

Facets

Data Visualization

Amit Chourasia

Why facet?

Manage visual complexity

1. Derive data
2. Change view
- 3. Facet - Split into multiple views or layers**

Pros

1. Easy comparison (eye beats memory)
2. No single encoding is optimal for all possible tasks
3. Allows context inspection with linked highlights

Cons

1. Large space
2. Clutter

4. Reduce
5. Dimensionality reduction

Facet: Design Choices

- Juxtapose & Coordinate Views
 - Share Encoding
 - Share Data
 - Share Navigation
- Partition into Side-by-Side Views
- Superimpose Layers

Facet: Design Choice - Juxtapose

- Juxtapose & Coordinate Views
 - Share Encoding
 - Share Data

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

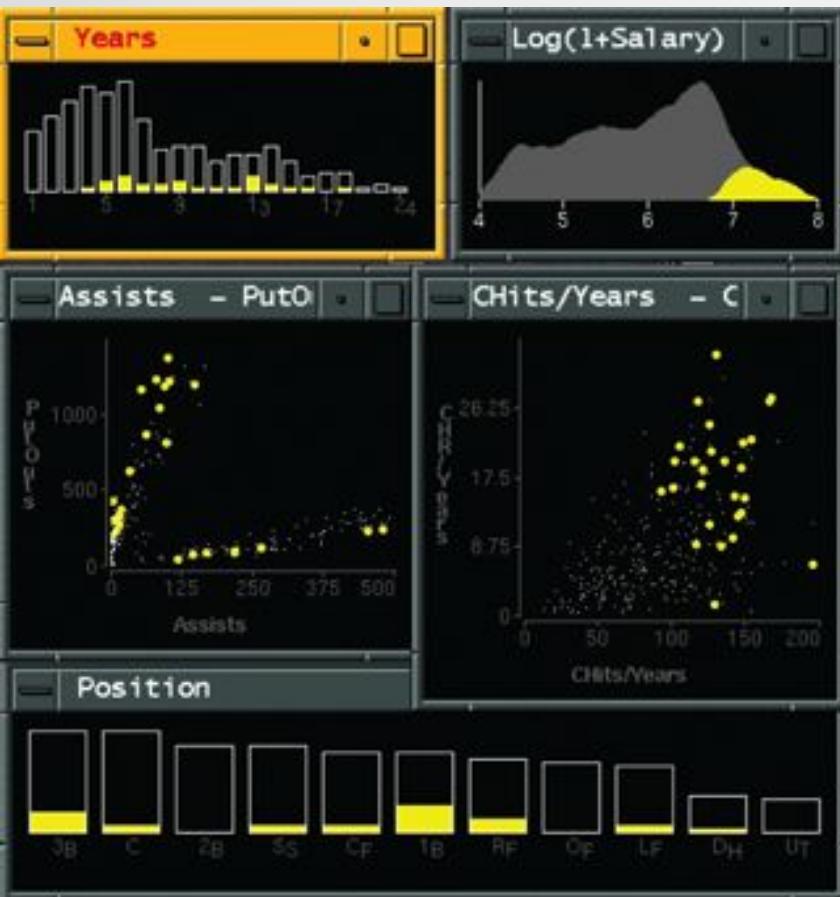
Facet: Design Choices

- Juxtapose & Coordinate Views
 - Share Encoding
 - Share Data
 - Share Navigation
- Partition into Side-by-Side Views
- Superimpose Layers

Facet: Design Choice – Coordinate Views

- Juxtapose & Coordinate Views
 - Share Encoding
 - Same – All channels are handled same way
 - Different
 - Share Data
 - Share Navigation
- Partition into Side-by-Side Views
- Superimpose Layers

Facet: Design Choice – Share Encoding (Linked Highlighting)



What: Data

Tables

How: Encode

Bar charts, scatterplots, and histograms.

How: Facet

Partition: multiform views. Coordinate: linked highlighting



Facet: Design Choice – Share Encoding

- Juxtapose & Coordinate Views
 - Share Encoding
 - Same – All channels are handled same way
 - Different
 - Share Data
 - All
 - Subset
 - None
 - Common choice with two views with overview and detail
 - Share Navigation
 - Partition into Side-by-Side Views
 - Superimpose Layers

Facet: Design Choices - Share Data, Share Navigation (Overview-detail)



