

CS49000-VIZ - Fall 2020

Introduction to Data Visualization

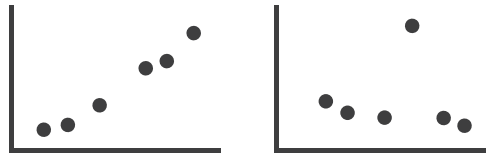
Facet

Lecture 15

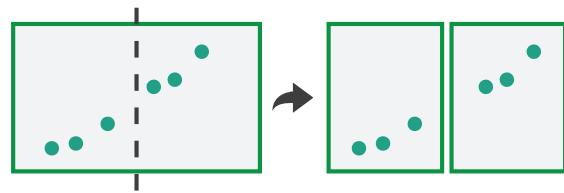
Slides credit: Tamara Munzner, UBC

Facet

→ Juxtapose



→ Partition



→ Superimpose



Juxtapose and coordinate views

→ Share Encoding: Same/Different

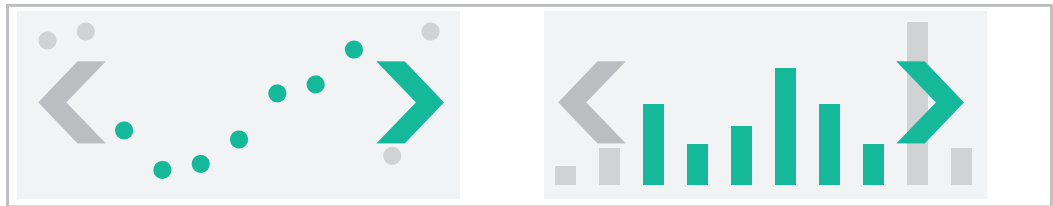
→ *Linked Highlighting*



→ Share Data: All/Subset/None



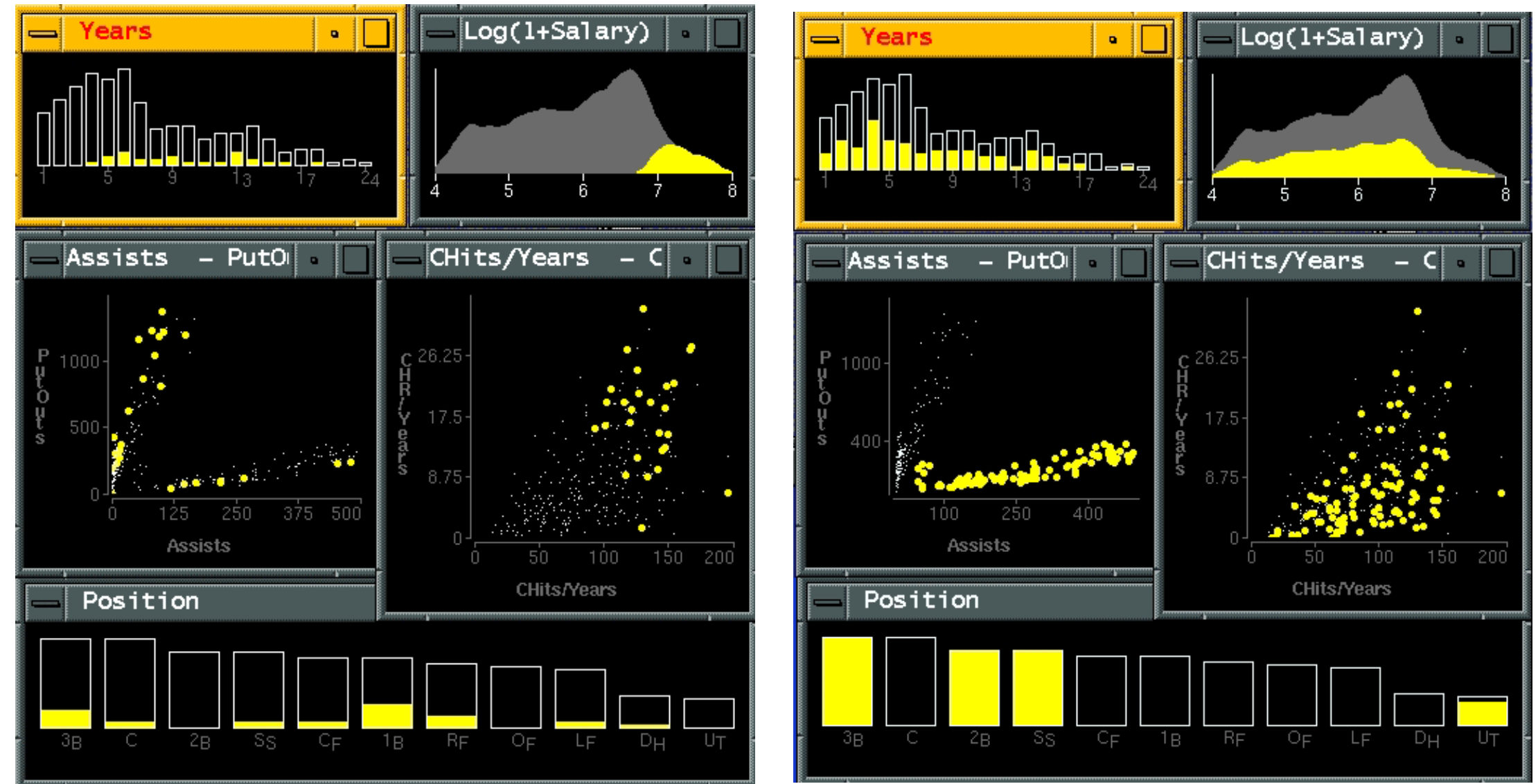
→ Share Navigation



Idiom: **Linked highlighting**

System: **EDV**

- see how regions contiguous in one view are distributed within another
 - powerful and pervasive interaction idiom
- encoding: different
 - ***multiform***
- data: all shared



[Visual Exploration of Large Structured Datasets. Wills. Proc. New Techniques and Trends in Statistics (NTTS), pp. 237–246. IOS Press, 1995.]

