CS-5630 / CS-6630 Visualization Views

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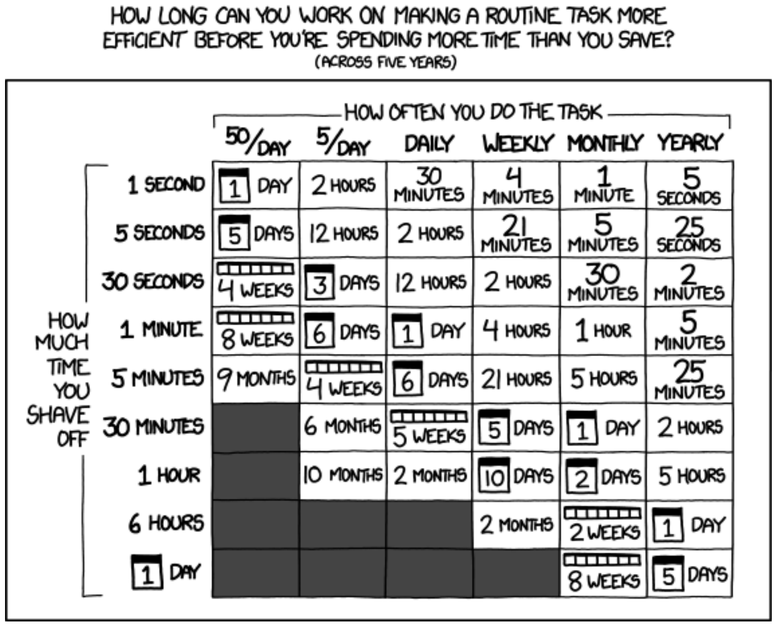
THE UNIVERSITY OF UTAH



[xkcd]

Multiple Views

Eyes over Memory:

Trade-off of display space and working memory

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

Linked Views

Multiple Views that are simultaneously visible and lined together such that actions in one view affect the others.

Linked Views Options

encoding: same or multiform

dataset: share all, subset, or none

highlighting: to link, or not

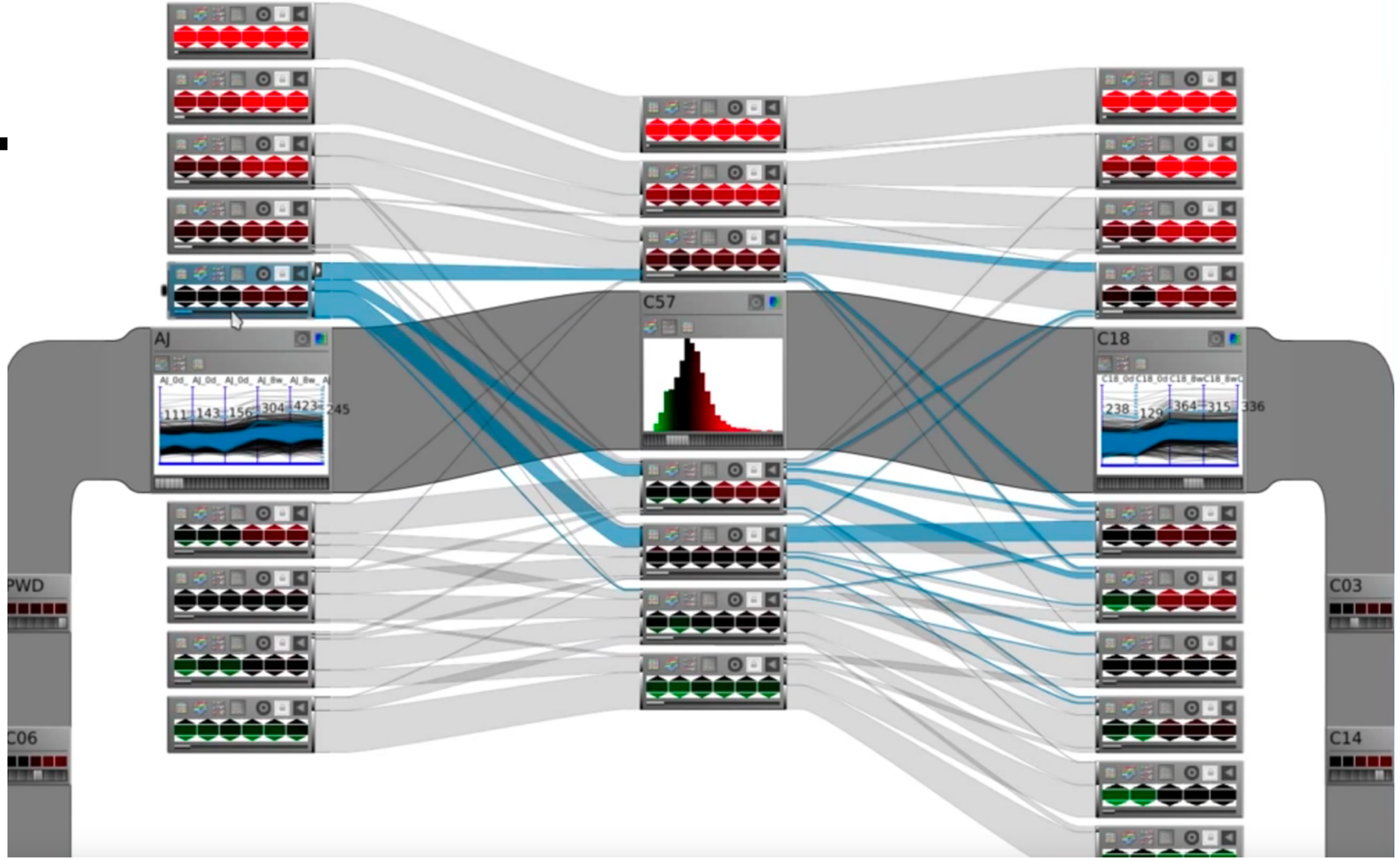
navigation: to share, or not

Multiform

difference visual encodings are used between the views

rational:
single, monolithic view has strong limits on the number of attributes that can be shown simultaneously

L



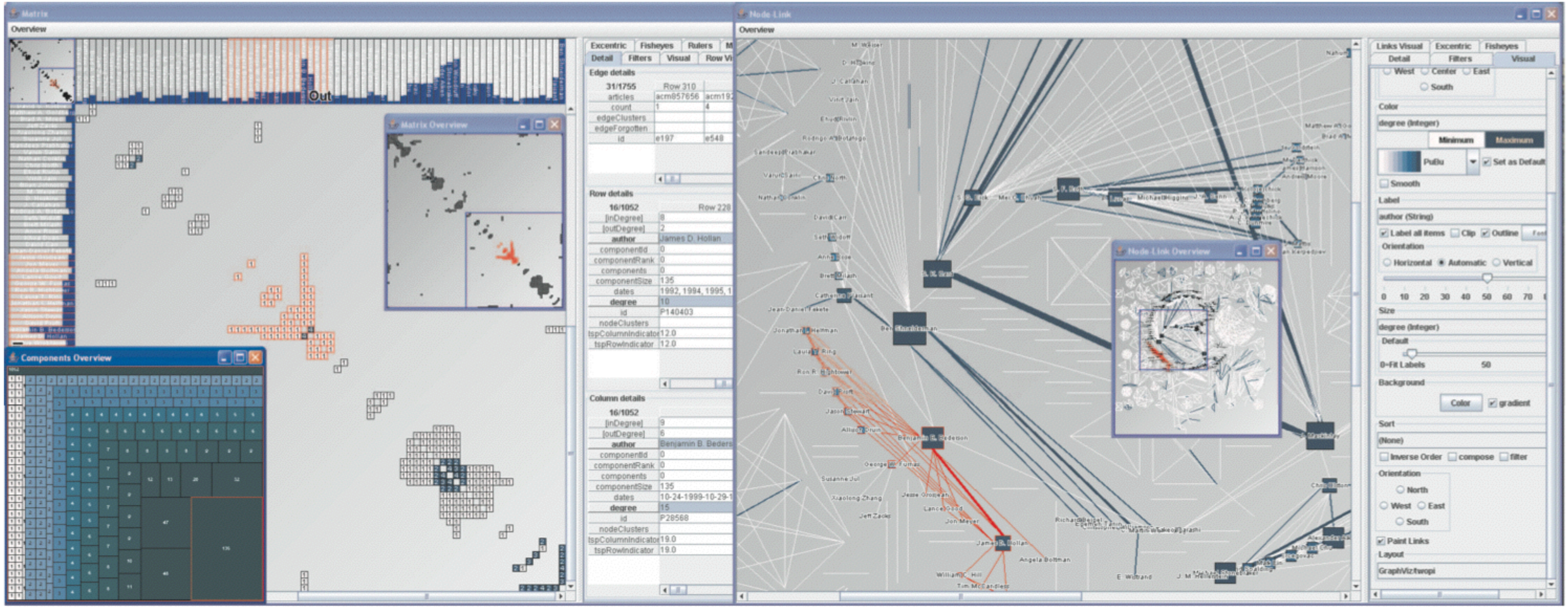
SHARED-DATA

showing all data in each view, but with different encoding schemes

rational

different views support different tasks

MatrixExplorer



Same Data - Different Idioms (Multiform)