Idiom Bird's-Eye Map

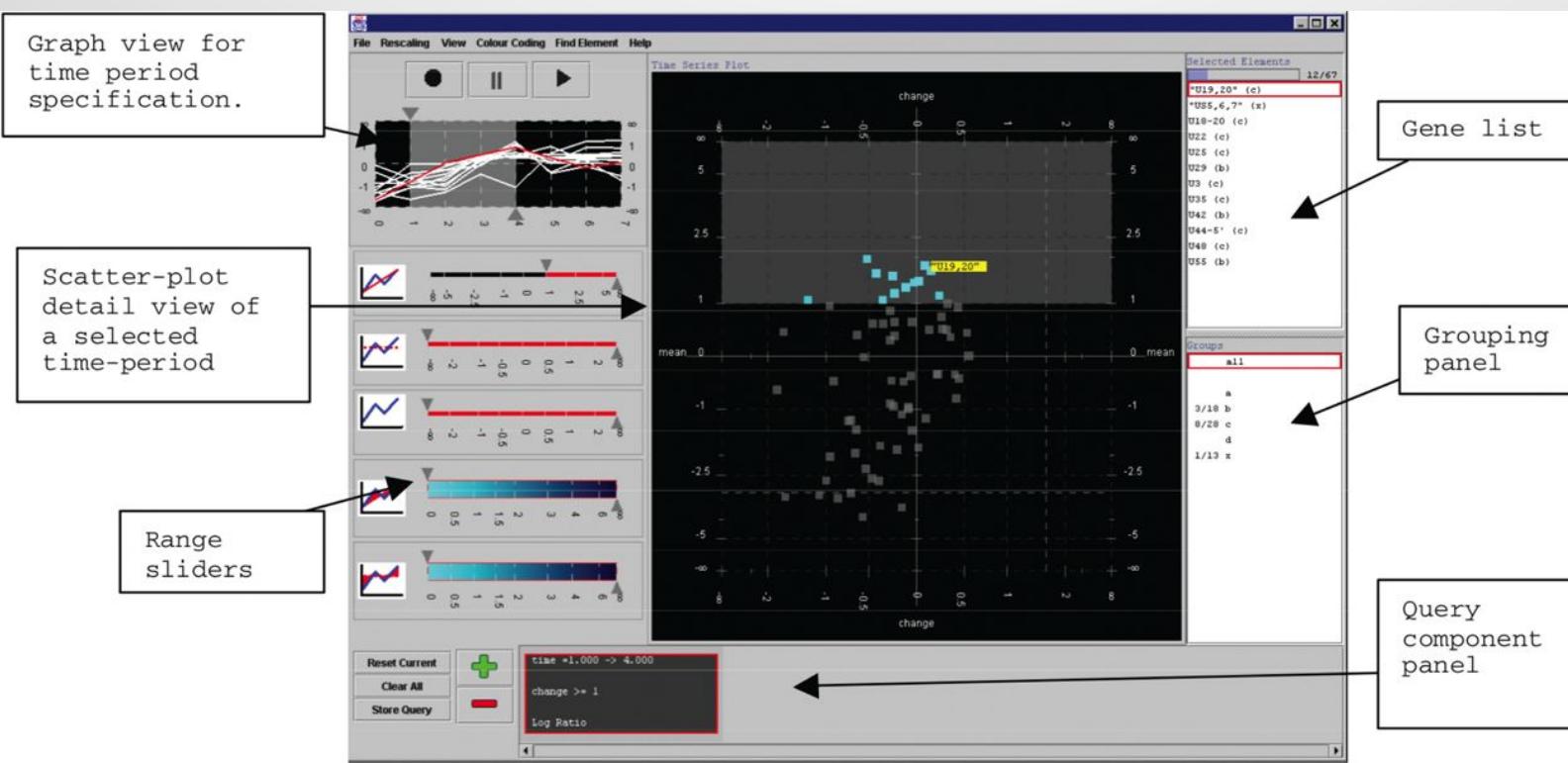
What: Data Geographic

How: Encode Area as given

How: Facet Partition into two views with same encoding, overview–detail.

How: Reduce Navigate

Facet: Design Choices - Share Data (Multiform view)

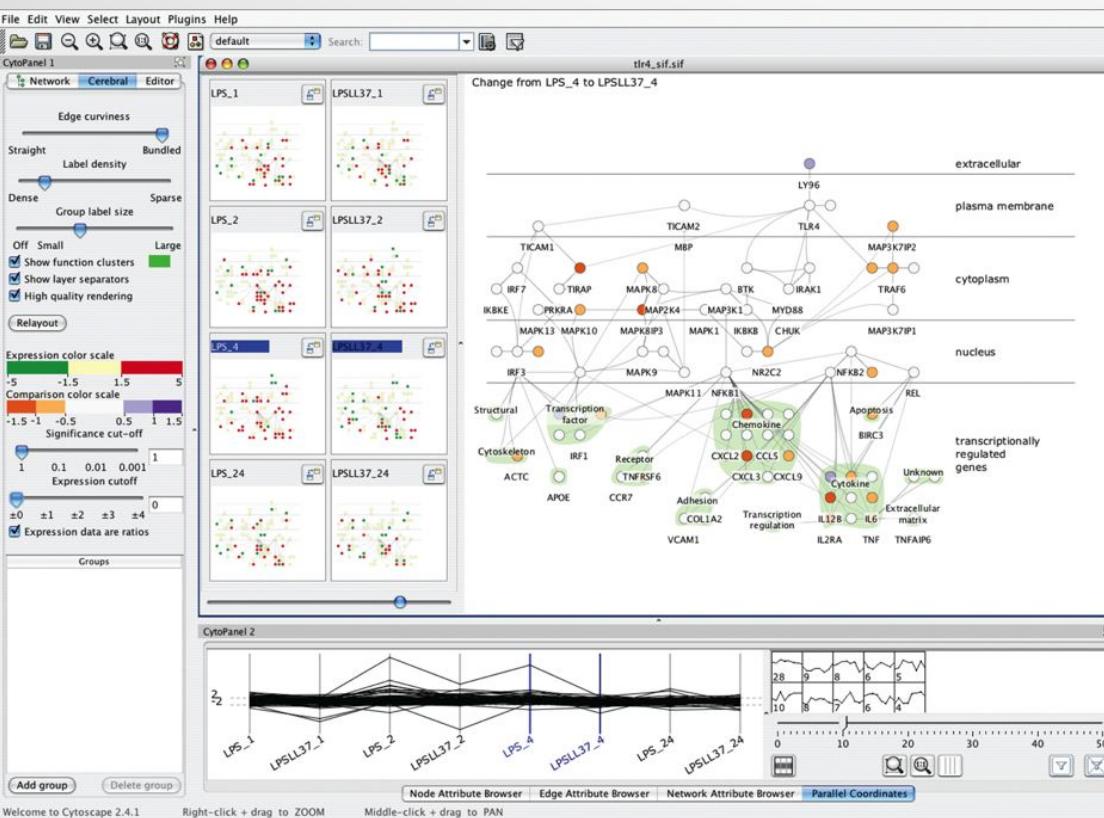


System Multiform Overview-Detail Microarrays

What: Data	Multidimensional table: one categorical key attribute (gene), one ordered key attribute (time), one quantitative value attribute (microarray measurement of gene activity at time)
What: Derived	Three quantitative value attributes: (value change, percentage of max value, fold change).
Why: Tasks	Locate, identify, and compare; distribution, trend, and similarity. Produce.
How: Encode	Line charts, scatterplots, lists.
How: Facet	Partition into multiform views. Coordinate with linked highlighting. Overview+detail filtering of time range. Superimpose line charts.