Idiom: **bird's-eye maps**

System: **Google Maps**

- encoding: same
- data: subset shared
- navigation: shared
 - bidirectional linking
- differences
 - viewpoint
 - (size)
- **overview-detail**

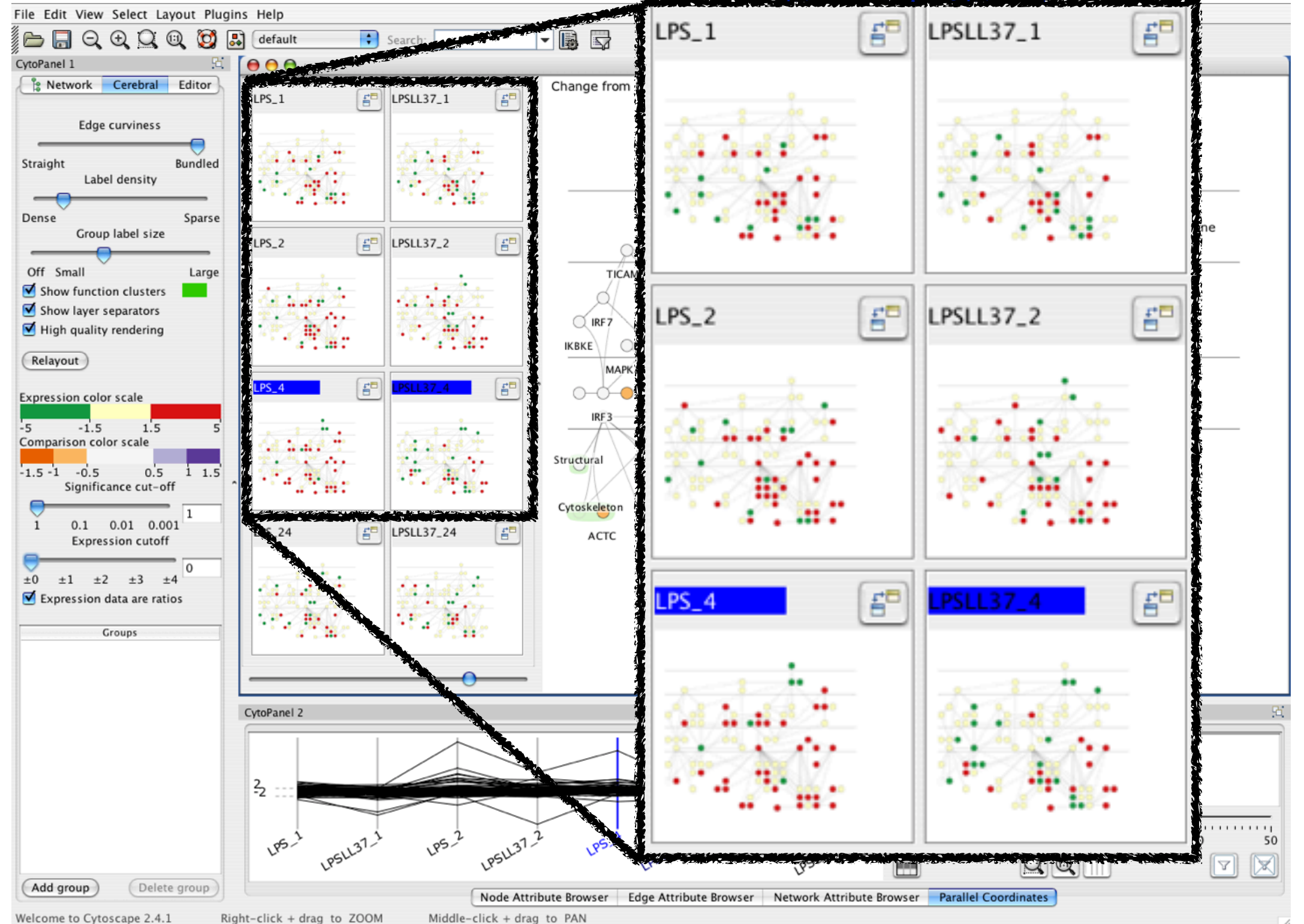


[A Review of Overview+Detail, Zooming, and Focus+Context Interfaces. Cockburn, Karlson, and Bederson. *ACM Computing Surveys* 41:1 (2008), 1–31.]

Idiom: **Small multiples**

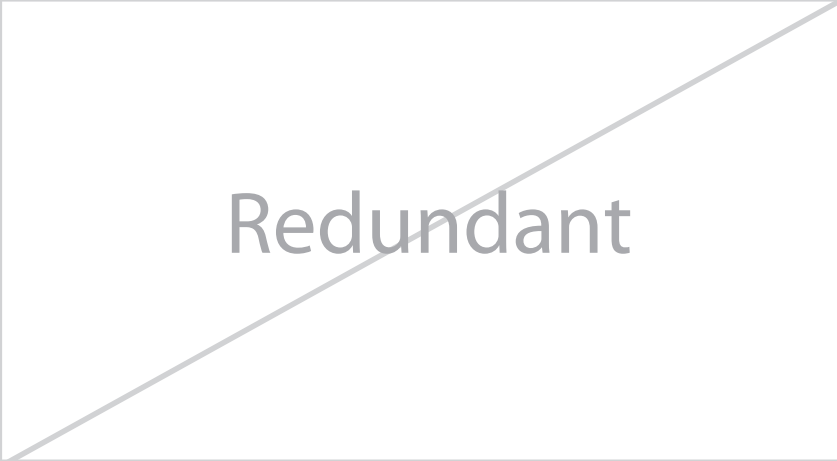
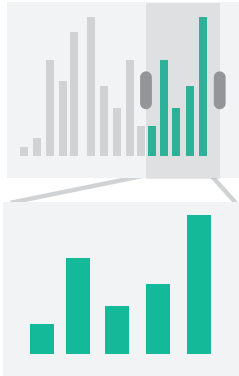
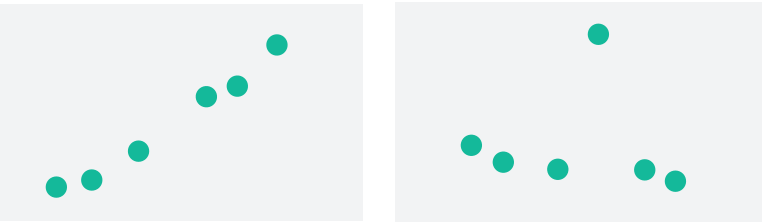
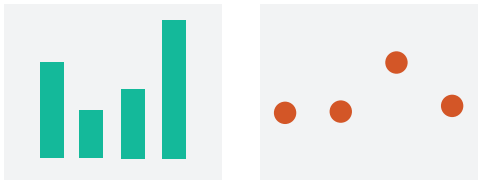


- encoding: same
- data: none shared
 - different attributes for node colors
 - (same network layout)
- navigation: shared

System: **Cytoscape**



[Cerebral: Visualizing Multiple Experimental Conditions on a Graph with Biological Context. Barsky, Munzner, Gardy, and Kincaid. *IEEE Trans. Visualization and Computer Graphics (Proc. InfoVis 2008)* 14:6 (2008), 1253–1260.]

