

11: Manipulate View

Enrico Puppo

Department of Computer Science, Bioengineering, Robotics and Systems Engineering
University of Genova

90529 Data Visualization

30 November - 3 December 2020

<https://2020.aulaweb.unige.it/course/view.php?id=4293>

Credits:

- material in these slides is partially taken from
- T. Munzner, University of British Columbia
 - A. Lex, University of Utah

How?

Encode

→ Arrange

→ Express



→ Separate



→ Order



→ Use



→ Map

from categorical and ordered attributes

→ Color



→ Size, Angle, Curvature, ...

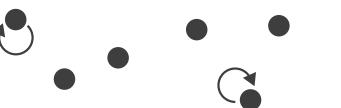


→ Shape



→ Motion

Direction, Rate, Frequency, ...



Manipulate

→ Change



→ Select



→ Navigate



Facet

→ Juxtapose



→ Partition



→ Superimpose



Reduce

→ Filter



→ Aggregate



→ Embed

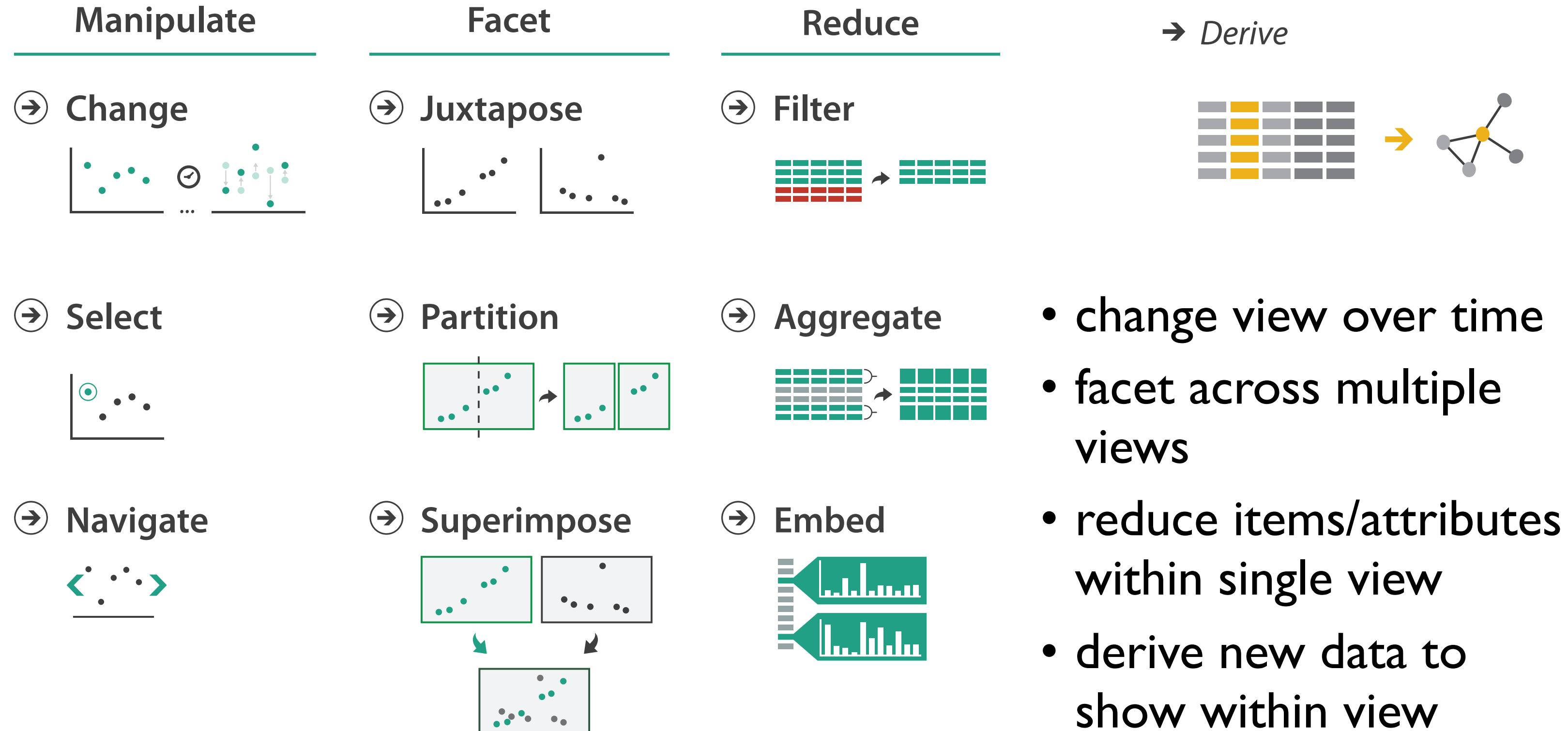


What?