Henry 2006

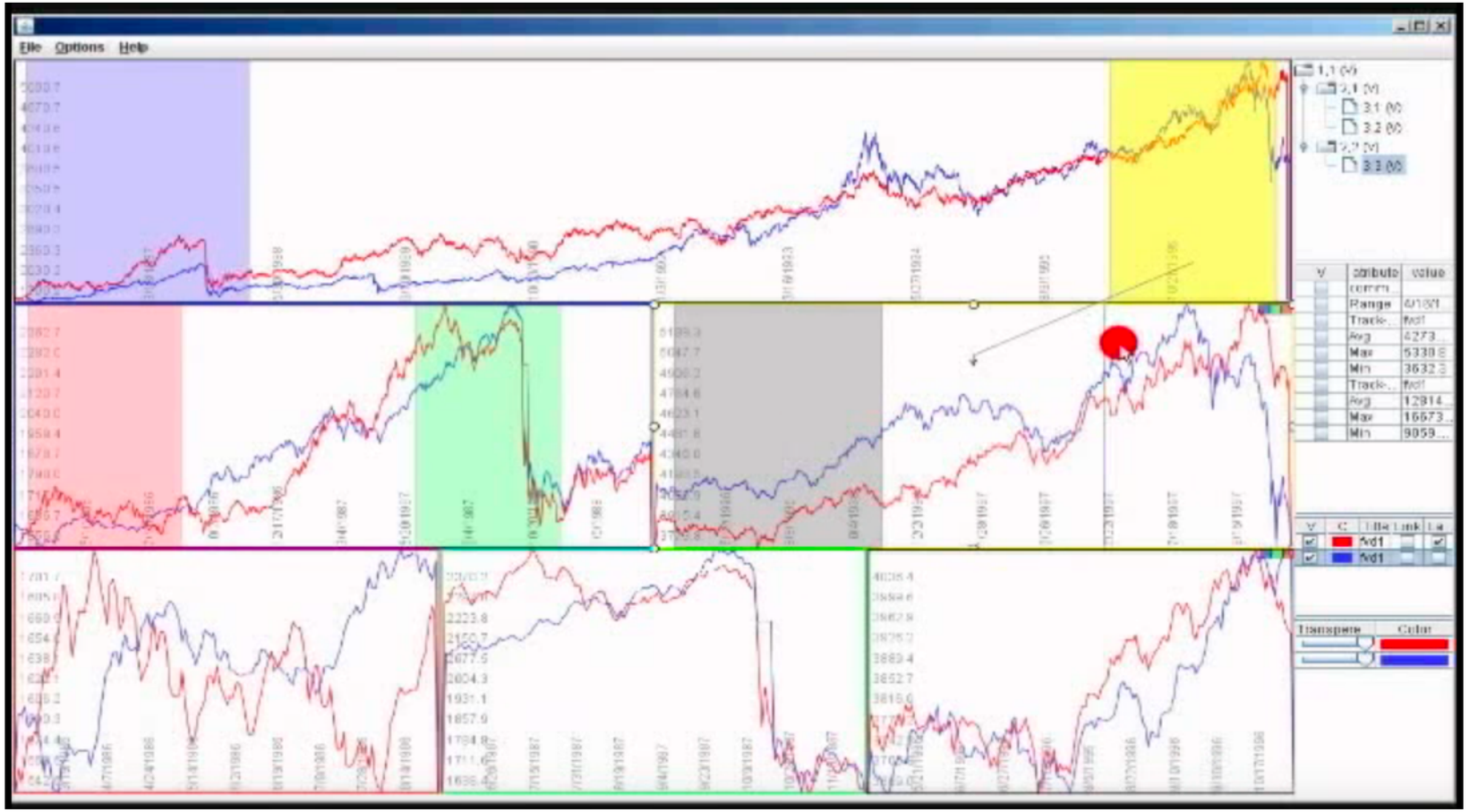
OVERVIEW + DETAIL

one view shows (often summarized) information about entire dataset, while additional view(s) shows more detailed information about a subset of the data

rational

for large or complex data, a single view of the entire dataset cannot capture fine details

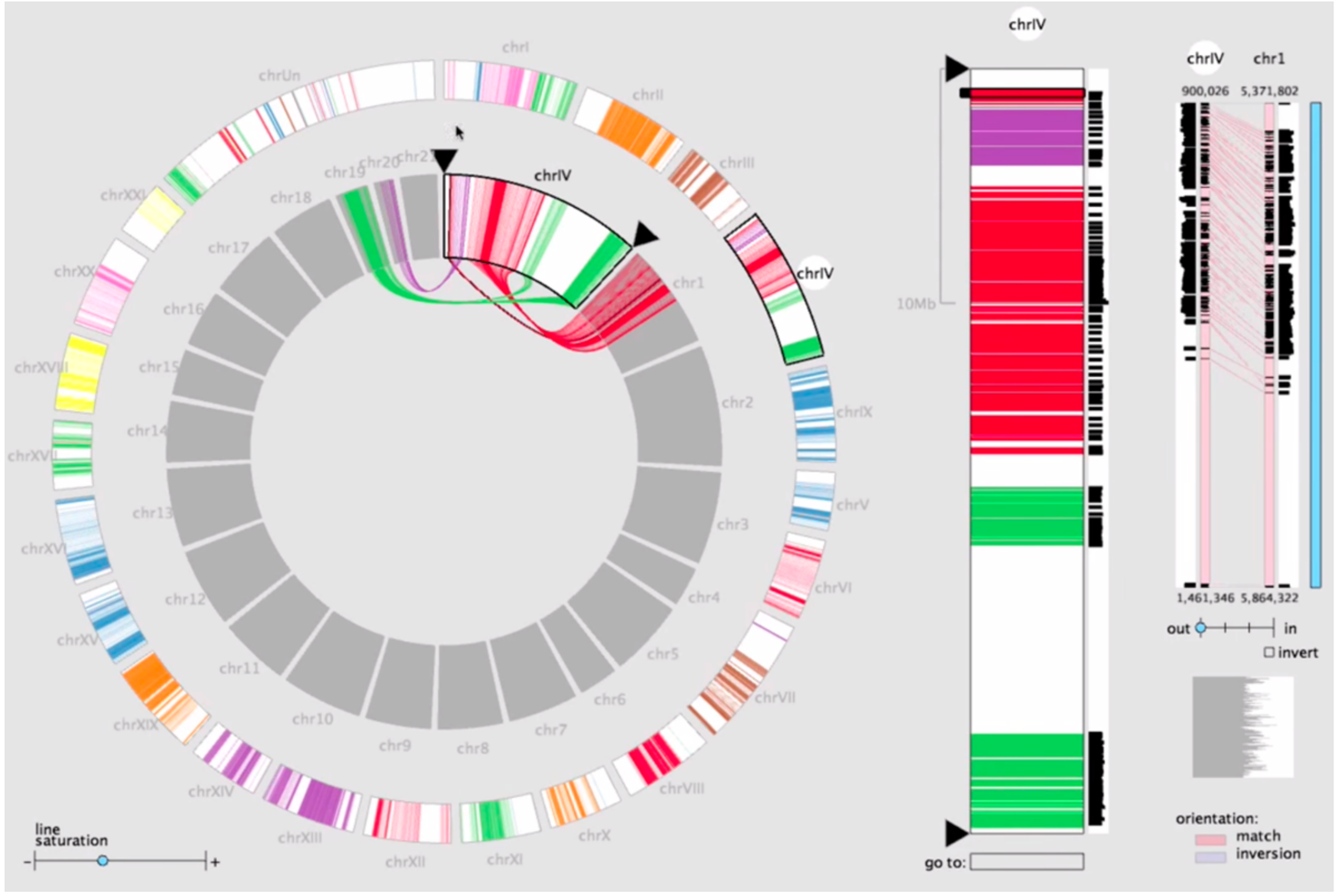
Stack Zooming



Same Data - Same Encoding, Different Resolution

[Javed & Emlqvist, PacificVis, 2010]

MizBee



[Meyer 2009]