Coordinate views: Design choice interaction

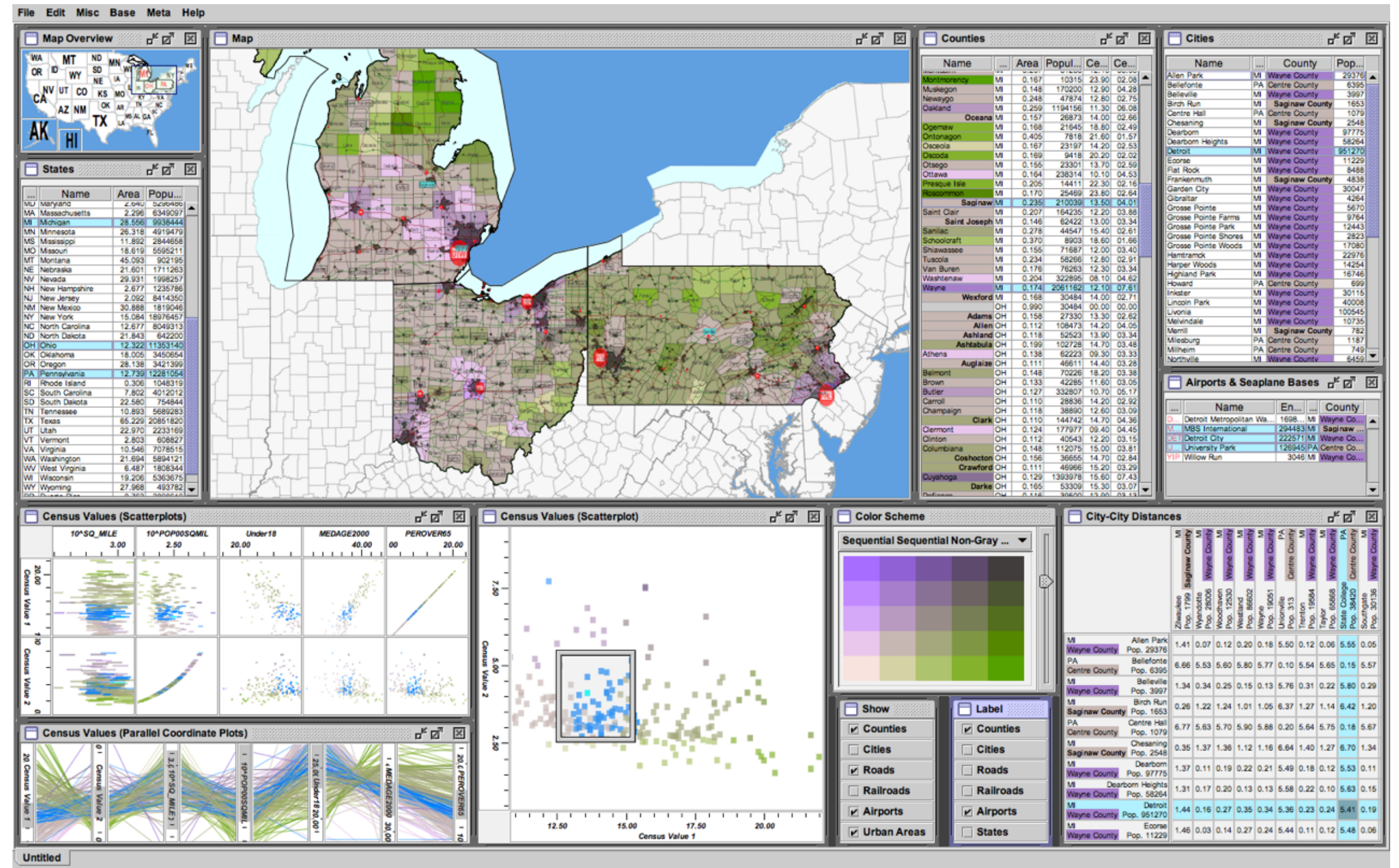
		Data		
		All	Subset	None
Encoding	Same	<p>Redundant</p> 	 <p>Overview/ Detail</p>	 <p>Small Multiples</p>
	Different	 <p>Multiform</p>	 <p>Multiform, Overview/ Detail</p>	<p>No Linkage</p> 

Juxtapose design choices

- design choices
 - view count
 - few vs many
 - how many is too many? open research question
 - view visibility
 - always side by side vs temporary popups
 - view arrangement
 - user managed vs system arranges/aligns
- why juxtapose views?
 - benefits: eyes vs memory
 - lower cognitive load to move eyes between 2 views than remembering previous state with 1
 - costs: display area
 - 2 views side by side each have only half the area of 1 view

System: **Improvise**

- investigate power of multiple views
 - pushing limits on view count, interaction complexity
 - reorderable lists
 - easy lookup
 - useful when linked to other encodings

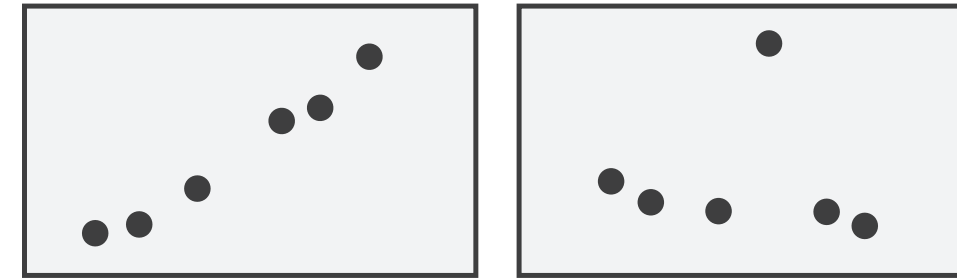


[Building Highly-Coordinated Visualizations In Improvise. Weaver. Proc. IEEE Symp. Information Visualization (InfoVis), pp. 159–166, 2004.]

