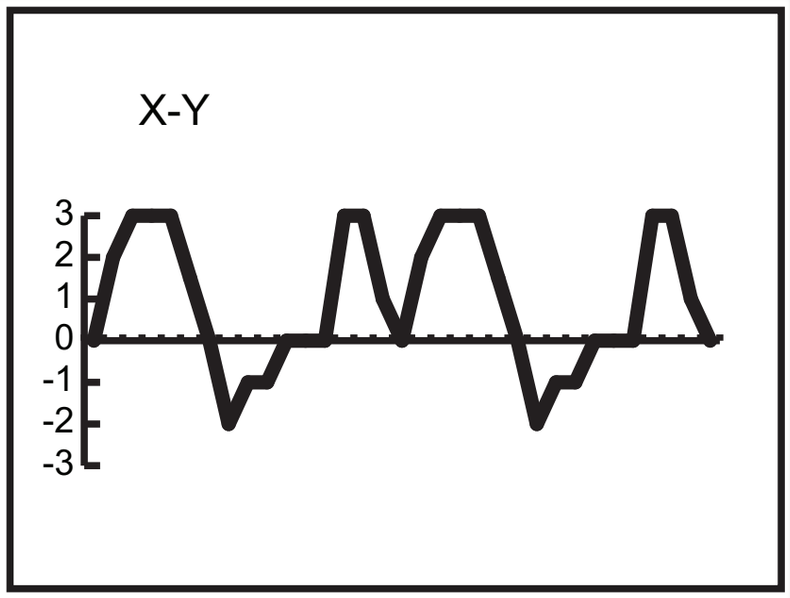

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