SMALL MULTIPLES

each view uses the same visual encoding, but shows a different subset of the data

rational

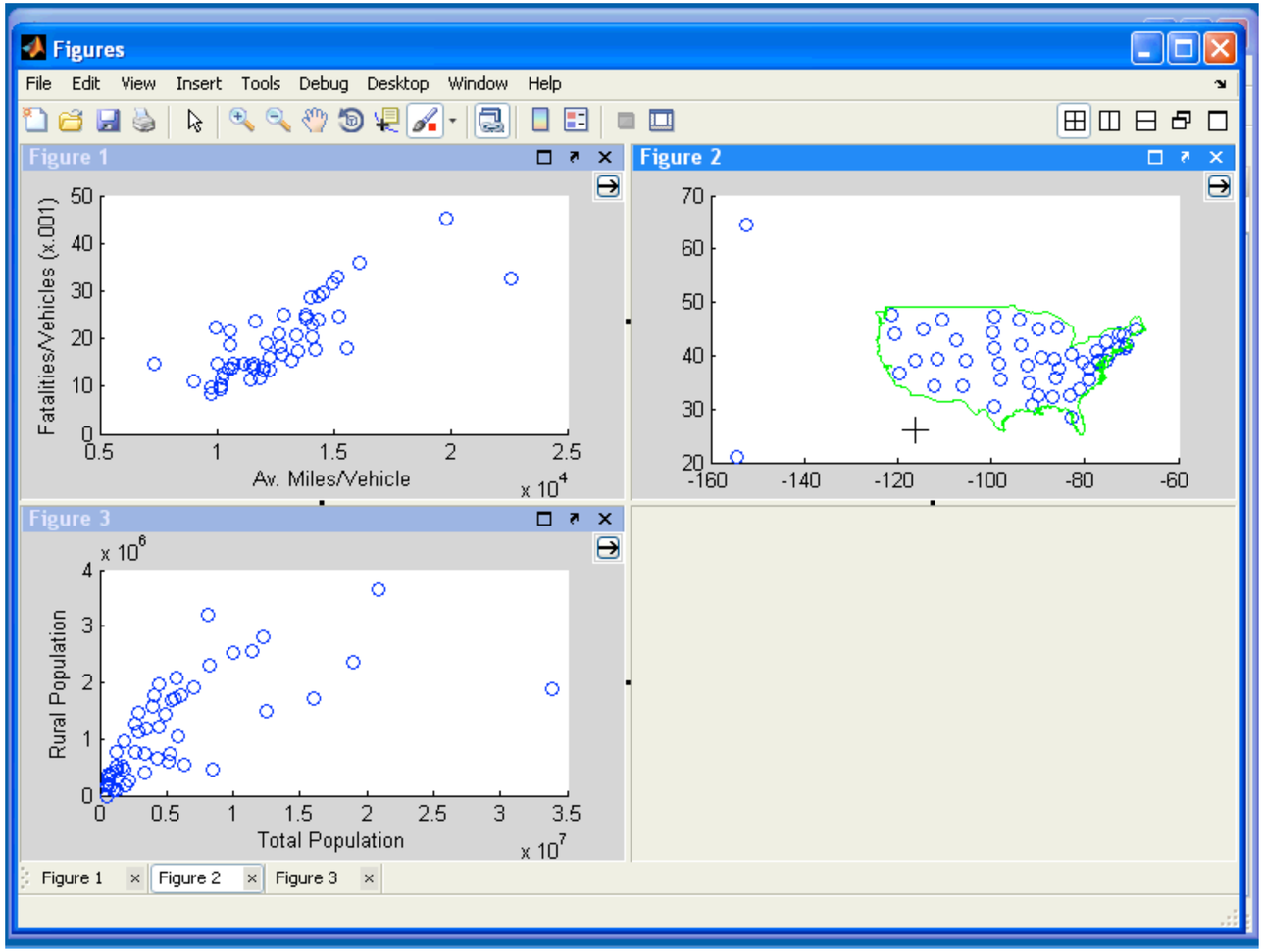
quickly compare different parts of a data set, relying on eyes instead of memory

Small Multiples for Graph Attributes

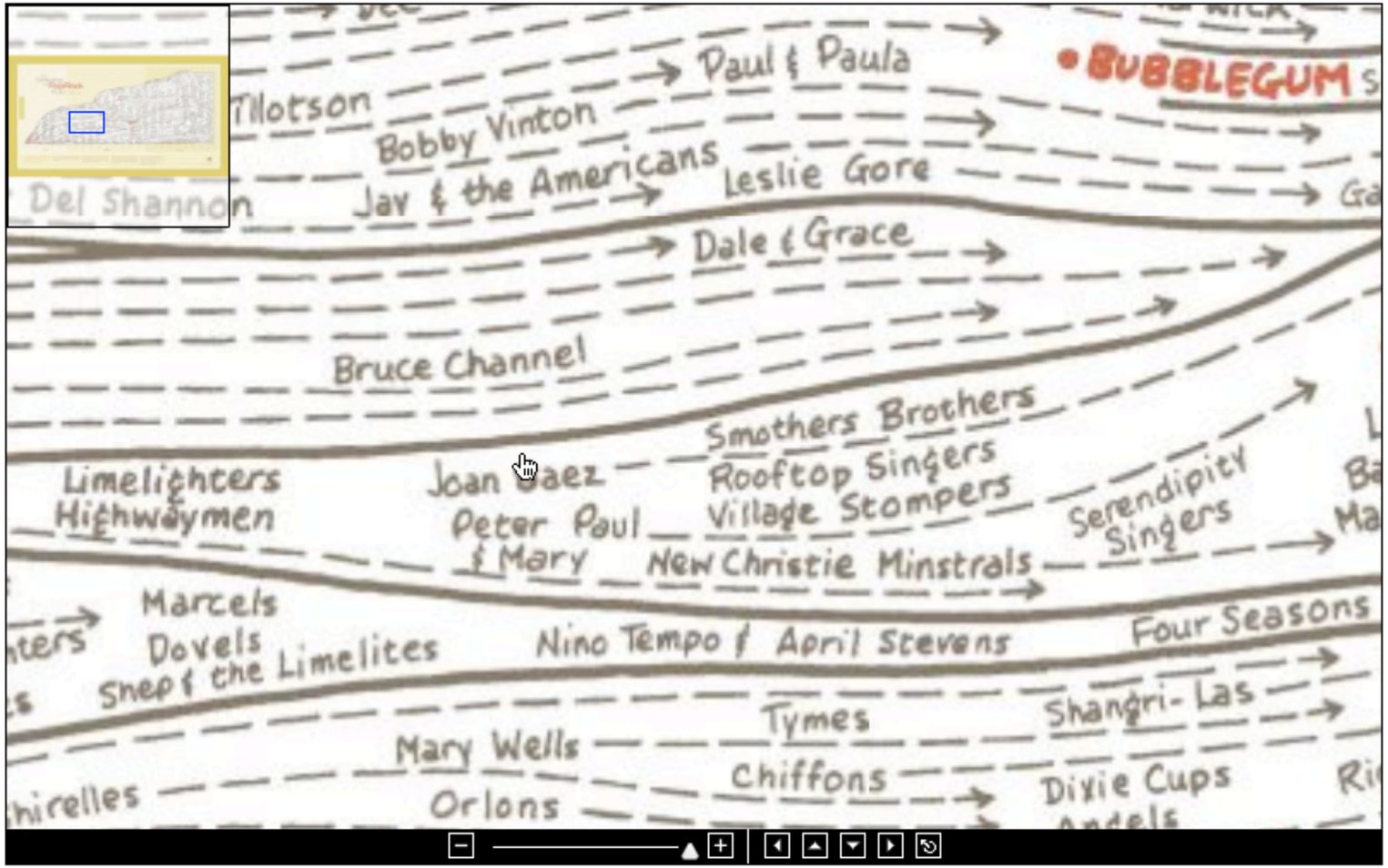
[Barsky, InfoVis 2008]

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

LINKED HIGHLIGHTING



LINKED NAVIGATION



http://www.historyshots.com/rockmusic/

Partitioning

PARTITIONING

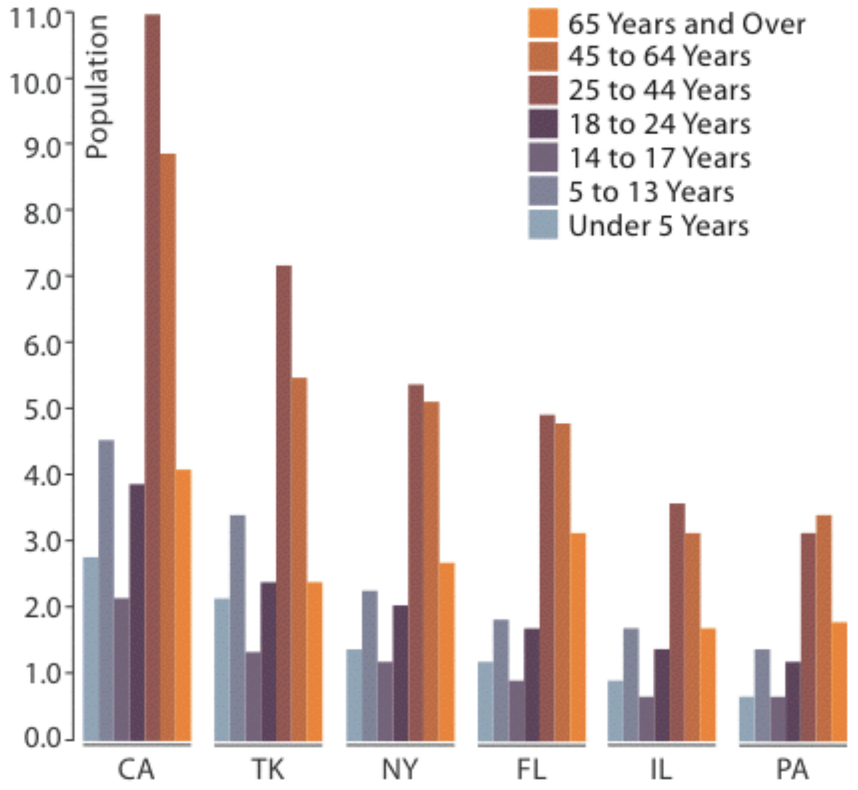
action on the dataset that **separates the data into groups**