Partition into views

- how to divide data between views
 - encodes association between items using spatial proximity
 - major implications for what patterns are visible
 - split according to attributes
- design choices
 - how many splits
 - all the way down: one mark per region?
 - stop earlier, for more complex structure within region?
 - order in which attribs used to split
 - how many views

➔ Partition into Side-by-Side Views



Views and glyphs

- **view**

- contiguous region in which visually encoded data is shown on the display

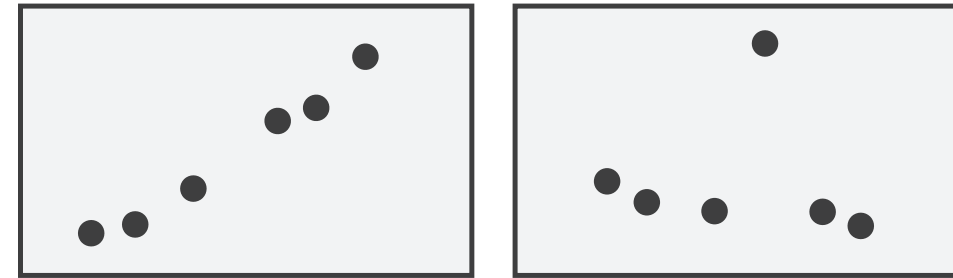
- **glyph**

- object with internal structure that arises from multiple marks

- no strict dividing line

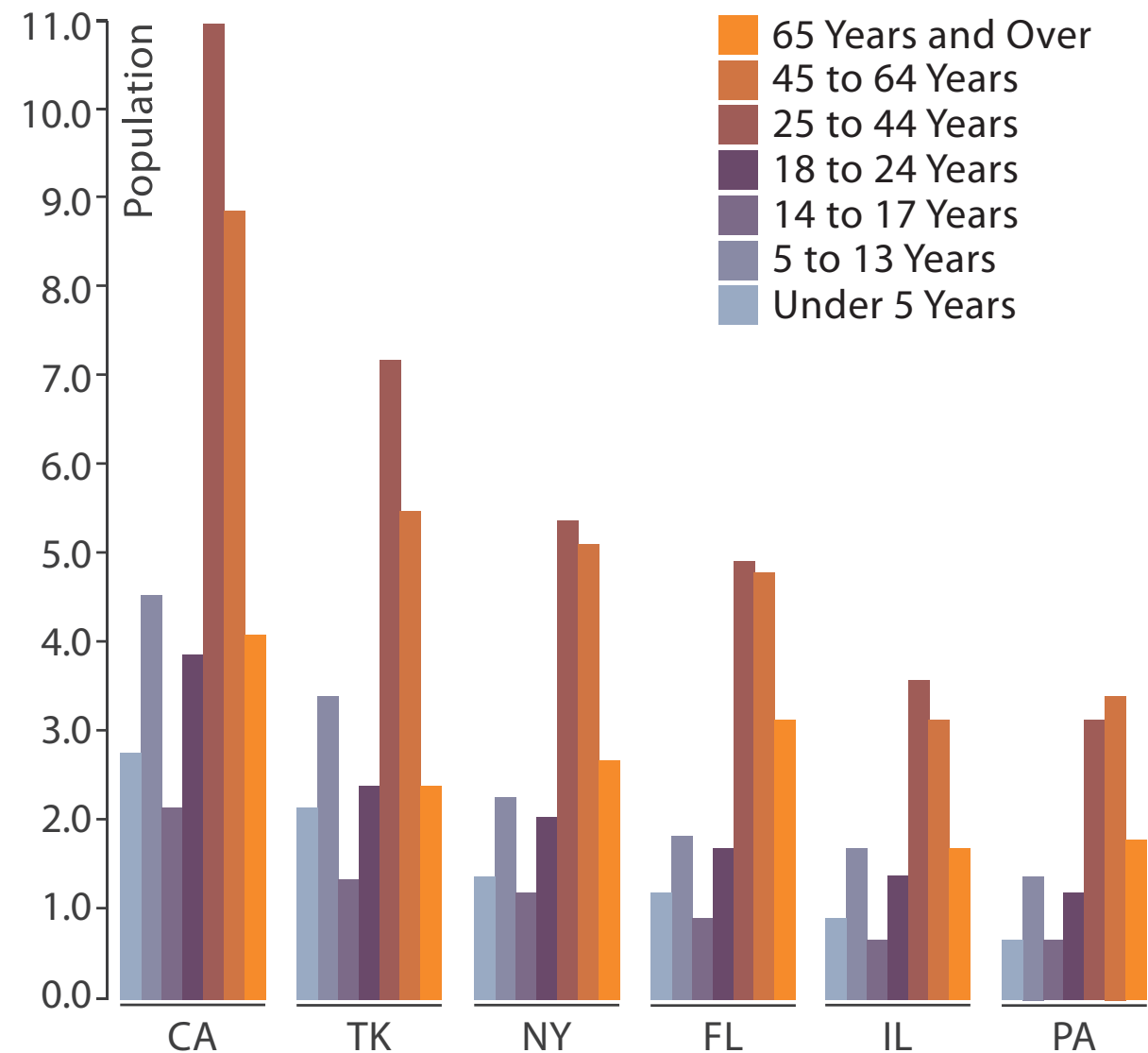
- view: big/detailed
- glyph: small/iconic