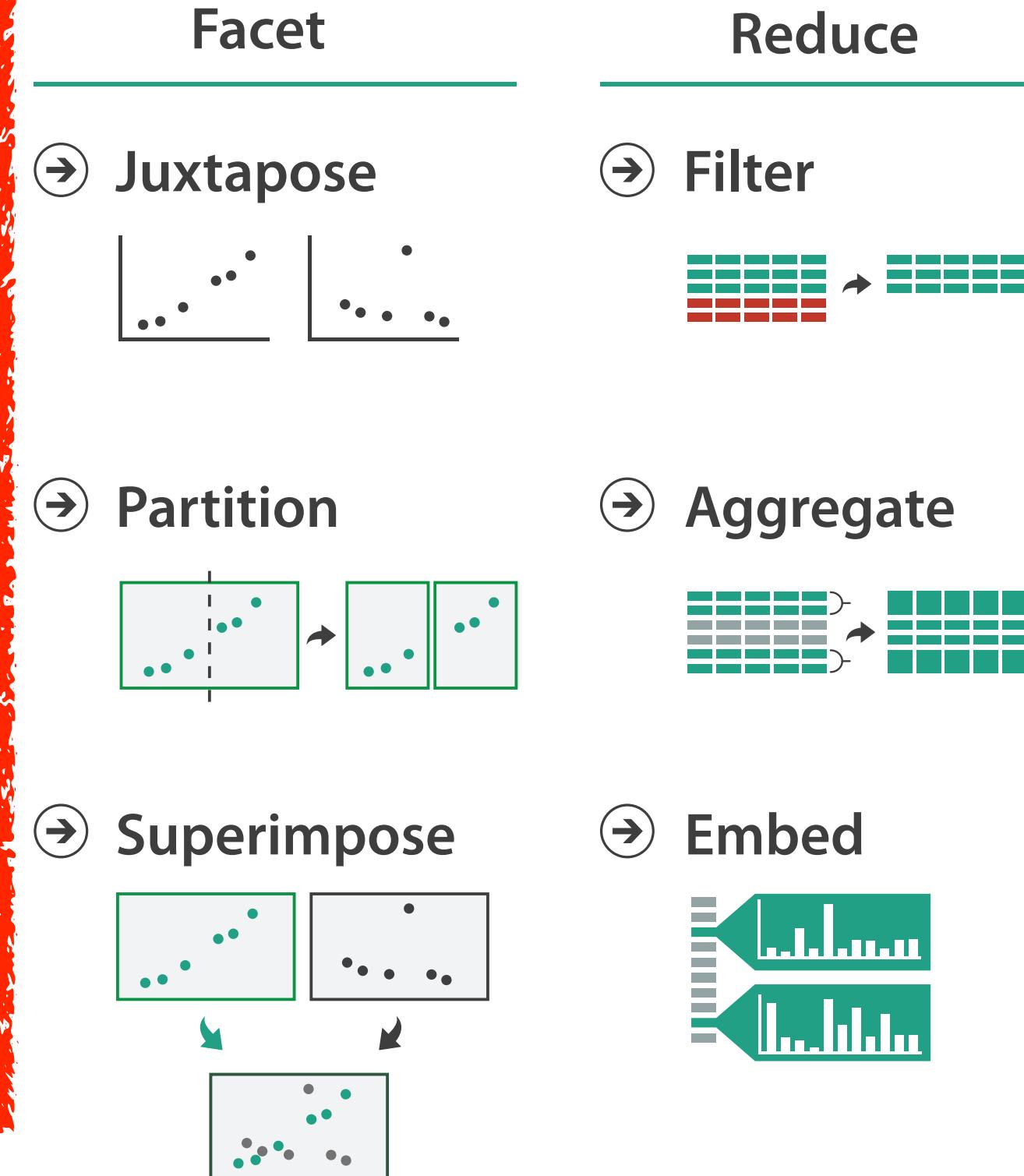
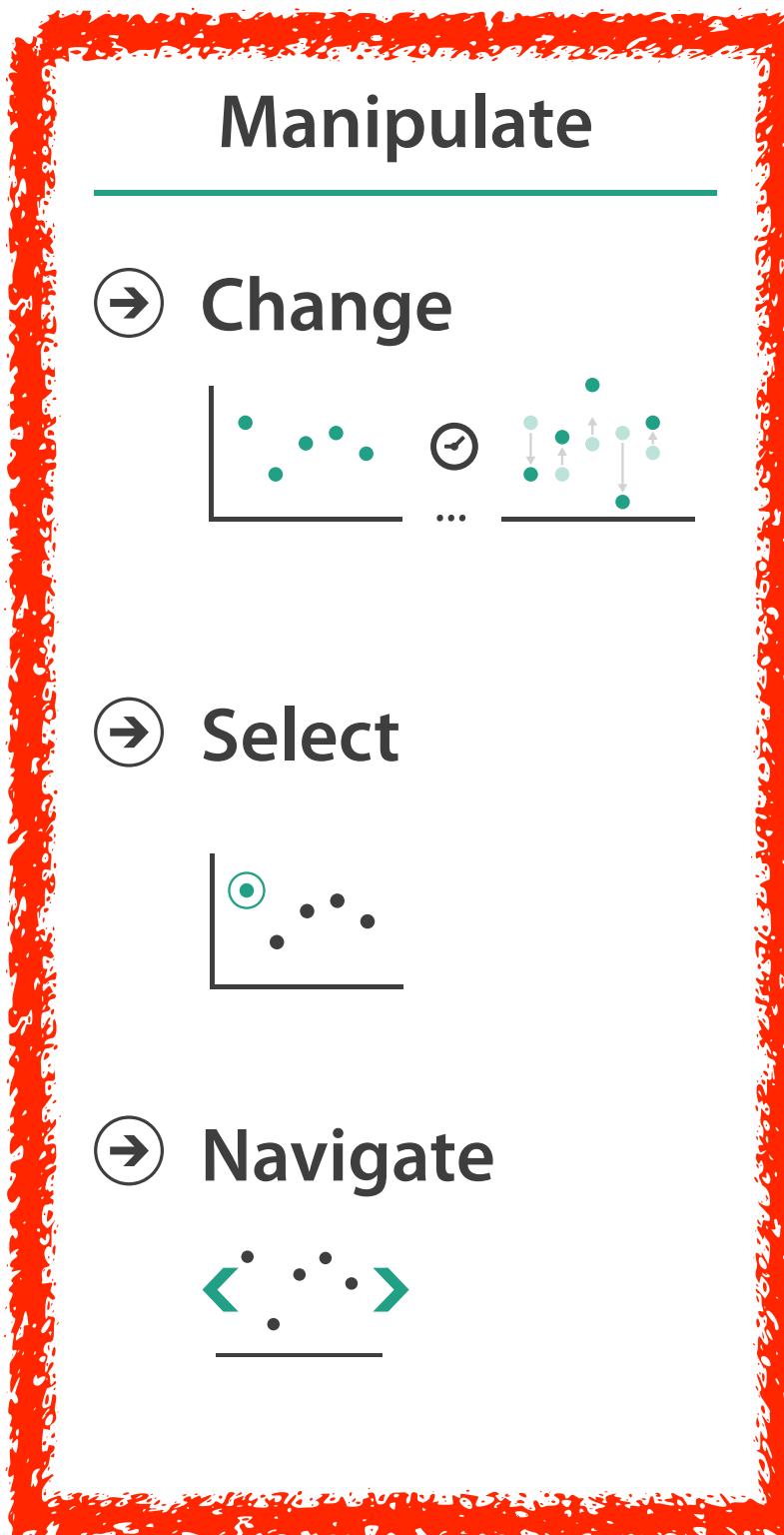
Why?

How?