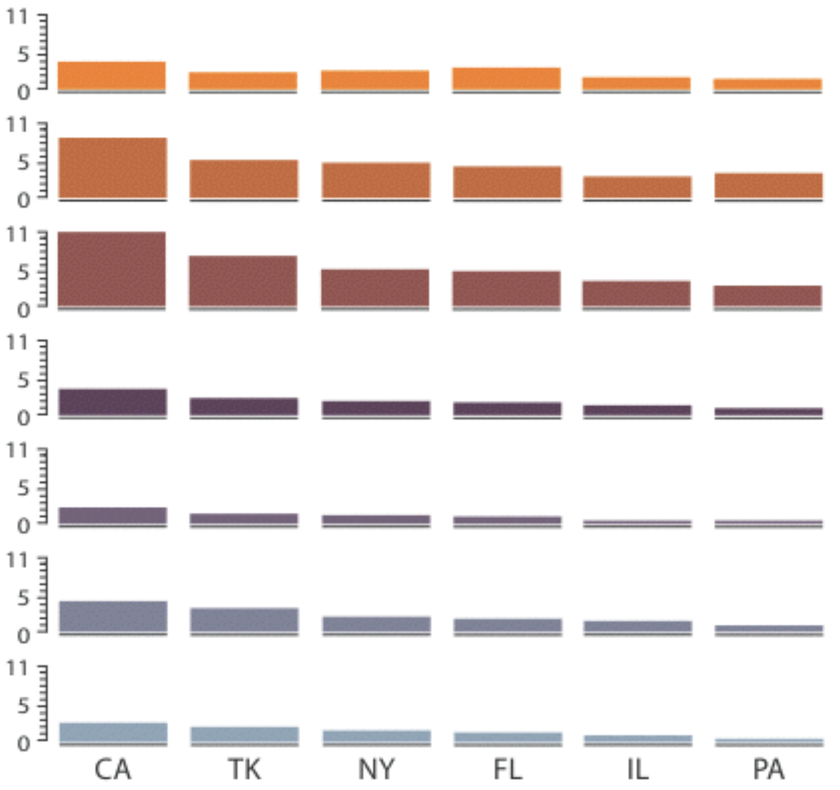
design choices

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

partition attribute(s)

- typically categorical


Population
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
65 Years and Over
45 to 64 Years
25 to 44 Years
18 to 24 Years
14 to 17 Years
5 to 13 Years
Under 5 Years
CA
TK
NY
FL
IL
PA


11
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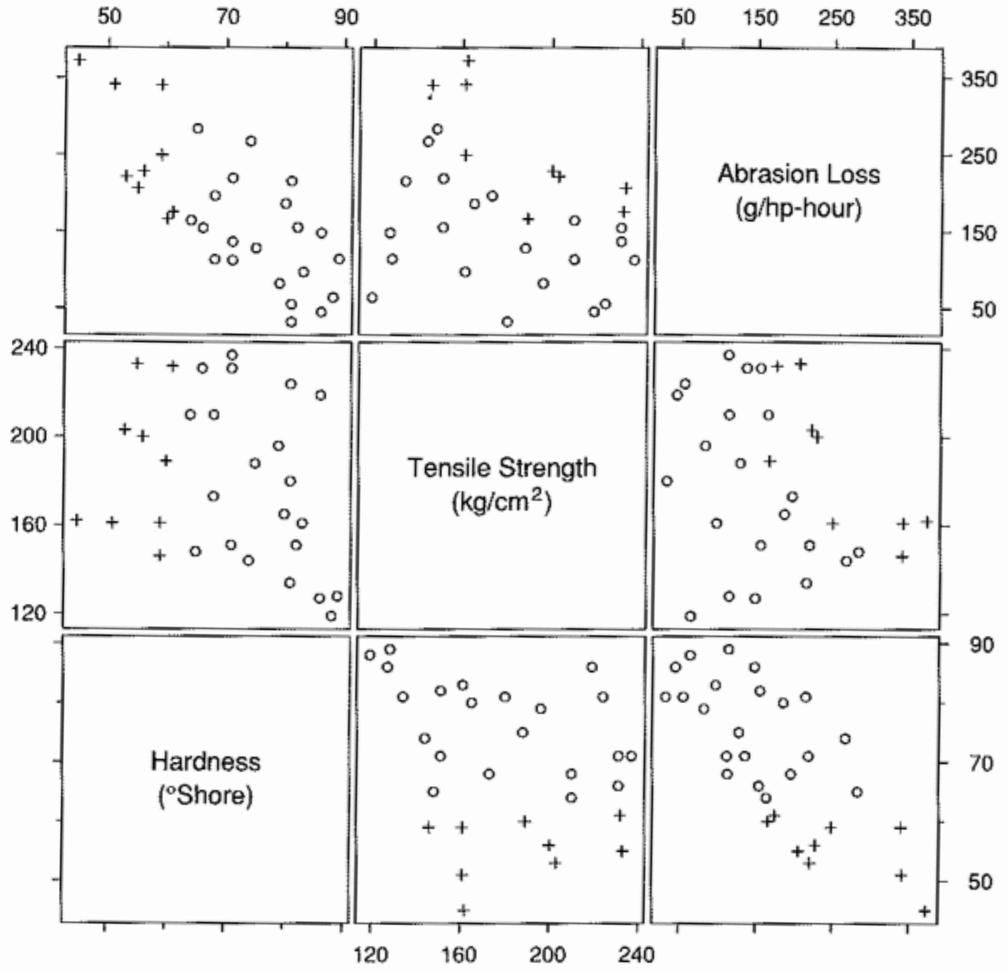
0
CA
TK
NY
FL
IL
PA

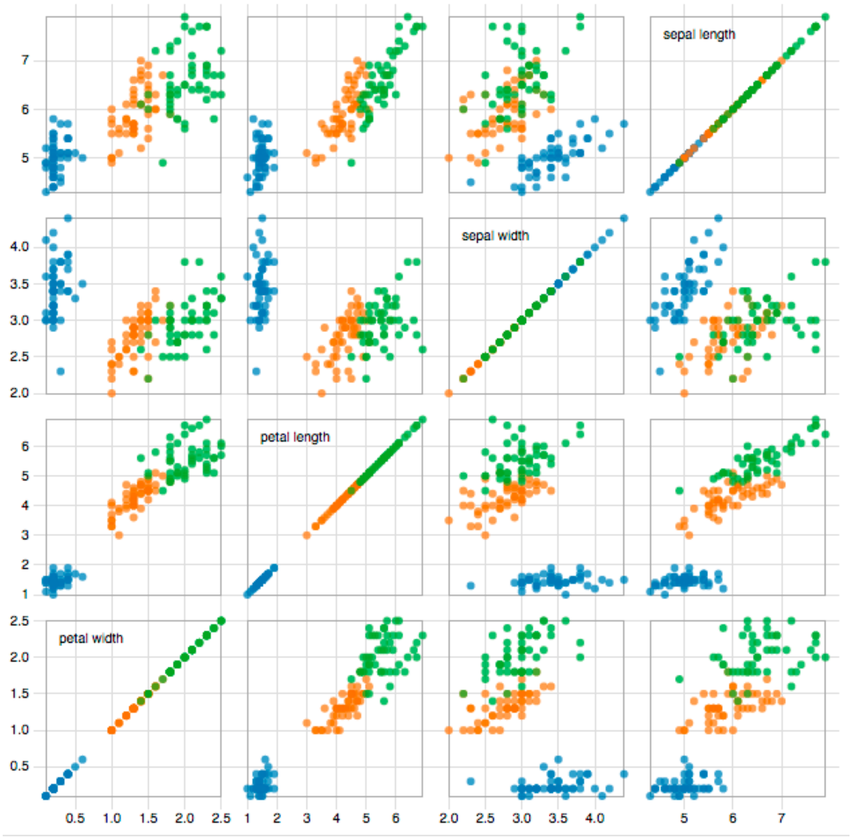
SCATTERPLOT MATRIX (SPLOM)



3.65 CONDITIONING. A scatterplot matrix displays trivariate data: measurements of abrasion loss, hardness, and tensile strength for 30 rubber specimens. The "+" plotting symbols encode the data for those specimens with hardness less than 62 °Shore.