Figure by Craig and Kennedy. "Coordinated Graph and Scatter-Plot Views for the Visual Exploration of Microarray Time-Series Data."

Design Choices: Share Data – Multiple views



System	Multiform Overview—Detail Microarrays
What: Data	Multidimensional table: one categorical key attribute (gene), one categorical key attribute (condition), one quantitative value attribute (gene activity at condition). Network: nodes (genes), links (known interaction between genes), one ordered attribute on nodes: location within cell of interaction.
What: Derived	One quantitative value attribute (difference between measurements for two partitions).
Why: Tasks	Locate, identify, and compare; distribution, trend, and similarity. Produce.
How: Encode	Node-link network using connection marks, vertical spatial position expressing interaction location, containment marks for coregulated gene groups, diverging colormap. Small-multiple network views aligned in matrix. Parallel coordinates.
How: Facet	Partition: small multiple views partitioned on condition, and multiform views. Coordinate: linked highlighting and navigation.

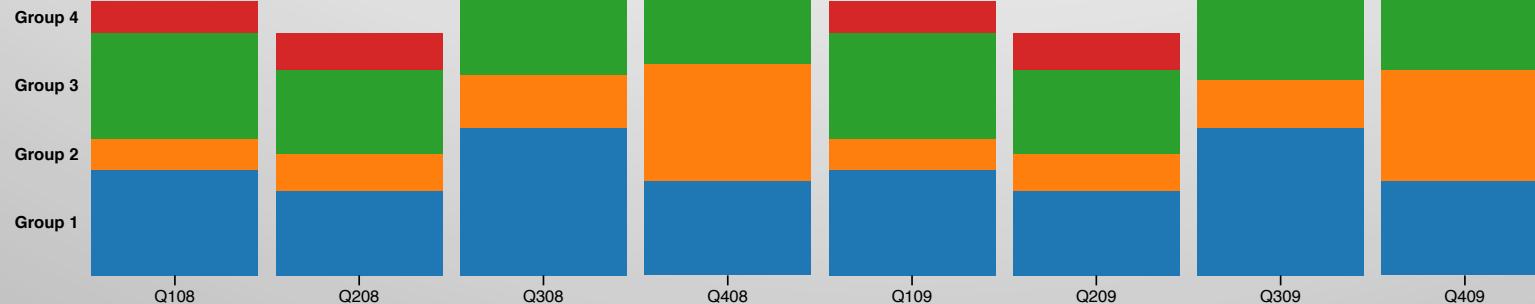
Figure by Barsky et al. "Cerebral: Visualizing Multiple Experimental Conditions on a Graph with Biological Context."

Facet: Design Choice – Partition

- Juxtapose & Coordinate Views
 - Share Encoding
 - Same – All channels are handled same way
 - Different
 - Share Data
 - All
 - Subset
 - None
 - Share Navigation
- **Partition into Side-by-Side Views**
 - Regions, Glyphs, Views
 - List Alignments
 - Matrix Alignments
 - Recursive Subdivision
- Superimpose Layers