How to handle complexity: 3 more strategies + 1 previous



How to handle complexity: 3 more strategies + 1 previous



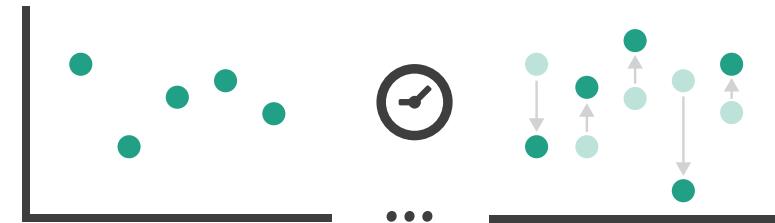
→ *Derive*



- change view over time
 - most obvious & flexible of the 4 strategies

Manipulate - Interactive tasks

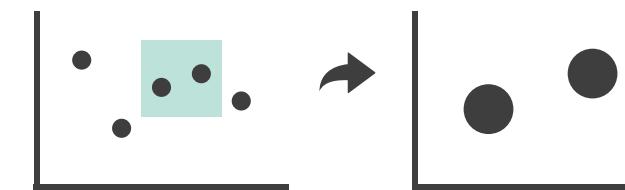
→ Change over Time



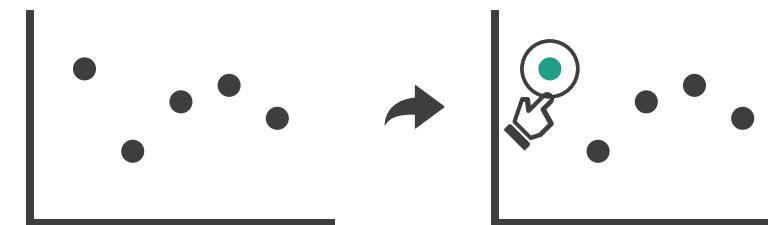
→ Navigate

→ Item Reduction

→ Zoom