Cleveland 1994

Linking & Brushing in SPLOM



TRELLIS

panel variables

attributes encoded in individual views

partitioning variables

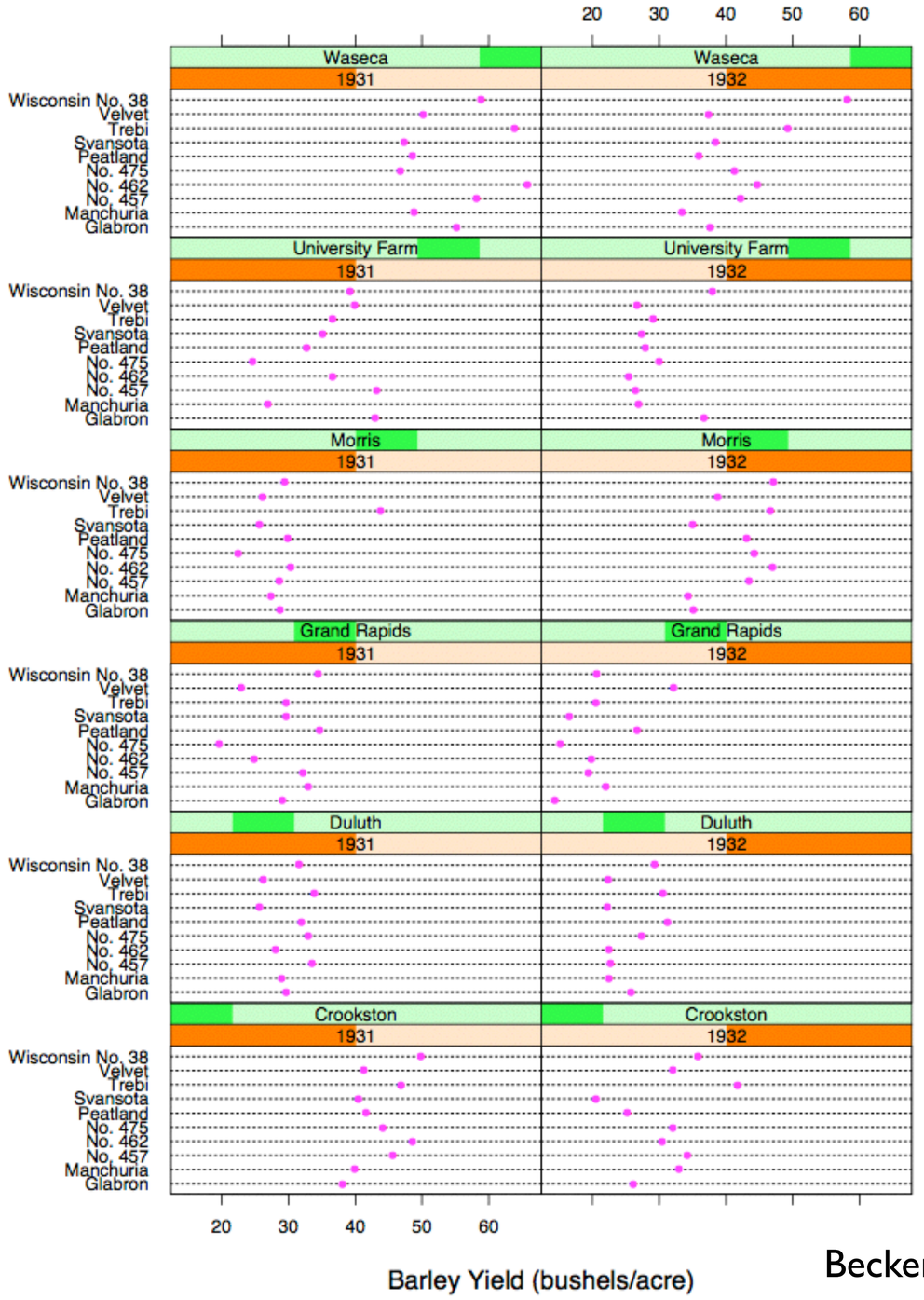
partitioning attributes assigned to columns, rows, and pages

main-effects ordering

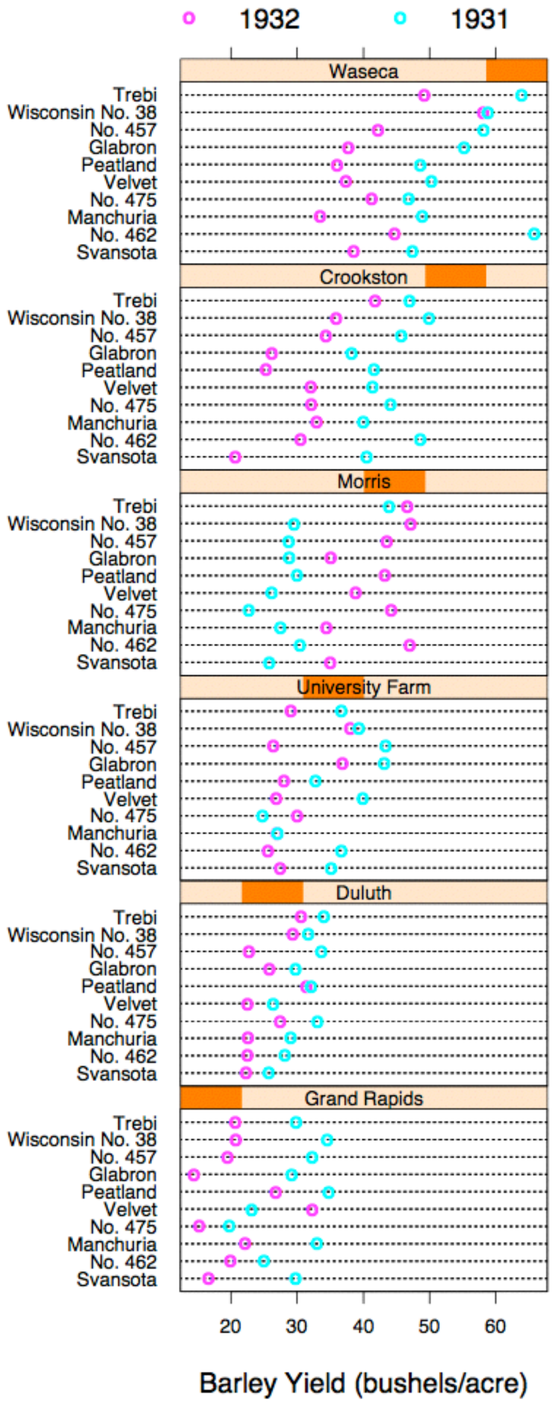
order partitioning variable levels/states based on derived data