➔ Partition into Side-by-Side Views

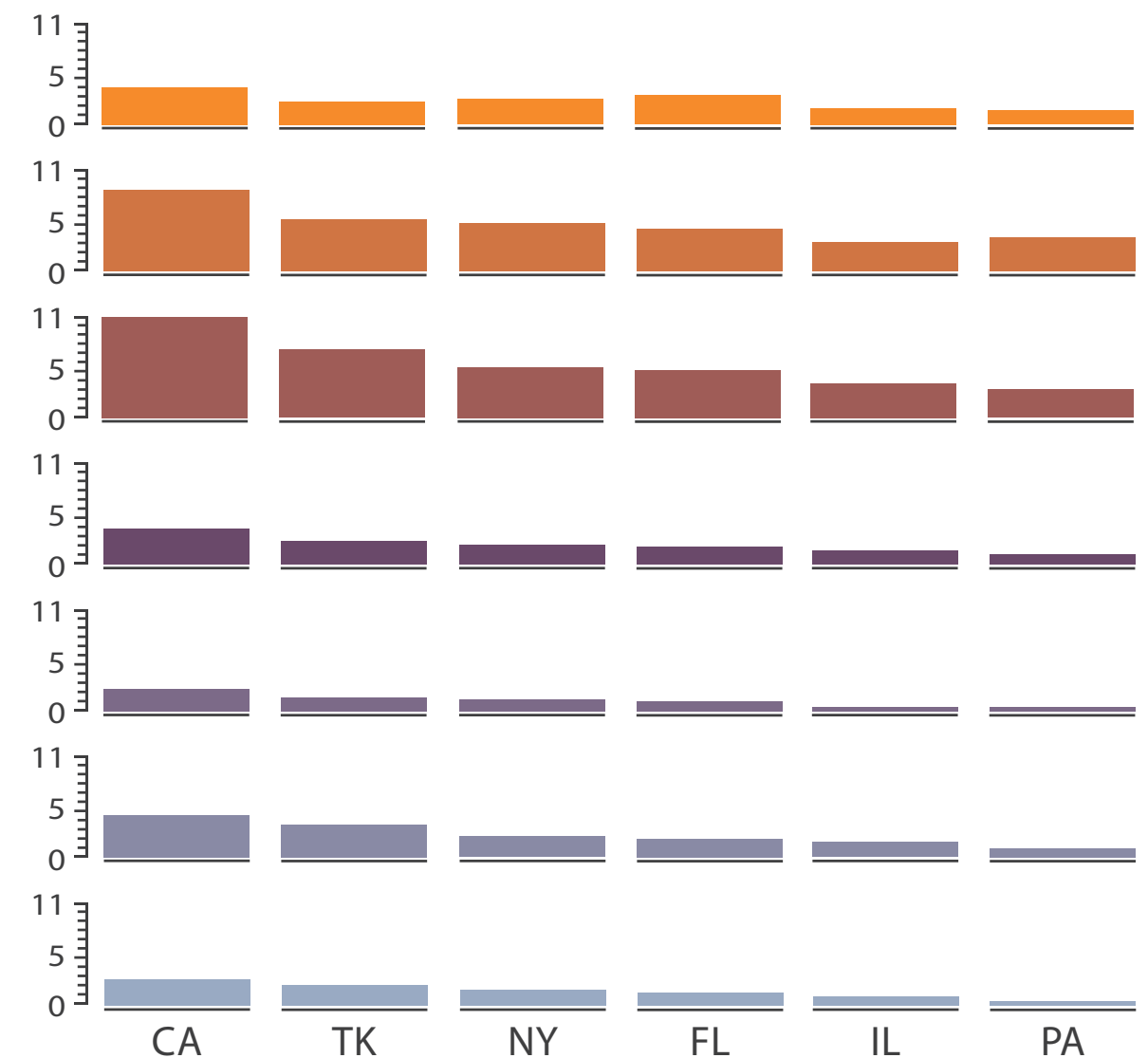


Partitioning: List alignment

- single bar chart with grouped bars
 - split by state into regions
 - complex glyph within each region showing all ages
 - compare: easy within state, hard across ages



- small-multiple bar charts
 - split by age into regions
 - one chart per region
 - compare: easy within age, harder across states



Partitioning: Recursive subdivision

System: **HIVE**

- split by type
- then by neighborhood
- then time
 - years as rows
 - months as columns