Facet : Partition – List Alignments

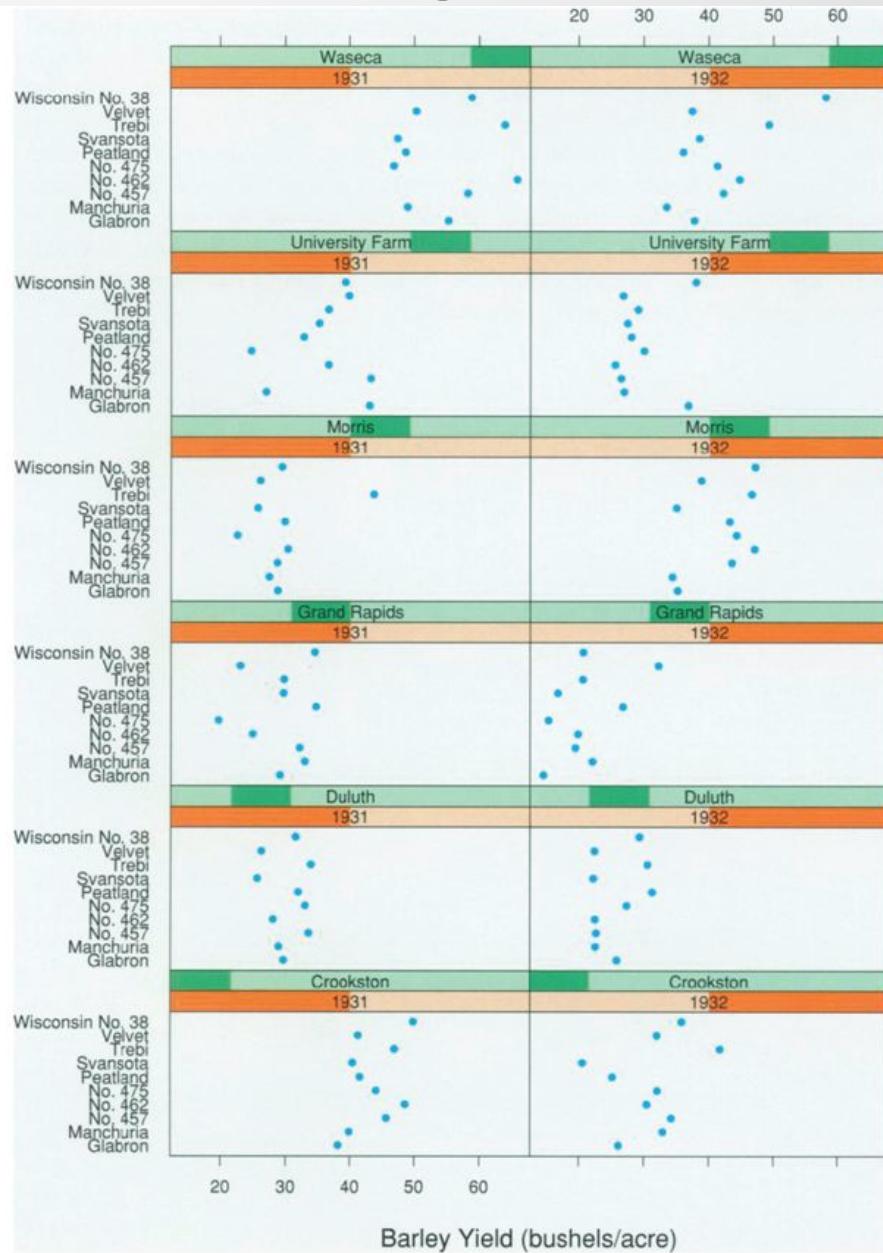
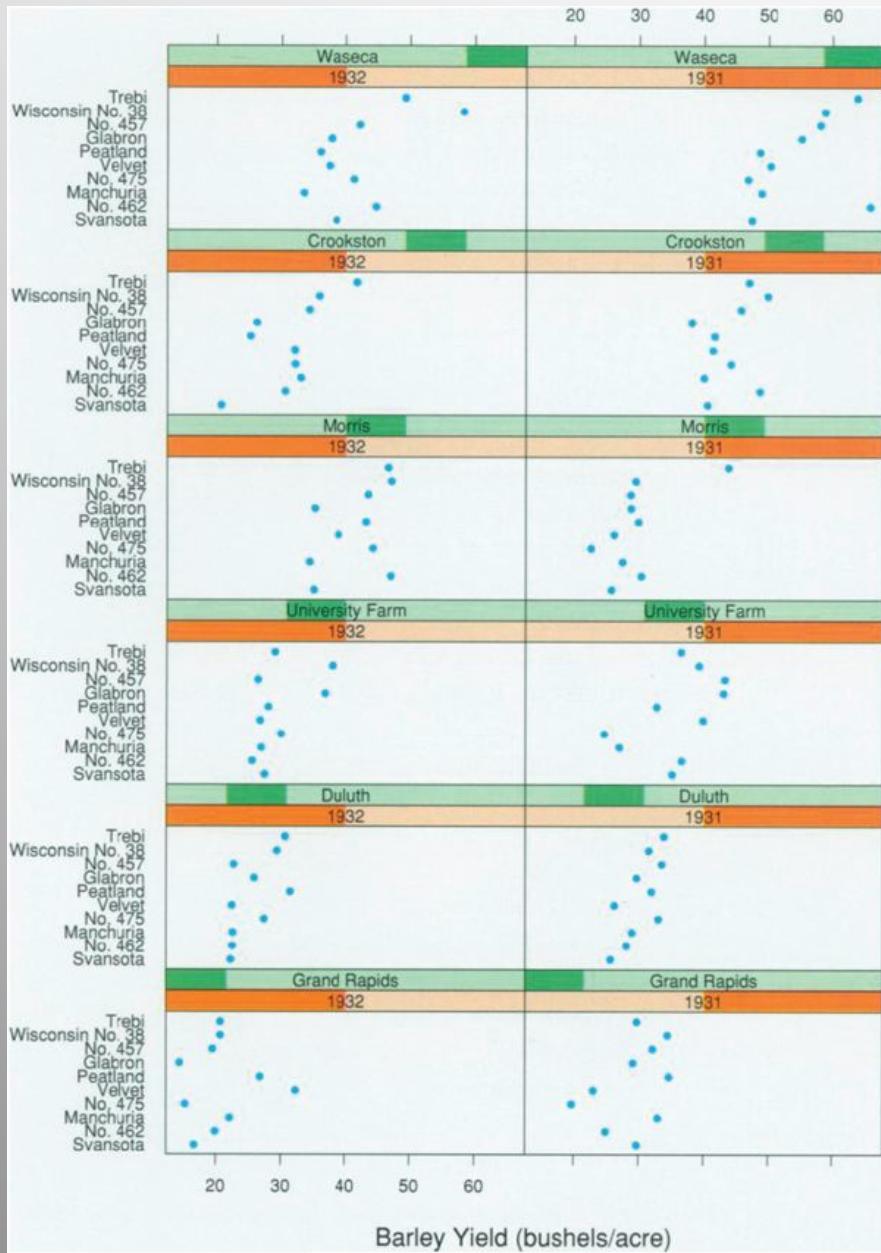
Stacked