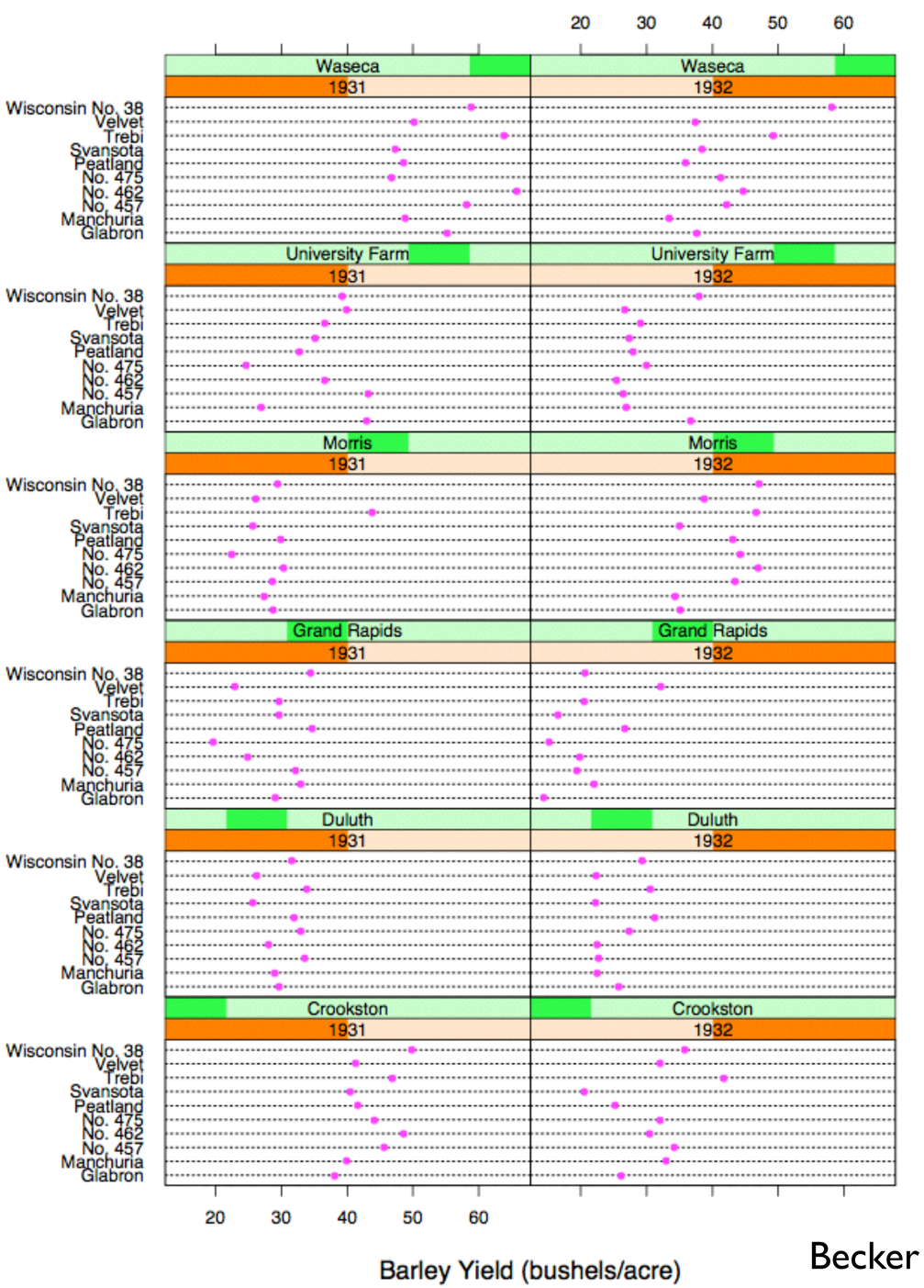
support perception of trends and structure in data

sort by group medians



Becker 1996


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


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

Becker 1996

HiVE: Hierarchical Visual Expression

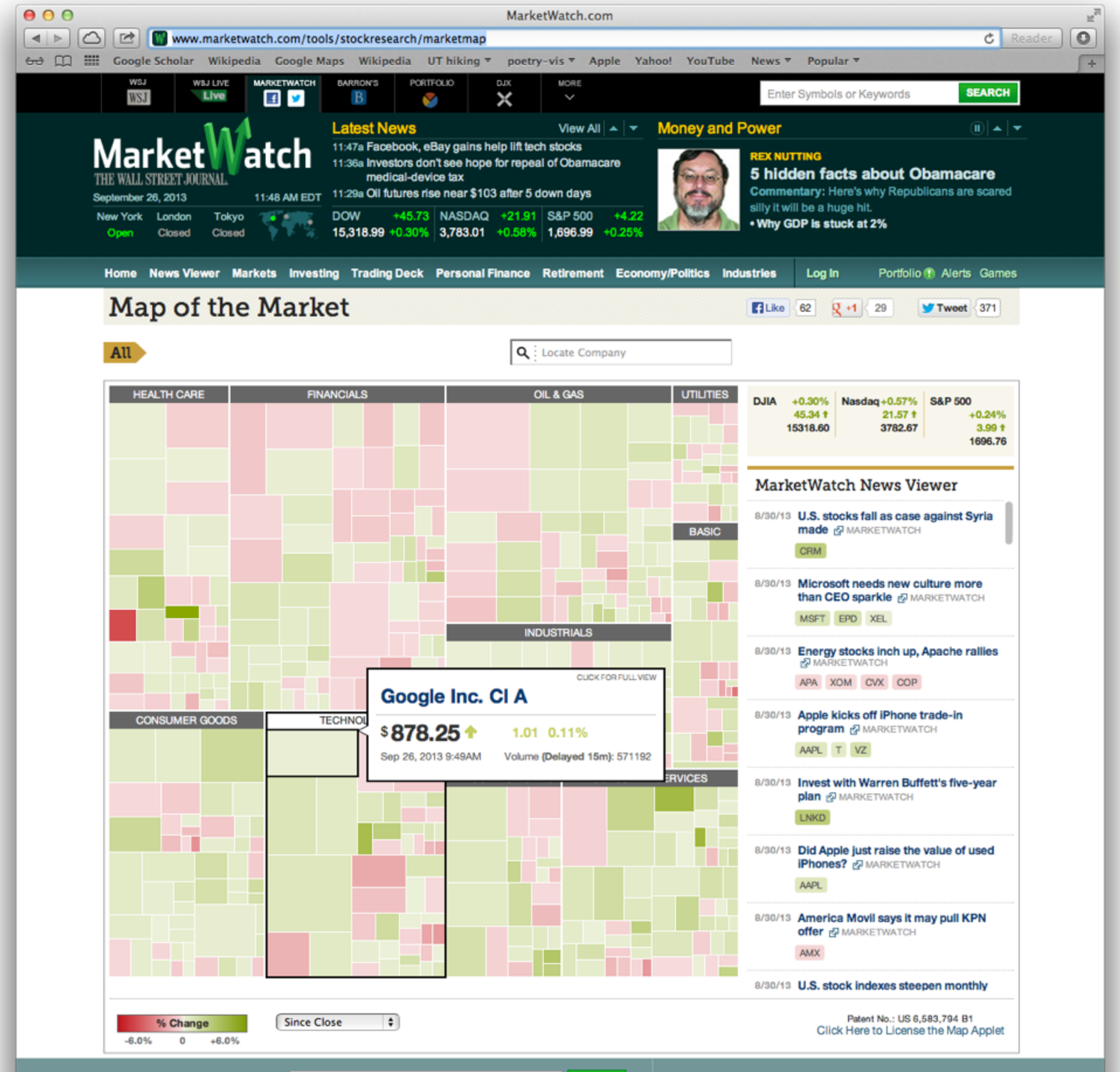
partitioning: transform data attributes into a hierarchy

reconfigure partitioning hierarchies to explore data space

use treemaps as spacefilling rectangular layouts

Slingsby 2009

TREEMAP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Enter Symbols or Keywords SEARCH
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11:29a Oil futures rise near $103 after 5 down days
DOW +45.73 15,318.99 +0.30%
NASDAQ +21.91 3,783.01 +0.58%
S&P 500 +4.22 1,696.99 +0.25%
Money and Power
REX NUTTING
5 hidden facts about Obamacare
Commentary: Here's why Republicans are scared silly it will be a huge hit.
• Why GDP is stuck at 2%
Home News Viewer Markets Investing Trading Deck Personal Finance Retirement Economy/Politics Industries
Log In Portfolio Alerts Games
Map of the Market
Like 62 +1 29 Tweet 371
All
Locate Company
HEALTH CARE
FINANCIALS
OIL & GAS
UTILITIES
BASIC
INDUSTRIALS
CONSUMER GOODS
TECHNOL
ERVICES
CLICK FOR FULL VIEW
Google Inc. Cl A
$878.25 1.01 0.11%
Sep 26, 2013 9:49AM Volume (Delayed 15m): 571192
DJIA +0.30% 45.34 15318.60
Nasdaq +0.57% 21.57 3782.67
S&P 500 +0.24% 3.99 1696.76
MarketWatch News Viewer
8/30/13 U.S. stocks fall as case against Syria made MARKETWATCH CRM
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8/30/13 Did Apple just raise the value of used iPhones? MARKETWATCH AAPL
8/30/13 America Movil says it may pull KPN offer MARKETWATCH AMX
8/30/13 U.S. stock indexes steepen monthly
% Change -6.0% 0 +6.0%
Since Close
Patent No.: US 6,583,794 B1
Click Here to License the Map Applet

HiVE: Hierarchical Visual Expression

partitioning: transform multidimensional data into a hierarchy

reconfigure partitioning hierarchies to explore data space

use treemaps as spacefilling rectangular layouts

- each rectangle is a partitioned subset
- nested graphical summaries
  - size, shape, color used to show subset properties
  - containment ordering by partition variables