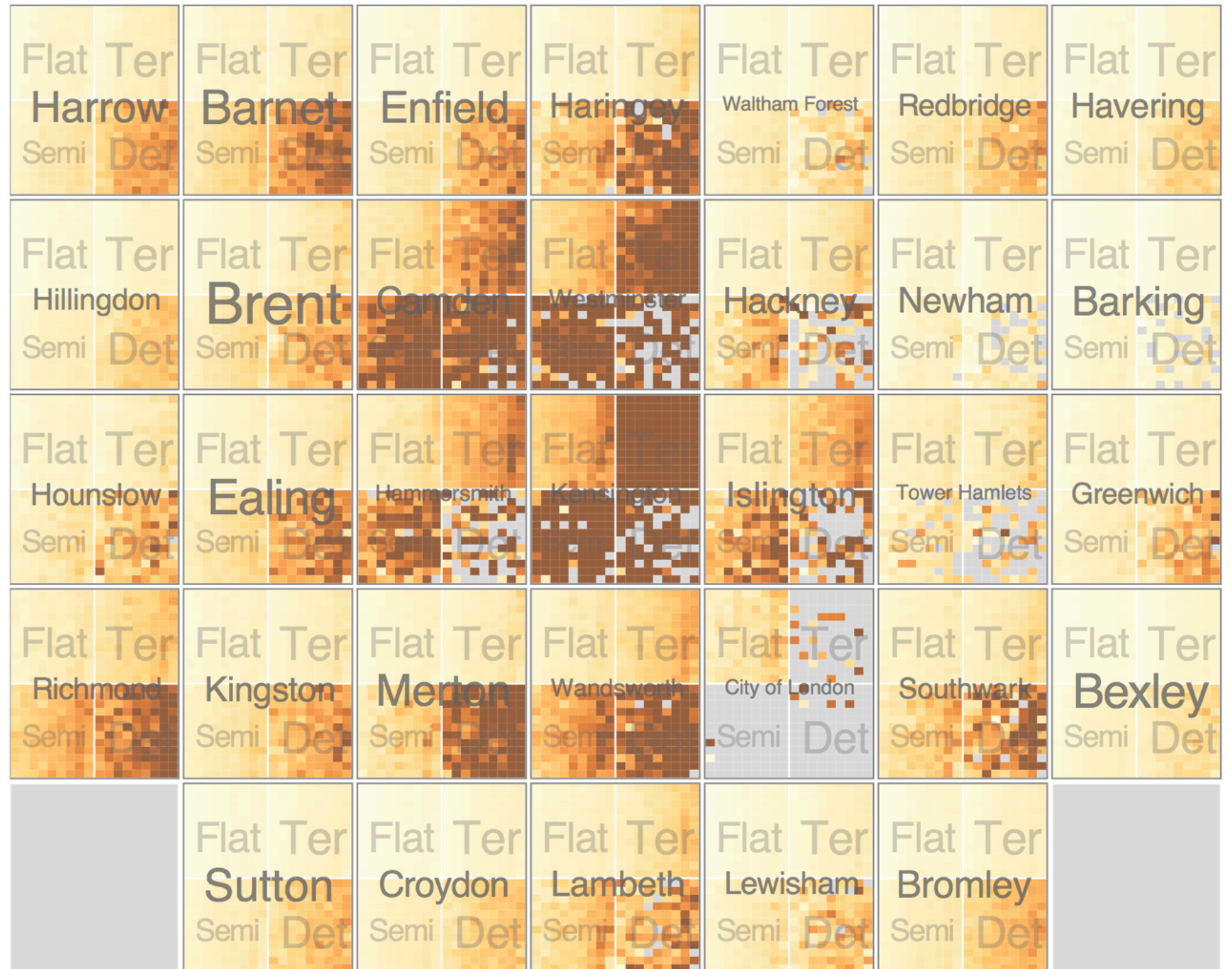


[Configuring Hierarchical Layouts to Address Research Questions. Slingsby, Dykes, and Wood. *IEEE Transactions on Visualization and Computer Graphics* (Proc. InfoVis 2009) 15:6 (2009), 977–984.]

Partitioning: Recursive subdivision

System: **HIVE**

- switch order of splits
 - neighborhood then type
- very different patterns



Partitioning: Recursive subdivision

System: **HIVE**

- size regions by sale counts
 - not uniformly
- result: treemap

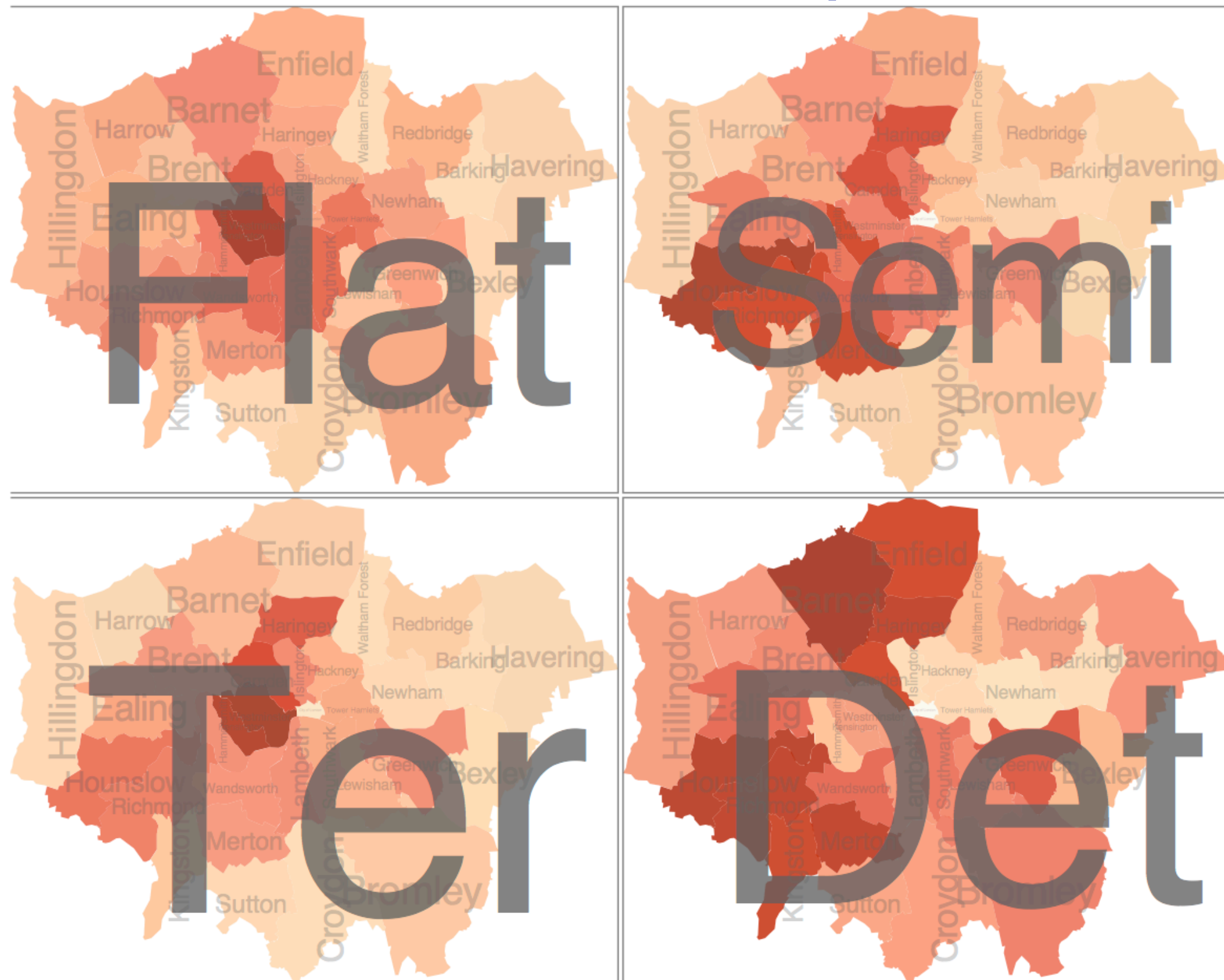


[Configuring Hierarchical Layouts to Address Research Questions. Slingsby, Dykes, and Wood. *IEEE Transactions on Visualization and Computer Graphics* (Proc. InfoVis 2009) 15:6 (2009), 977–984.]