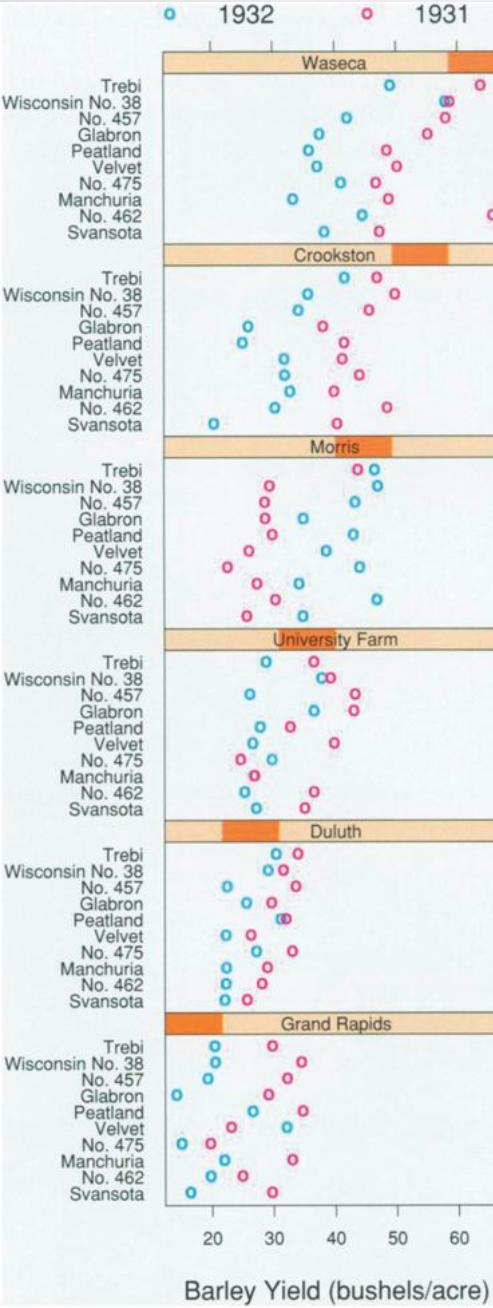
Multiple



Facet : Partition – Matrix Alignments



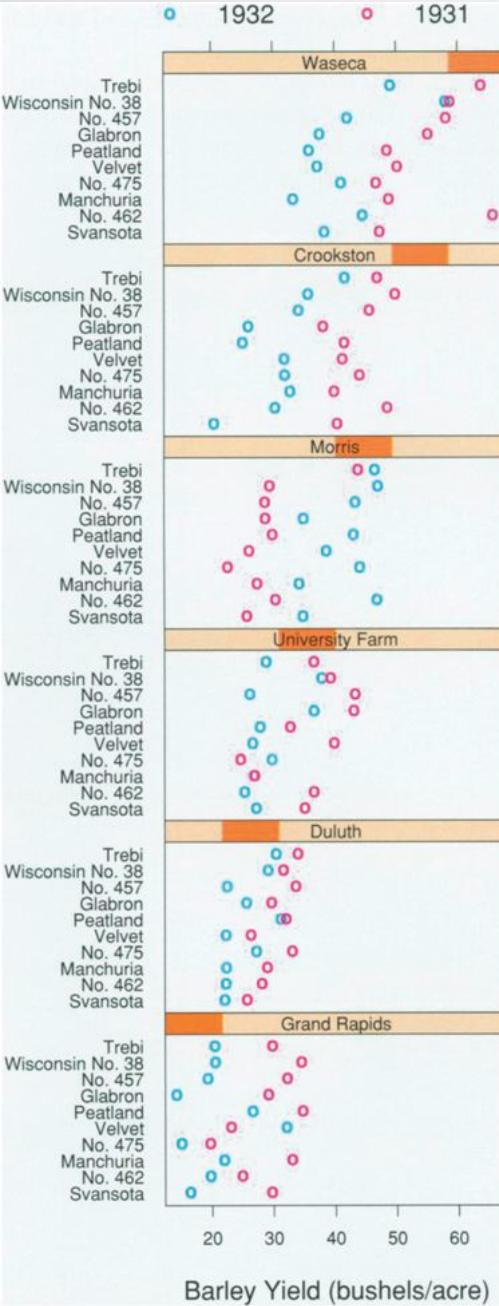
Facet : Partition – Matrix Alignments



System	Trellis
What: Data	Multidimensional table: three categorical key attributes, one quantitative value attribute.
What: Derived	Medians for each partition.
Why: Tasks	Locate, identify, and compare; distribution, trend, and similarity. Produce.
How: Encode	Dot charts aligned in 2D matrix.
How: Facet	Partitioned by any combination of keys into regions.

Figure by Becker et al. "The Visual Design and Control of Trellis Display."

Facet : Partition – Recursive Subdivision



System	Trellis
What: Data	Multidimensional table: three categorical key attributes, one quantitative value attribute.
What: Derived	Medians for each partition.
Why: Tasks	Locate, identify, and compare; distribution, trend, and similarity. Produce.
How: Encode	Dot charts aligned in 2D matrix.
How: Facet	Partitioned by any combination of keys into regions.

Figure by Becker et al. "The Visual Design and Control of Trellis Display."

Hierarchical Visual Expression (HiVE) system

Dataset

1M+ property transactions in the London area

- 4 house types (Categorical)
 - Flat
 - Ter - attached terrace houses
 - Semi - semidetached houses
 - Det - fully detached houses
- Price (Quantitative)
- Time: Month + Year (Order)
- 33 Neighborhoods (Categorical or Spatial)