Slingsby 2009

HiVE example: London property

partitioning attributes

house type
neighborhood
sale time

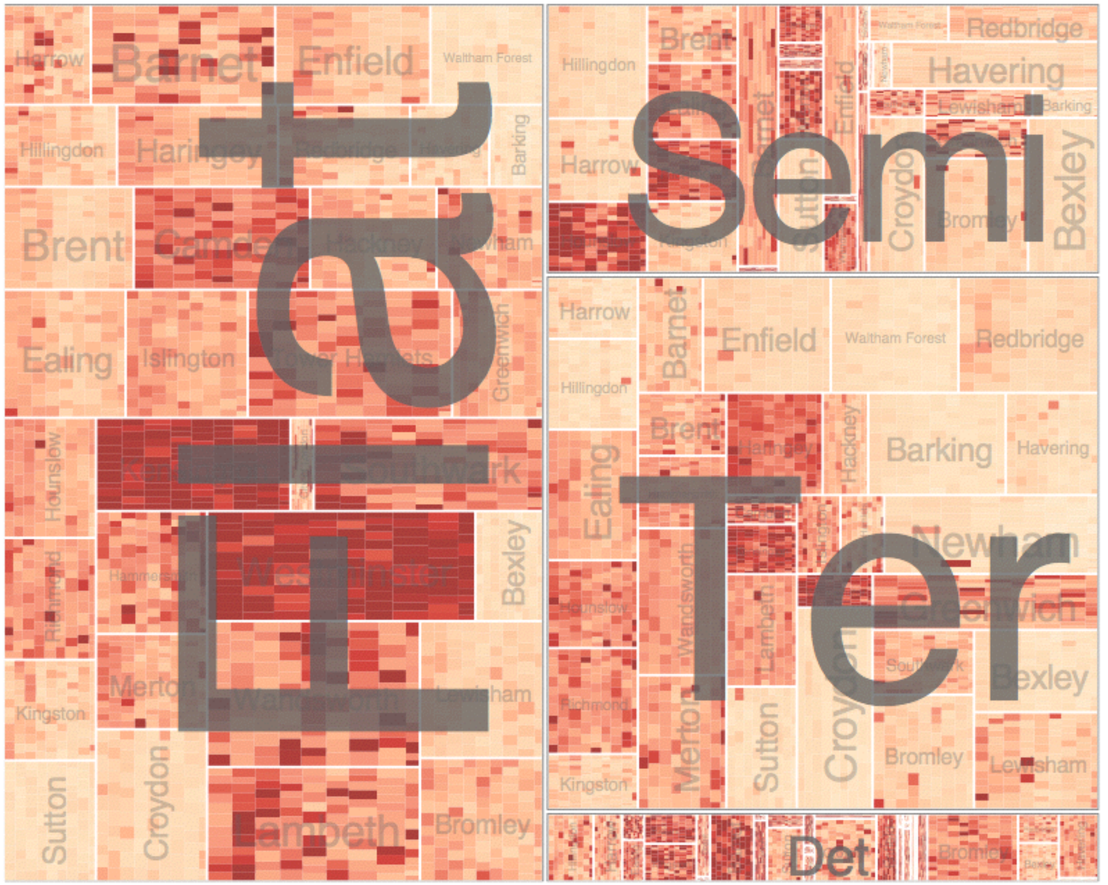
encoding attributes

average price (color)
number of sales (size)

results

between neighborhoods, different housing distributions

within neighborhoods, similar prices



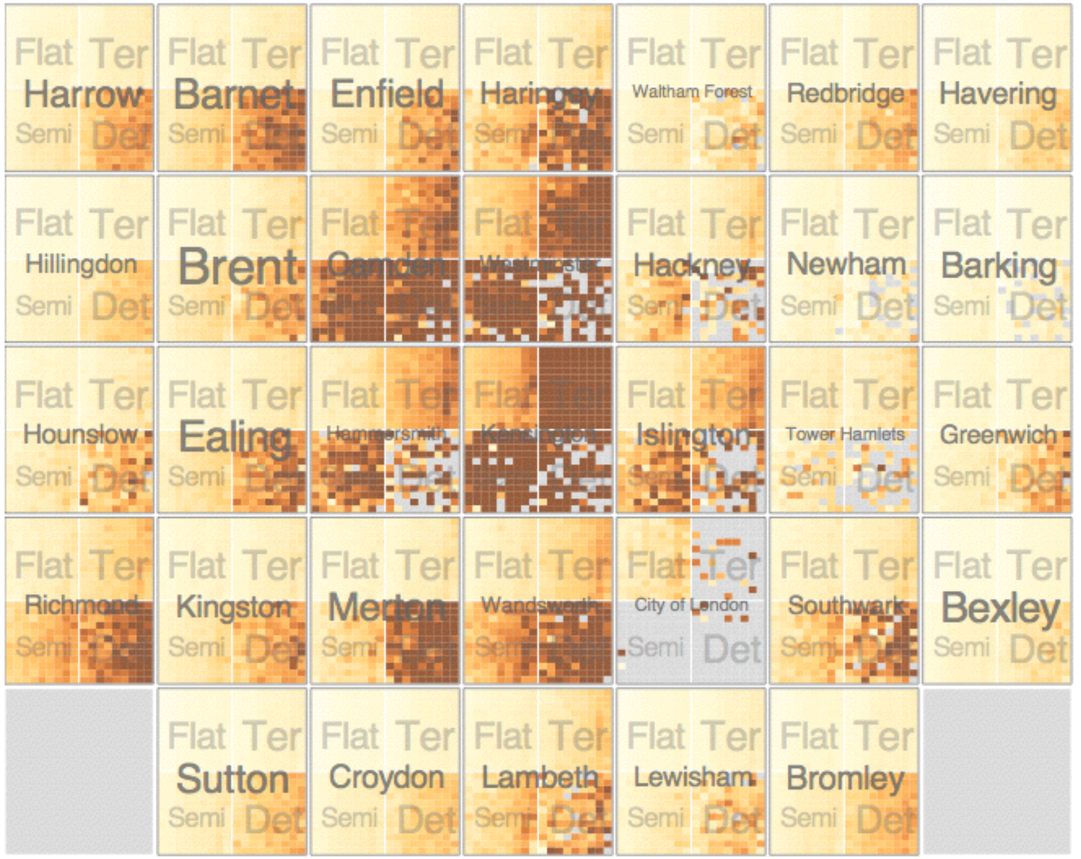
Slingsby 2009

HiVE example: London property

partitioning attributes
neighborhood location
neighborhood
house type
sale time (year)
sale time (month)

encoding attributes
average price (color)
n/a (size)

results
expensive neighborhoods
near center of city



Slingsby 2009

Configuring Hierarchical Layouts to Address Research Questions

Aidan Slingsby, Jason Dykes and Jo Wood
giCentre, Department of Information Science, City University London
http://www.gicentre.org/hierarchical_layouts/

LAYERING

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

rational

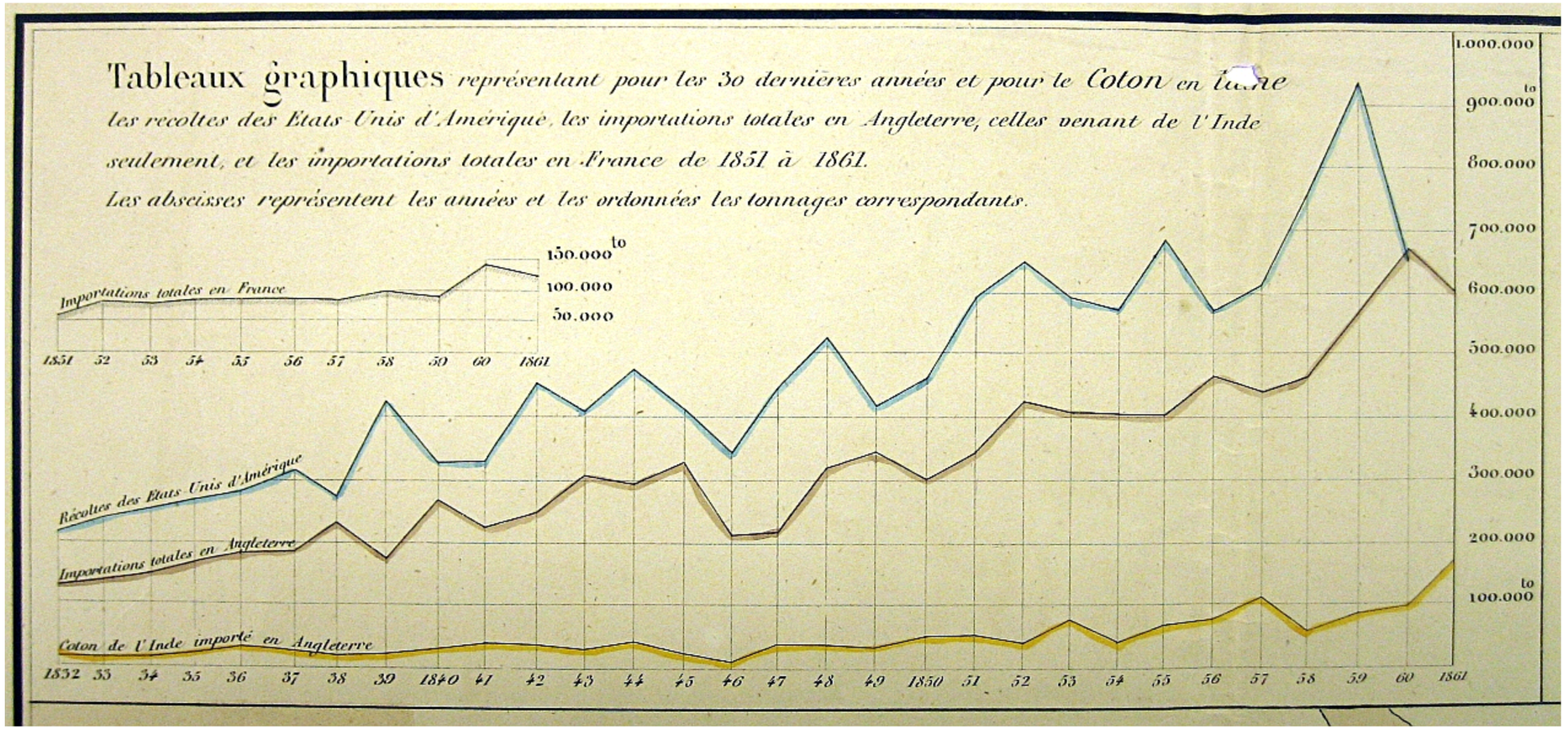
supports a larger, more detailed view than using multiple views