Geometric or Semantic



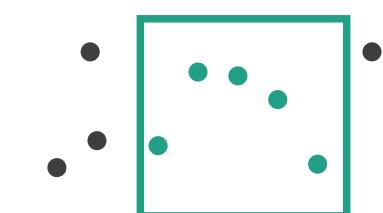
→ Select



→ Pan/Translate

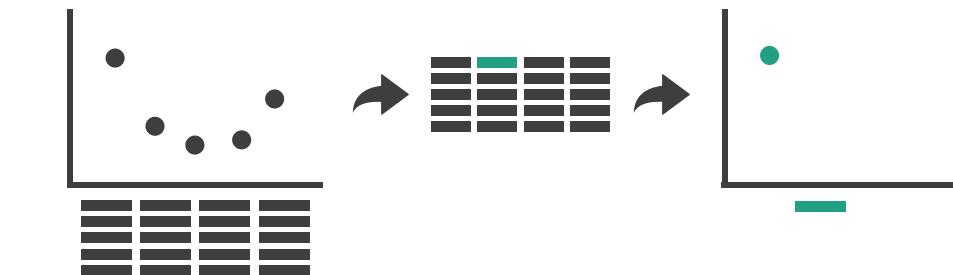


→ Constrained

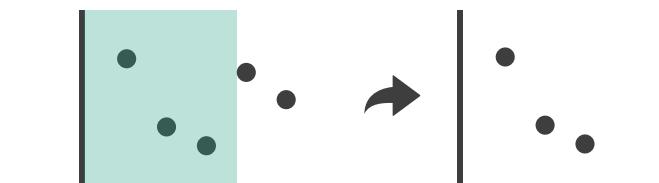


→ Attribute Reduction

→ Slice



→ Cut



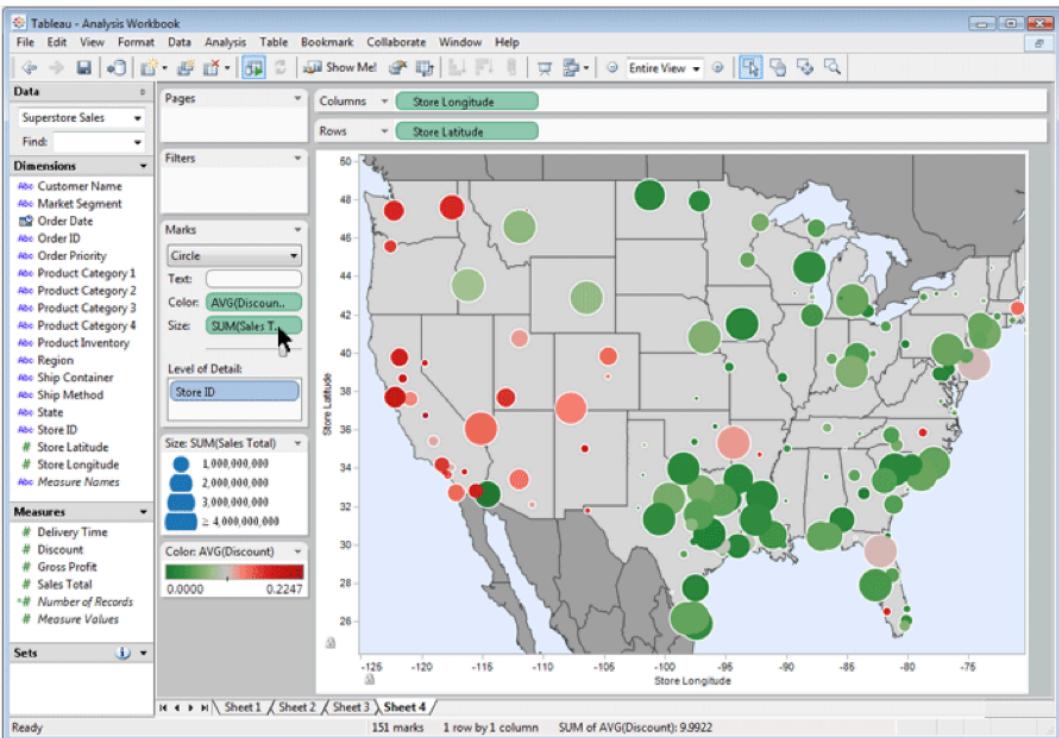
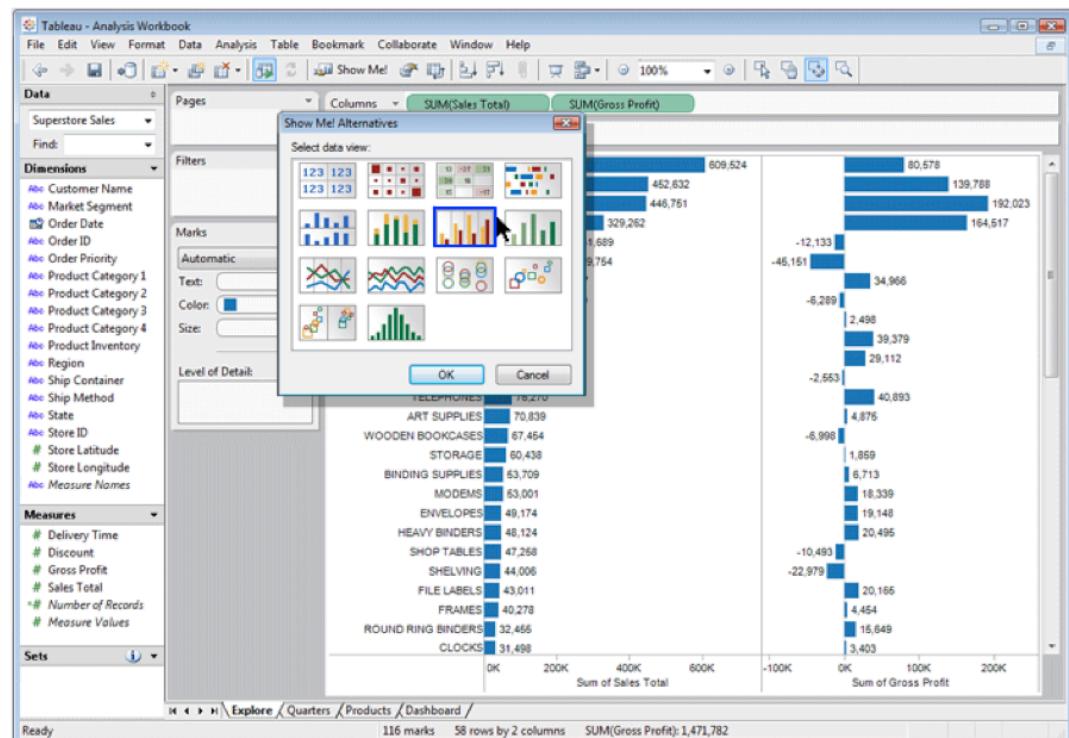
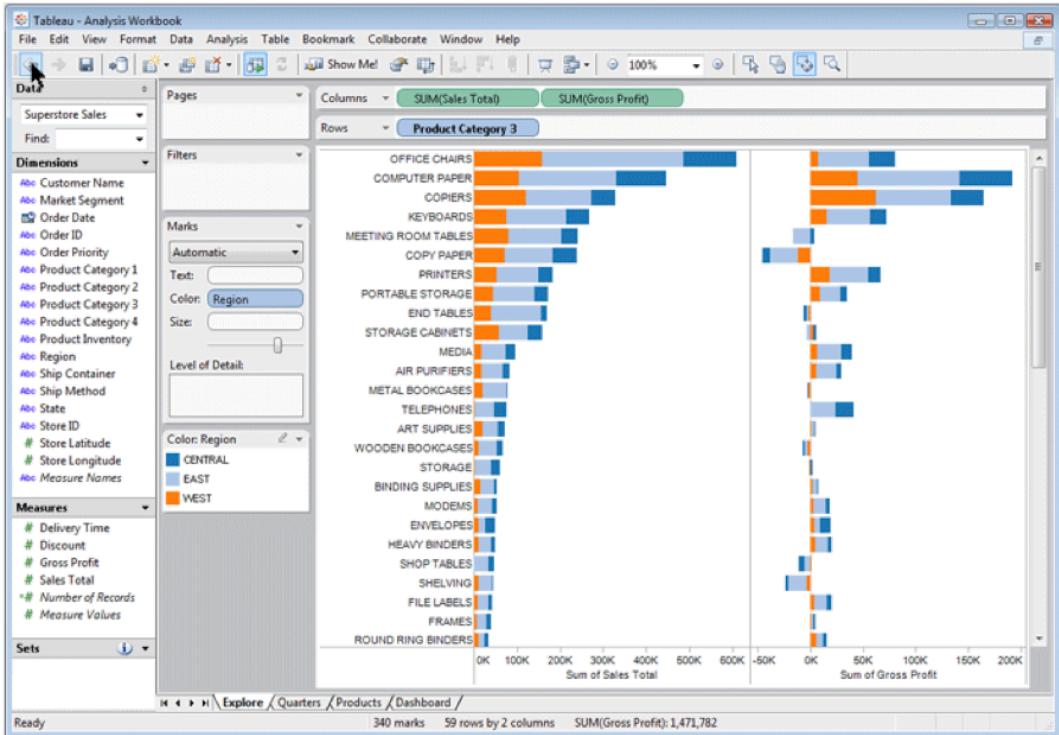
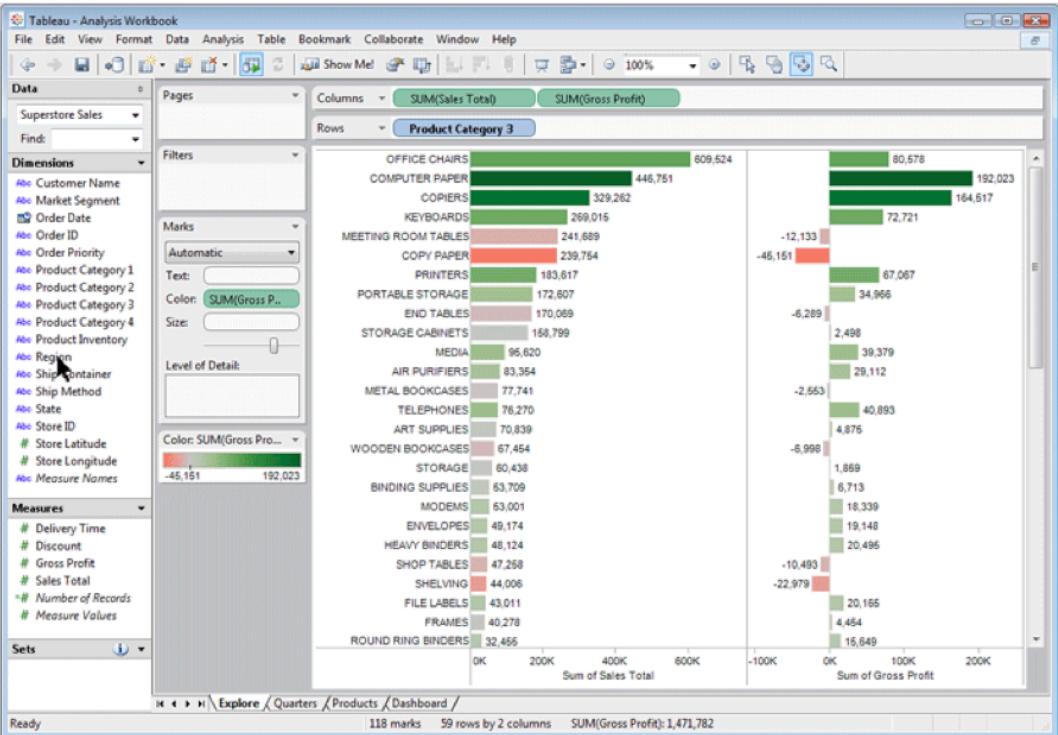
→ Project