Hierarchical Visual Expression (HiVE) system

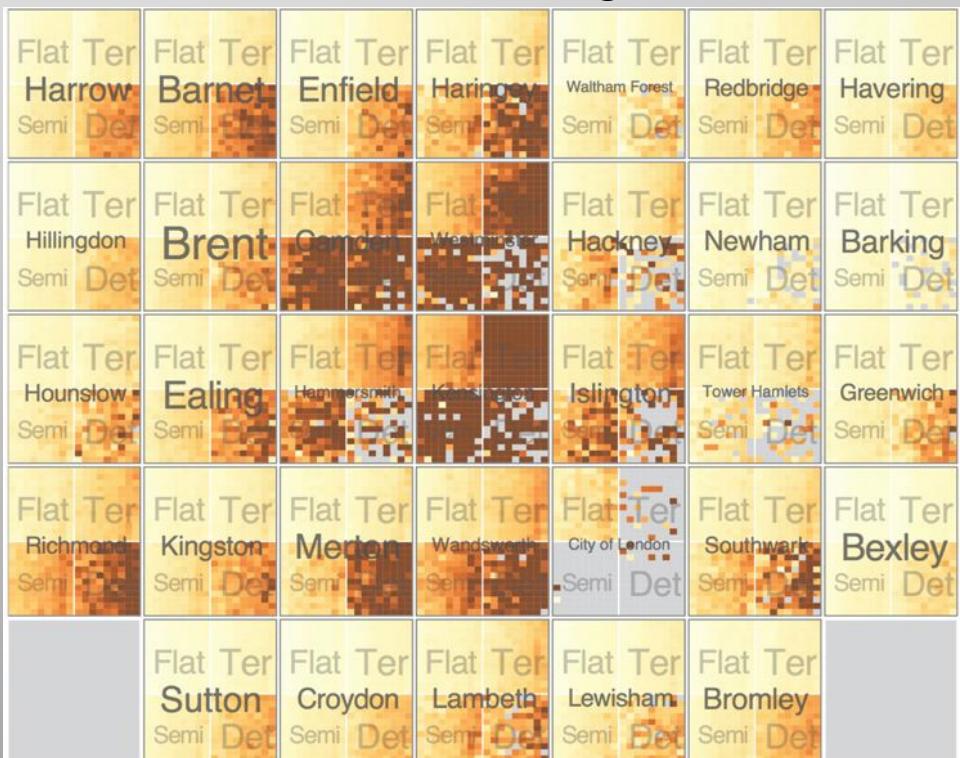


Hierarchical Visual Expression (HiVE) system

Subdivision on House Type



Subdivision on Neighborhood

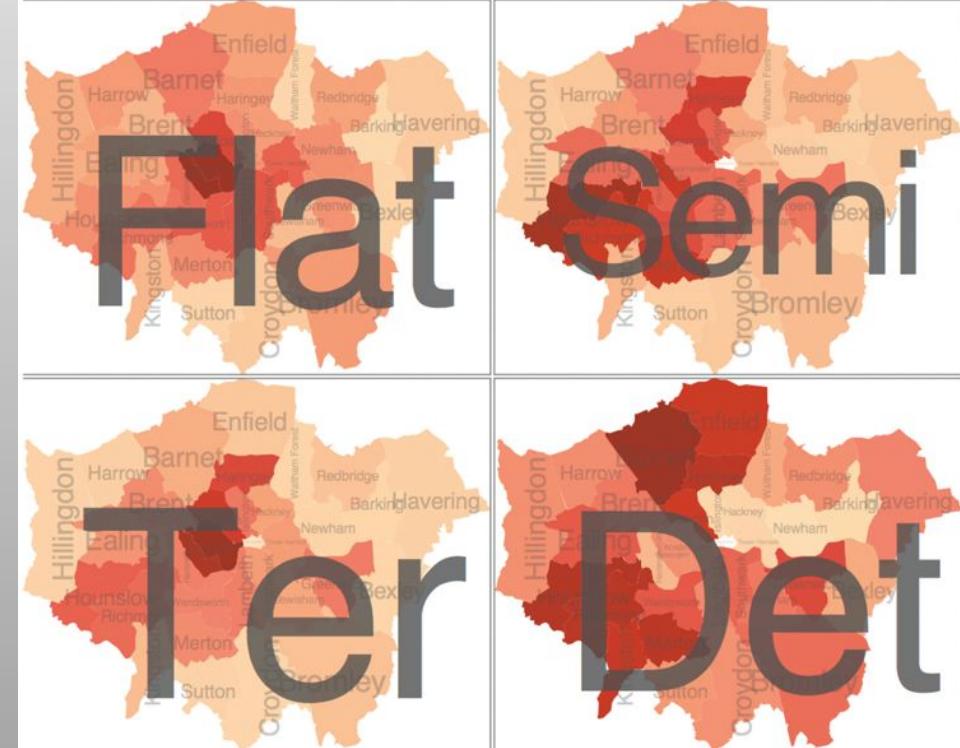


Hierarchical Visual Expression (HiVE) system

Treemap subdivision on House Type



Choropleth on House Type



Facet: Design Choice – Layers

- Juxtapose & Coordinate Views
 - Share Encoding
 - Same – All channels are handled same way
 - Different
 - Share Data
 - All
 - Subset
 - None
 - Share Navigation
- Partition into Side-by-Side Views
 - Regions, Glyphs, Views
 - List Alignments
 - Matrix Alignments
 - Recursive Subdivision
- Superimpose Layers

Facet: Design Choice – Layers

- Static Layers
- Dynamic Layers

Facet: Design Choice - Static Layers (Cartographic Layering)