Partitioning: Recursive subdivision

System: **HIVE**

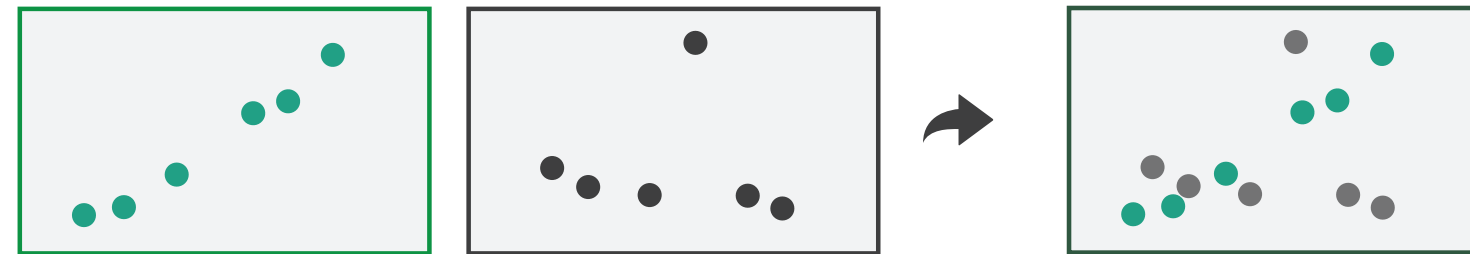
- different encoding for second-level regions
 - choropleth maps



Superimpose layers

- **layer**: set of objects spread out over region
 - each set is visually distinguishable group
 - extent: whole view
- design choices
 - how many layers?
 - how are layers distinguished?
 - small static set or dynamic from many possible?
 - how partitioned?
 - heavyweight with attribs vs lightweight with selection
- distinguishable layers
 - encode with different, nonoverlapping channels
 - two layers achievable, three with careful design

➔ Superimpose Layers



Static visual layering

- foreground layer: roads
 - hue, size distinguishing main from minor
 - high luminance contrast from background
- background layer: regions
 - desaturated colors for water, parks, land areas
- user can selectively focus attention
- “get it right in black and white”
 - check luminance contrast with greyscale view

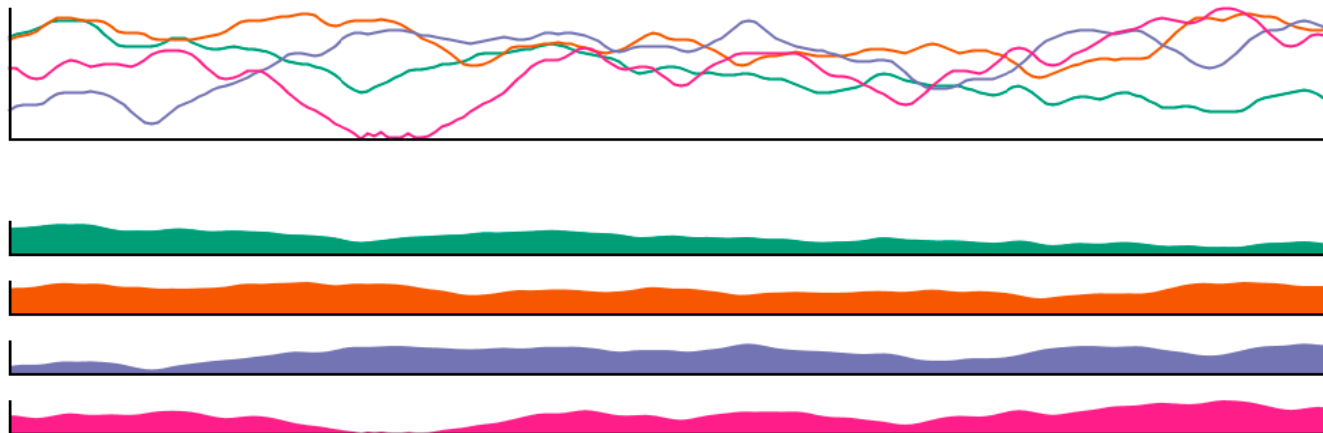


[Get it right in black and white. Stone. 2010.

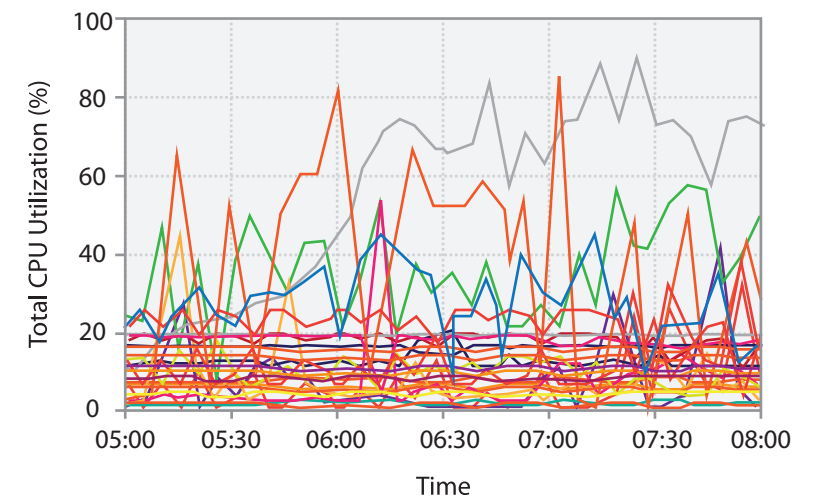
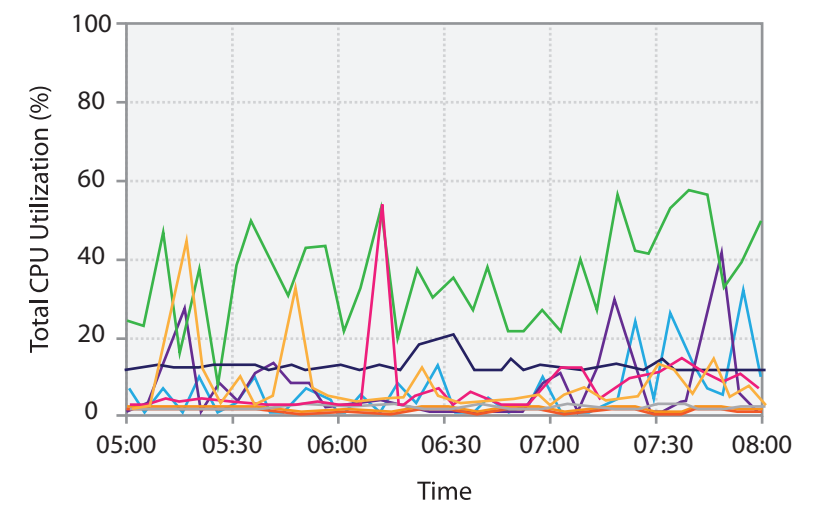
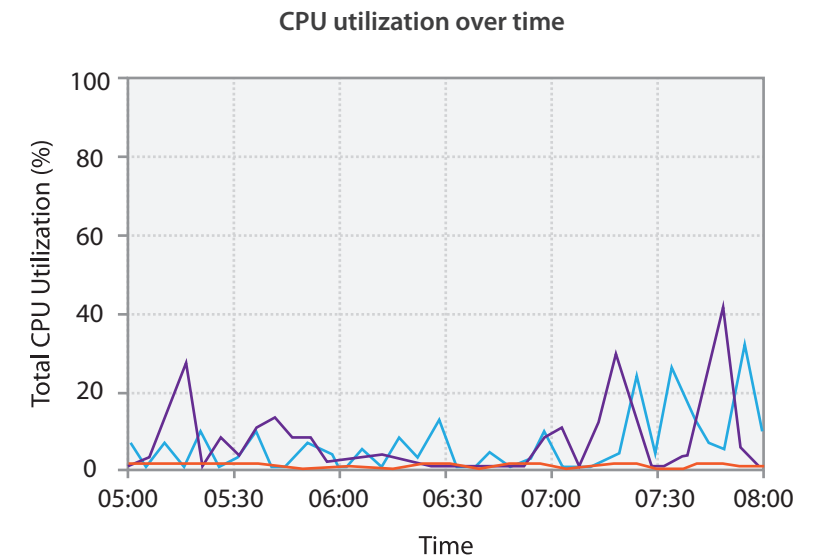
<http://www.stonesc.com/wordpress/2010/03/get-it-right-in-black-and-white>]