Change over time

- what to change?
 - encoding
 - parameters
 - arrangement: rearrange, reorder
 - viewpoint
 - aggregation level, what is filtered...
- why change?
 - highlight different aspects of the same data
 - most obvious, powerful, flexible
 - interaction entails change

Idiom: Re-encode

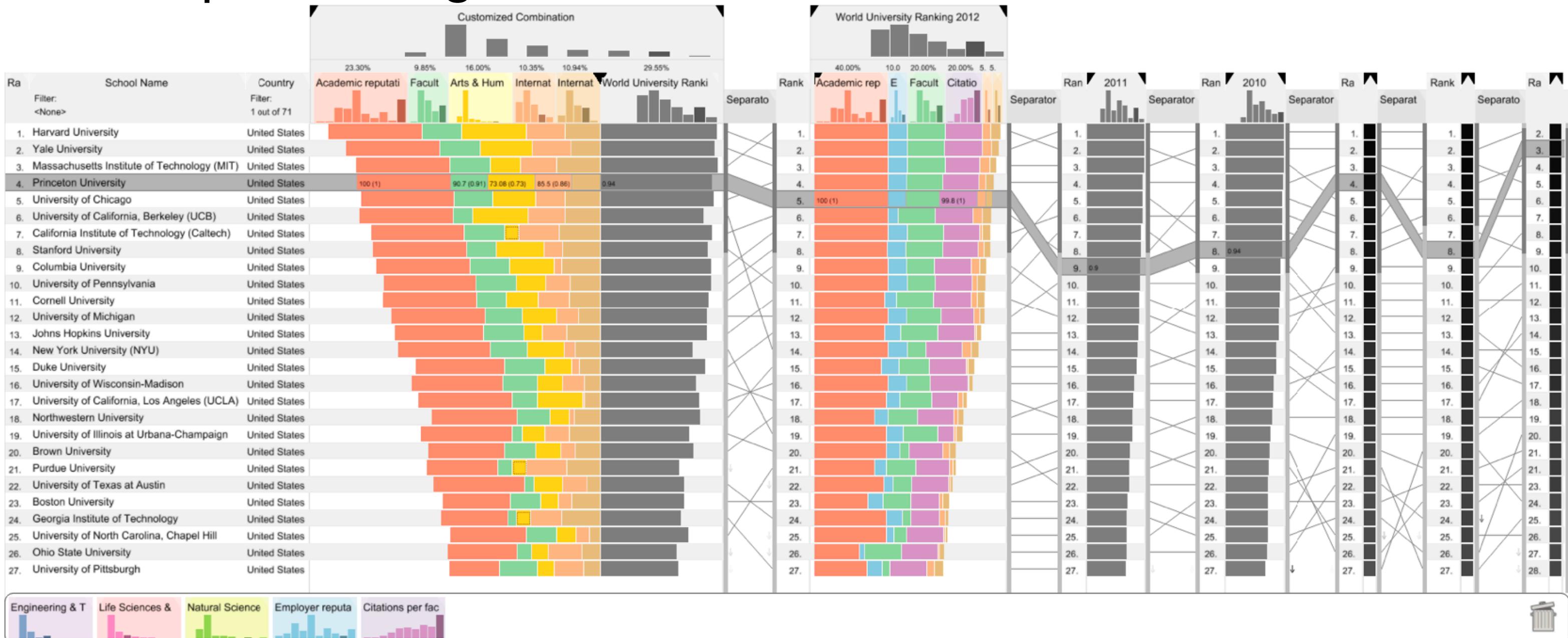


made using Tableau, <http://tableausoftware.com>

System: Tableau

Idiom: Reorder

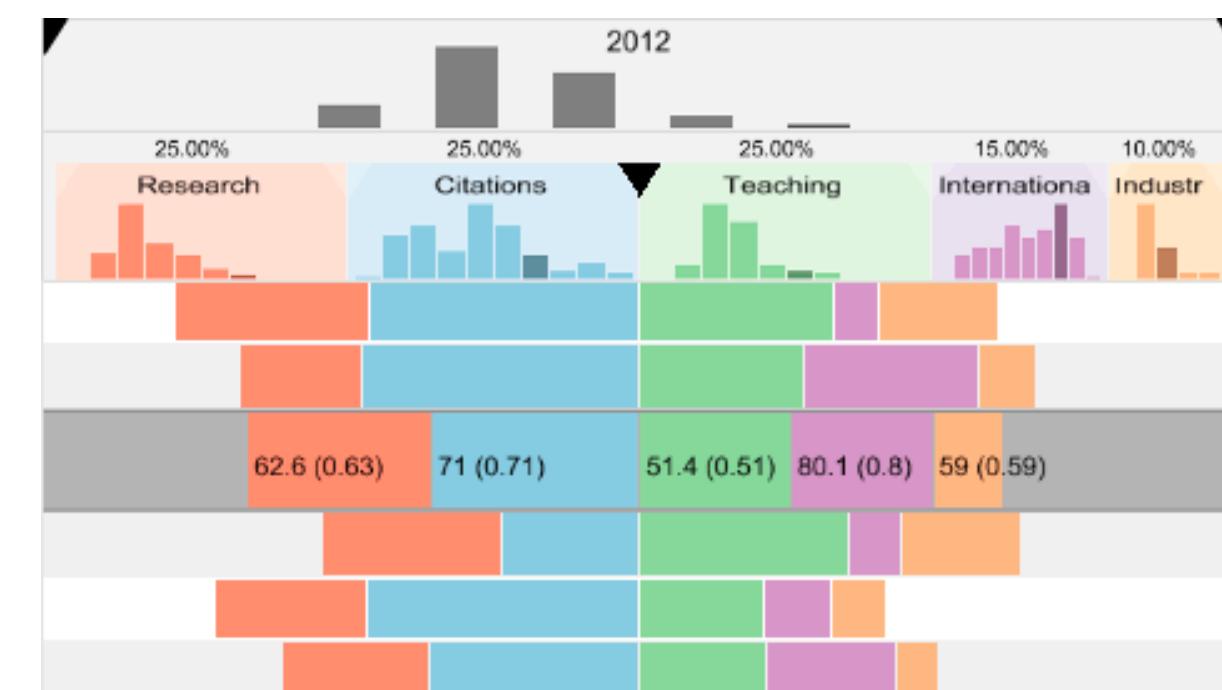
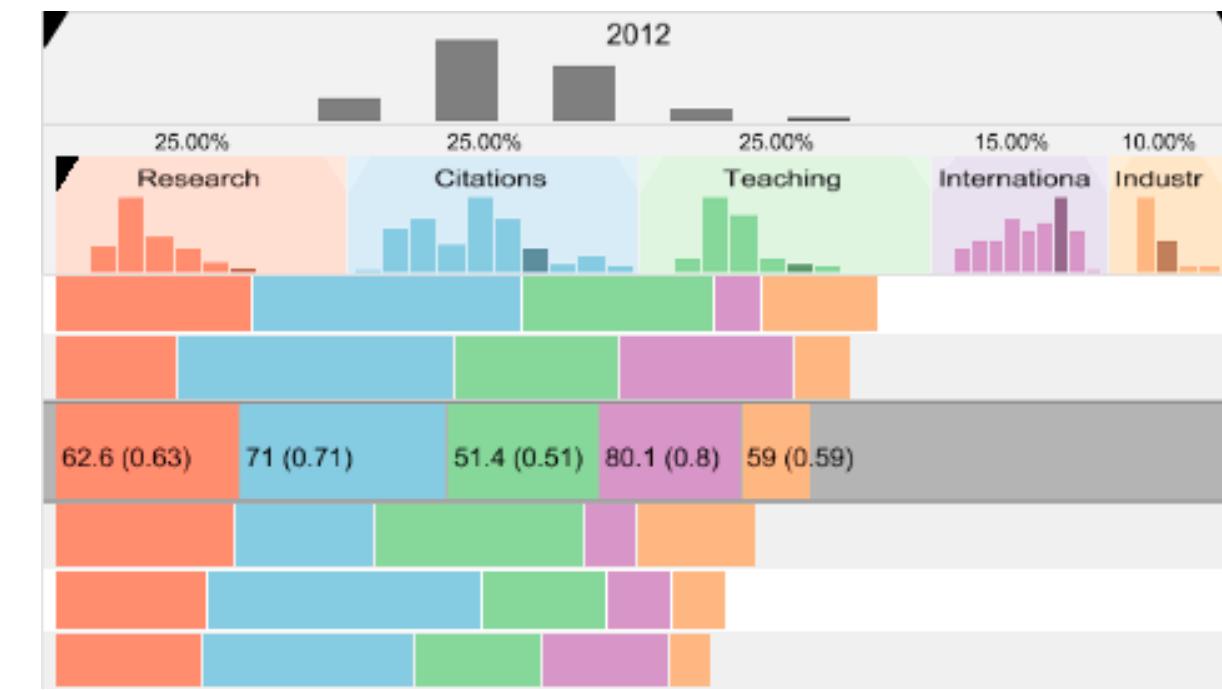
- data: tables with many attributes
- task: compare rankings



Idiom: Realign

- stacked bars
 - easy to compare
 - first segment
 - total bar
- align to different segment