Idiom

Cartographic Layering

What: Data

Geographic

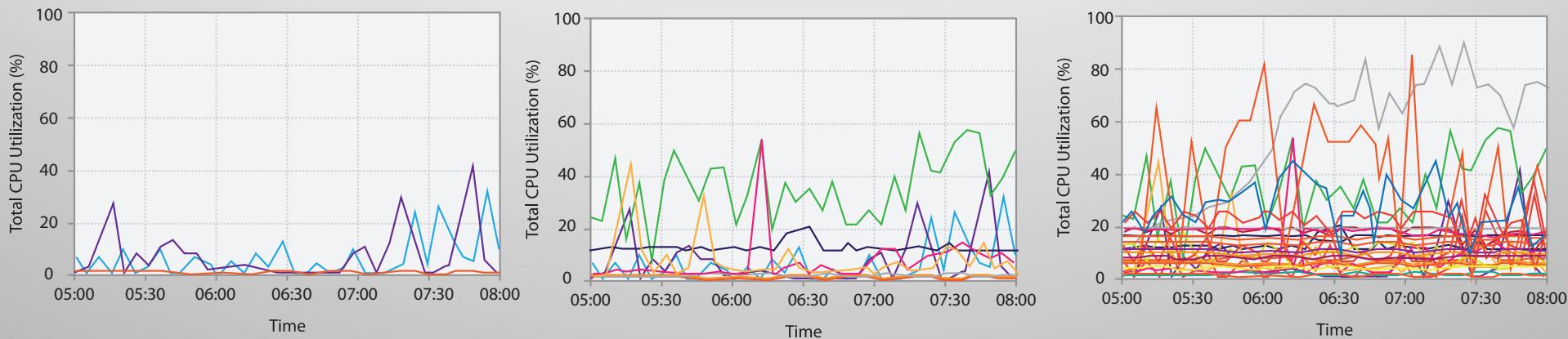
How: Encode

Area marks for regions (water, parks, other land),
line marks for roads,
categorical colormap

How: Facet

Superimpose: static layers distinguished with color saturation, color luminance, and size channels

Facet: Design Choice - Static Layers (Superimposed Line Chart)

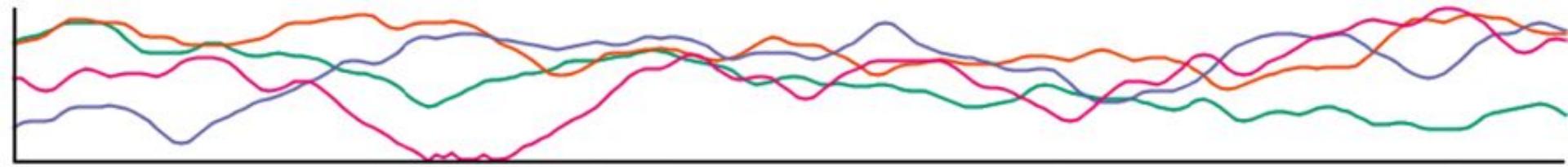


Idiom

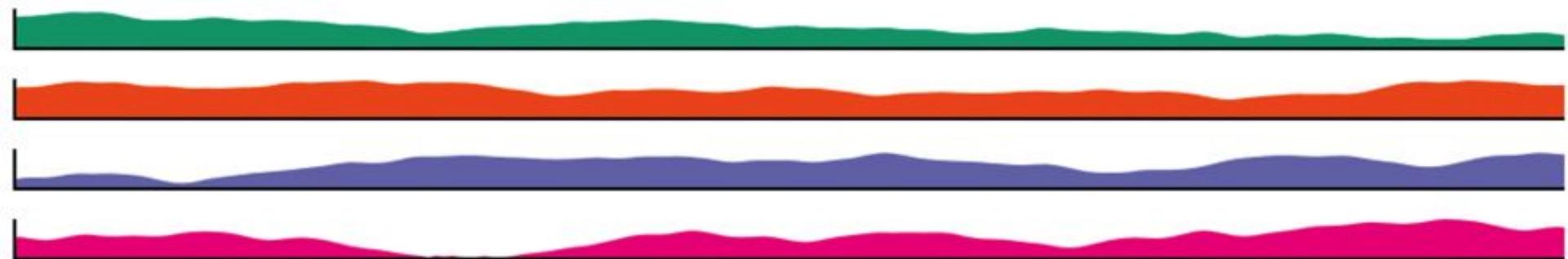
Cartographic Layering

What: Data	Multidimensional table: one ordered key attribute (time), one categorical key attribute (machine), one quantitative value attribute (CPU utilization).
How: Encode	Line charts, colored by machine attribute.
How: Facet	Superimpose: static layers, distinguished with color.

Facet: Design Choice: Static Layers (Superimposed Line Chart)