Superimposing limits

- few layers, but many lines
 - up to a few dozen
 - but not hundreds
- superimpose vs juxtapose: empirical study
 - superimposed for local visual, multiple for global
 - same screen space for all multiples, single superimposed
 - tasks
 - local: maximum, global: slope, discrimination



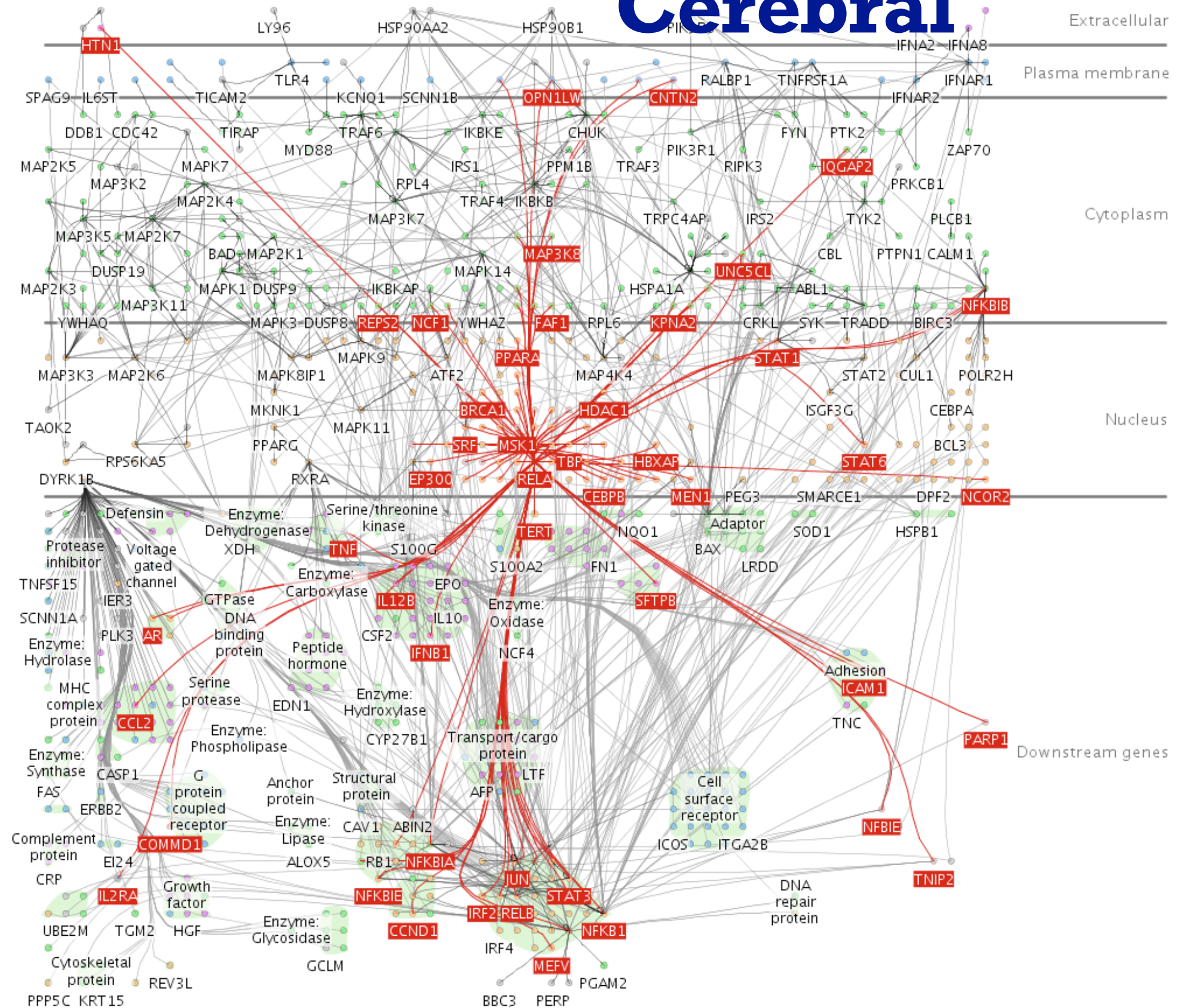
[Graphical Perception of Multiple Time Series. Javed, McDonnell, and Elmqvist. *IEEE Transactions on Visualization and Computer Graphics (Proc. IEEE InfoVis 2010)* 16:6 (2010), 927–934.]



Dynamic visual layering

- interactive, from selection
 - lightweight: click
 - very lightweight: hover
- ex: 1-hop neighbors

System: Cerebral



[Cerebral: a Cytoscape plugin for layout of and interaction with biological networks using subcellular localization annotation. Barsky, Gardy, Hancock, and Munzner. *Bioinformatics* 23:8 (2007), 1040–1042.]