 - supports flexible comparison

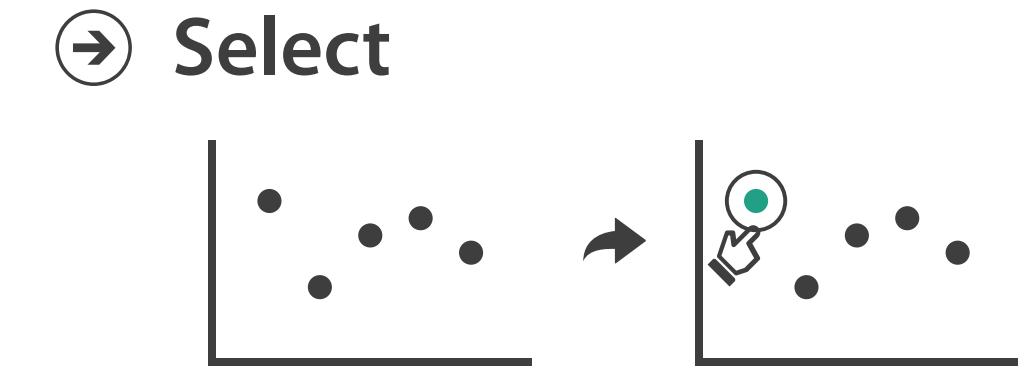
System: LineUp



[LineUp: Visual Analysis of Multi-Attribute Rankings. Gratzl, Lex, Gehlenborg, Pfister, and Streit. IEEE Trans. Visualization and Computer Graphics (Proc. InfoVis 2013) 19:12 (2013), 2277–2286.]

Select & highlight

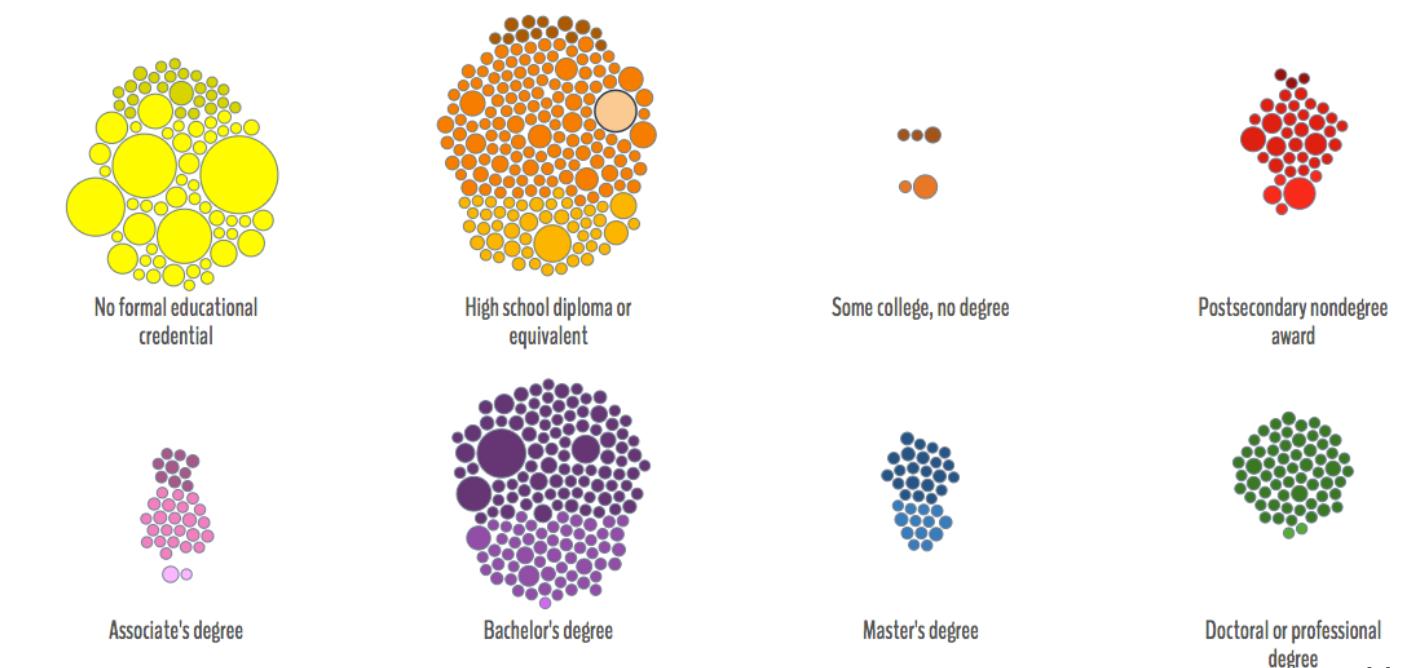
- selection: basic operation for most interaction
- selected elements
 - items
 - links
 - attributes
 - ranges in an attribute
- selection types
 - hover, click, double click, click & drag (brush, windowing), ...
 - primary vs secondary (induced selection)
 - simple vs multiple selection
- selection is an interaction idiom