trade-off

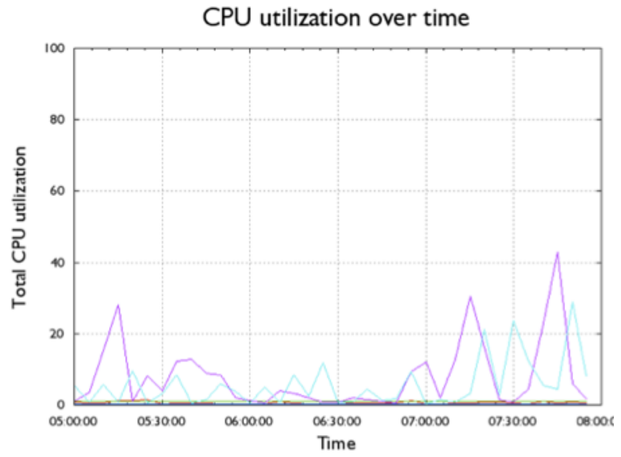
layering imposes constraints on visual encoding choice as well as number of layers that can be shown

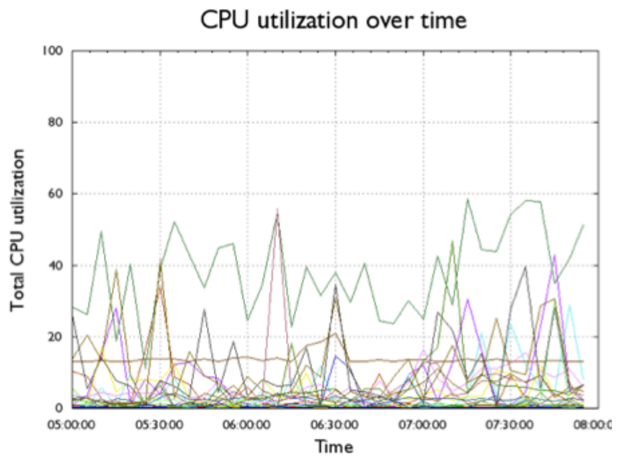
JOSEPH MINARD

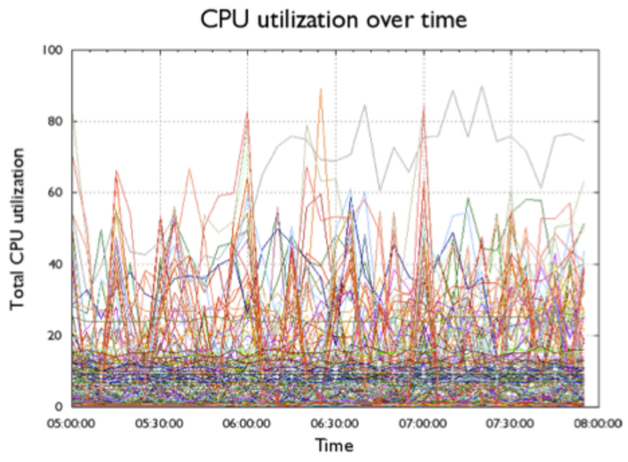
1781-1870



overlays


CPU utilization over time
Total CPU utilization
100
80
60
40
20
0
05:00:00
05:30:00
06:00:00
06:30:00
07:00:00
07:30:00
Time


CPU utilization over time
Total CPU utilization
100
80
60
40
20
0
05:00:00
05:30:00
06:00:00
06:30:00
07:00:00
07:30:00
Time


CPU utilization over time
Total CPU utilization
100
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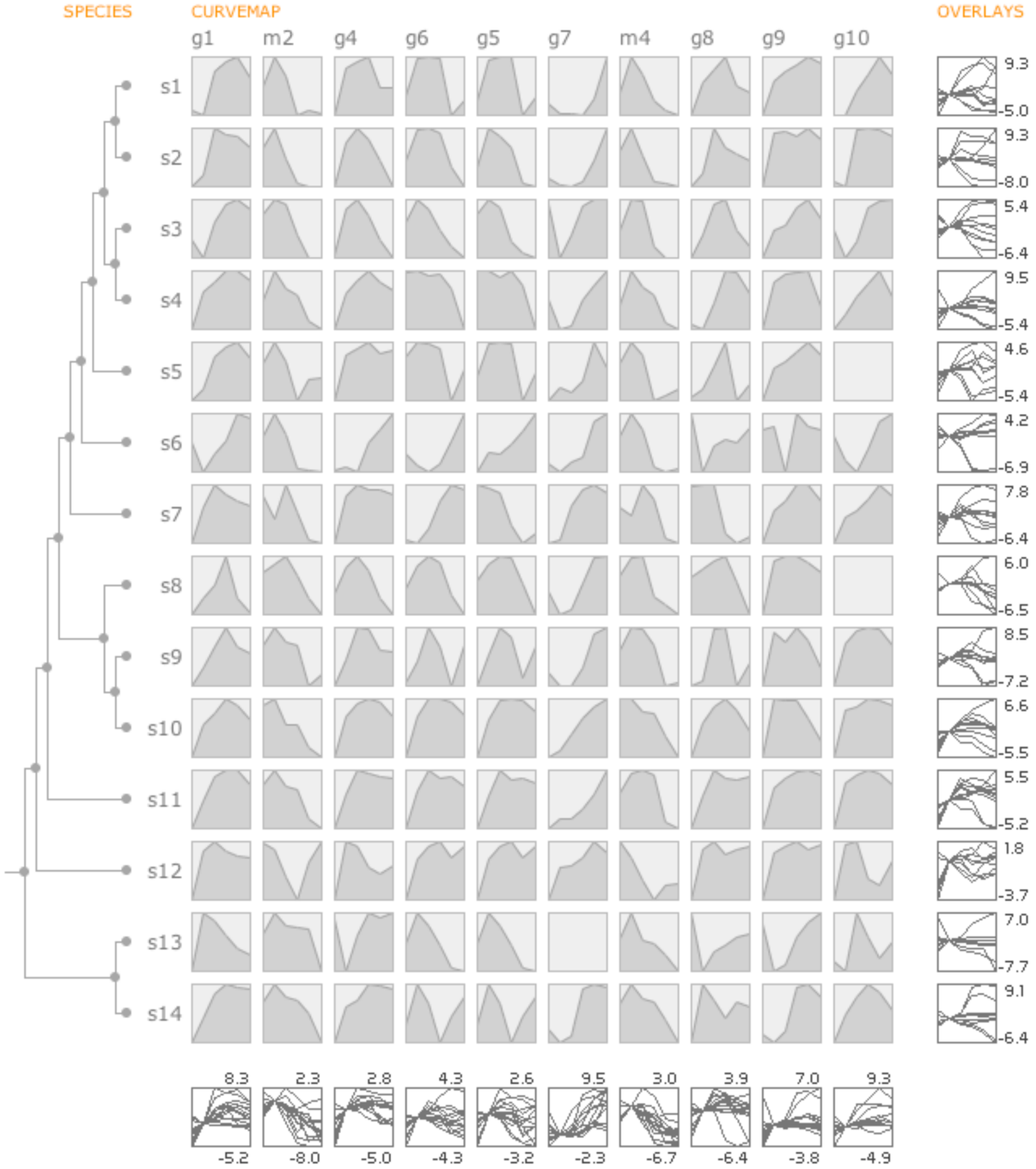
06:00:00
06:30:00
07:00:00
07:30:00
08:00:00
Time

highlighting



MCV to the Max