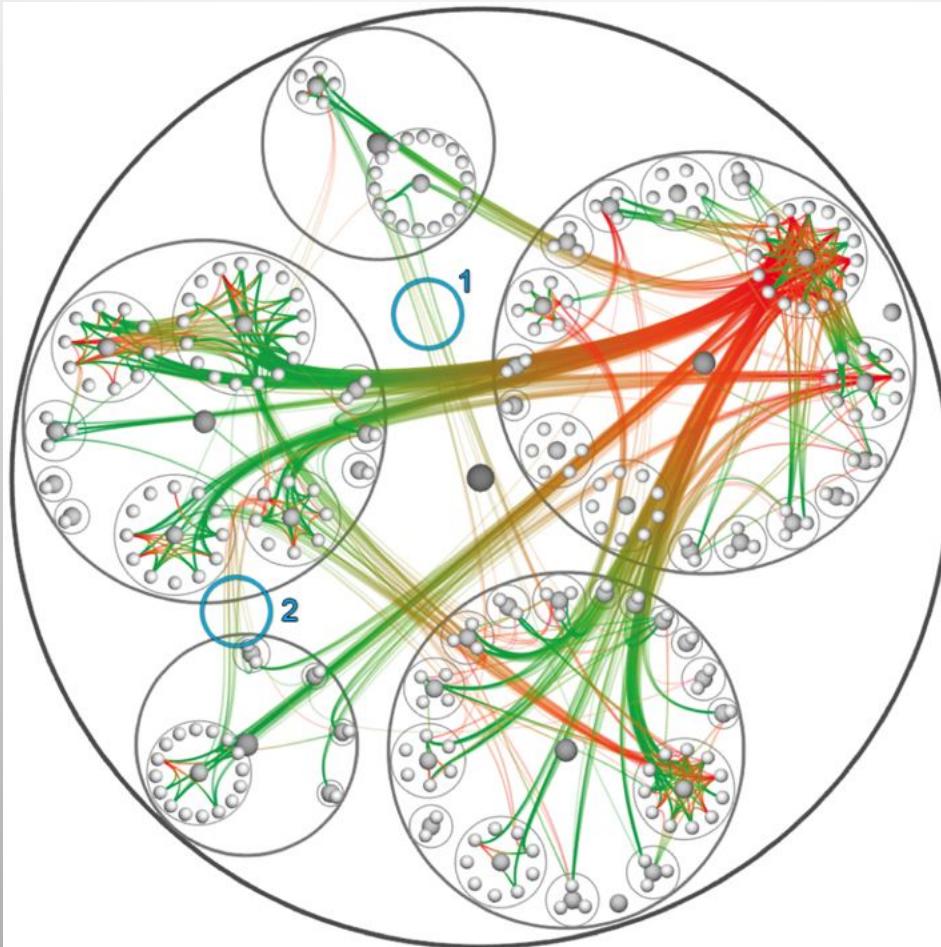


(a)



(b)

Design Choice: Static Layers – Hierarchical Edge Bundling

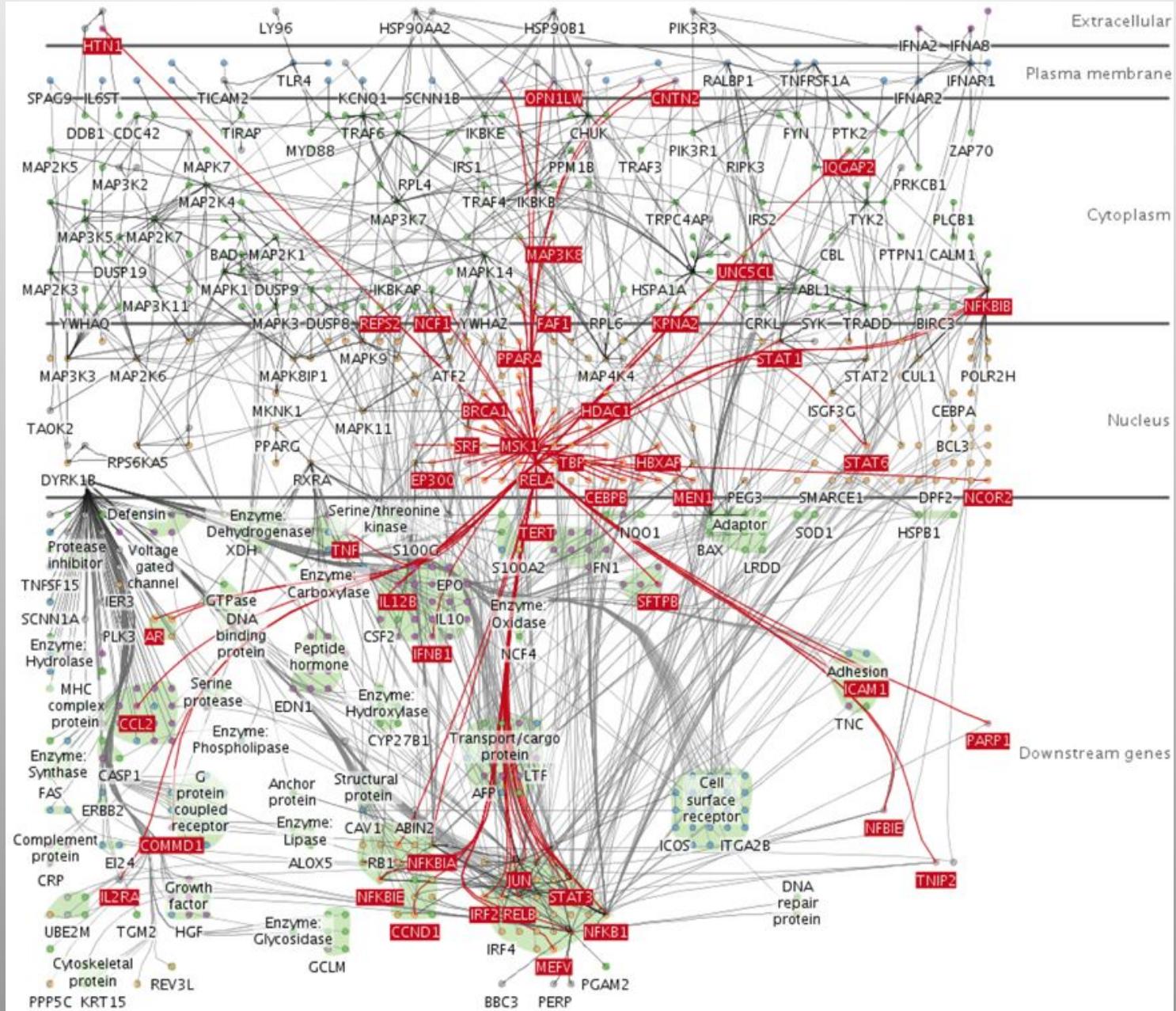


Idion

Hierarchical Edge Bundles

What: Data	Compound graph: network, hierarchy whose leaves are nodes in network.
How: Encode	Back layer shows hierarchy with containment marks colored gray, middle layer shows network links colored red–green, front layer shows nodes colored gray.
How: Facet	Superimpose static layers, distinguished with color.

Facet : Design Choice - Dynamic Layers



Facet

⊕ 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	Multiform, Overview/Detail	No Linkage

⊕ Partition into Side-by-Side Views



⊕ Superimpose Layers



Readings

- Visual Analysis and Design – Chapter 12