Select & highlight

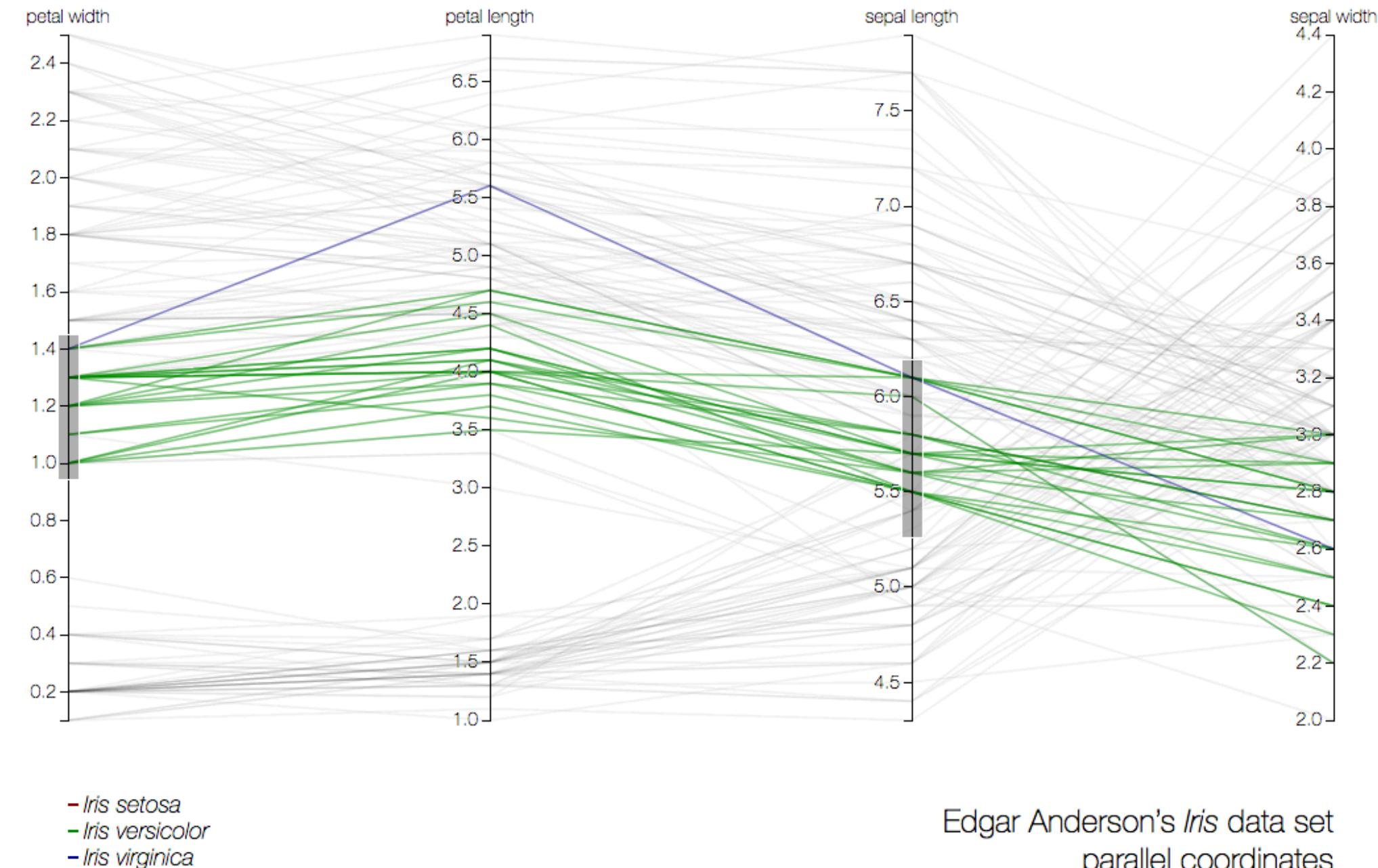
- highlight: change visual encoding for selection targets
 - color
 - limitation: existing color coding hidden
 - other channels (e.g. shape, size, motion)
 - add explicit connection marks between items
- highlight: encoding idiom

Occupations Clustered by Level of Education Typically Required



Idiom: Brushes

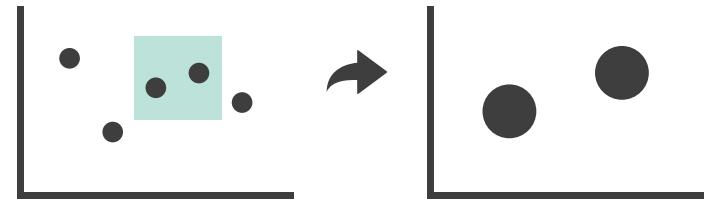
- Interaction idiom to select ranges within one or more attributes



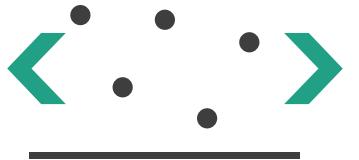
Navigate: Changing item visibility

- change viewpoint
 - changes which items are visible within view
 - camera metaphor
 - zoom
 - geometric zoom: familiar semantics
 - semantic zoom: adapt object representation based on available pixels
 - » dramatic change, or more subtle one
 - pan/translate
 - rotate
 - especially in 3D
 - constrained navigation
 - often with animated transitions
 - often based on selection set

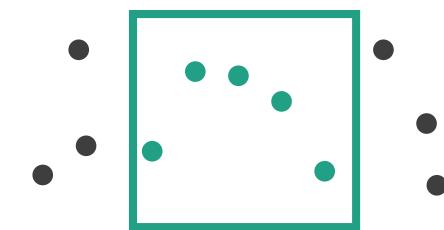
→ Navigate
→ Item Reduction
→ Zoom
Geometric or *Semantic*



→ Pan/Translate



→ Constrained



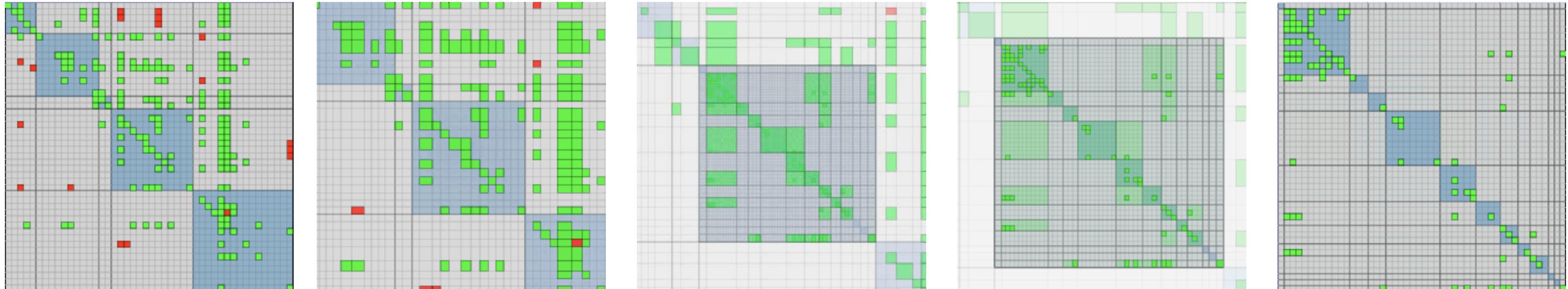
Idiom: Pan & zoom

System: Apple GarageBand



Idiom: Semantic zooming & Animated transitions

- smooth transition from one state to another
 - alternative to jump cuts
 - support for item tracking when amount of change is limited
- example: multilevel matrix views
 - scope of what is shown narrows down
 - middle block stretches to fill space, additional structure appears within
 - other blocks squish down to increasingly aggregated representations



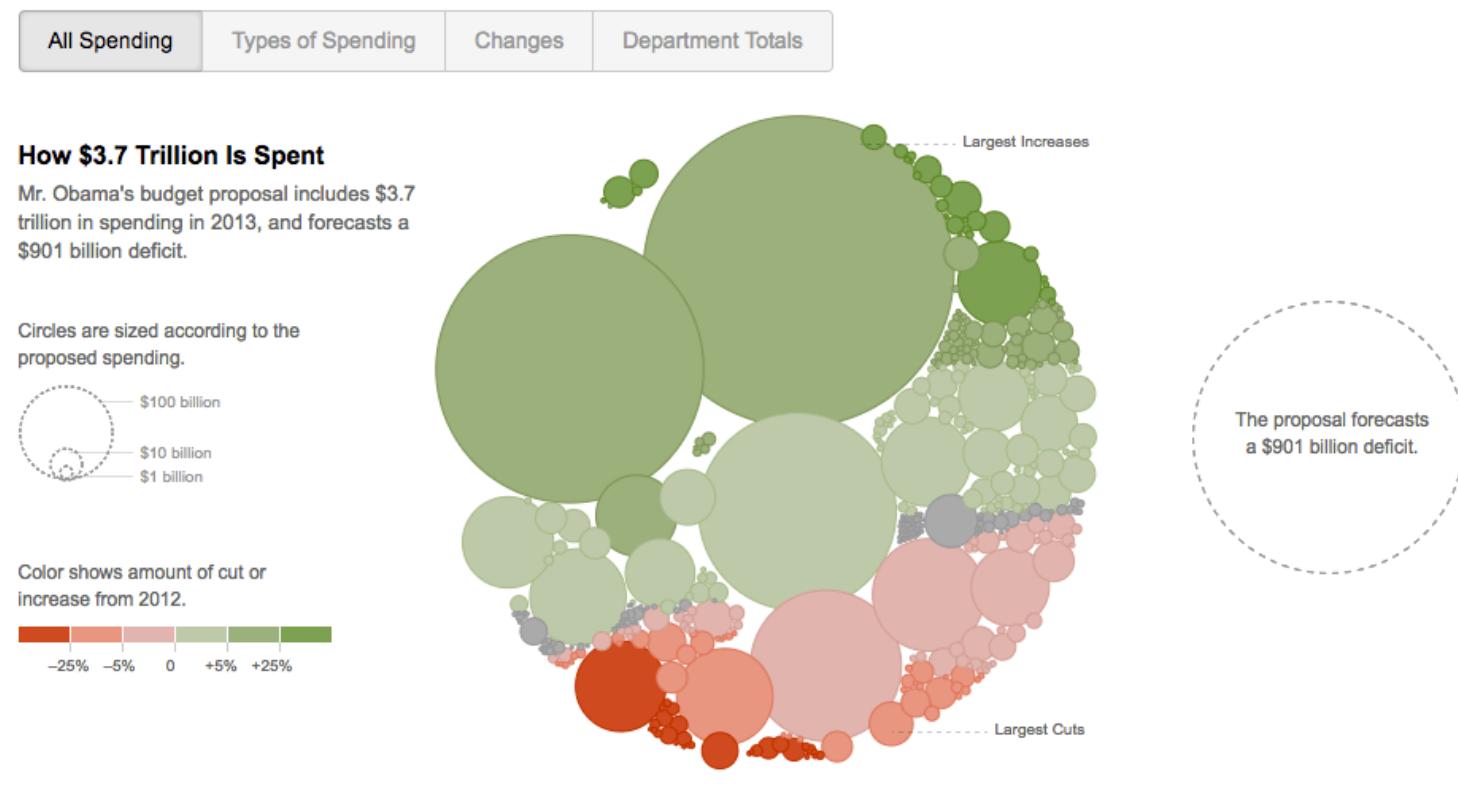
[Using Multilevel Call Matrices in Large Software Projects. van Ham. Proc. IEEE Symp. Information Visualization (InfoVis), pp. 227–232, 2003.]

Idiom: Animated transitions

- more examples

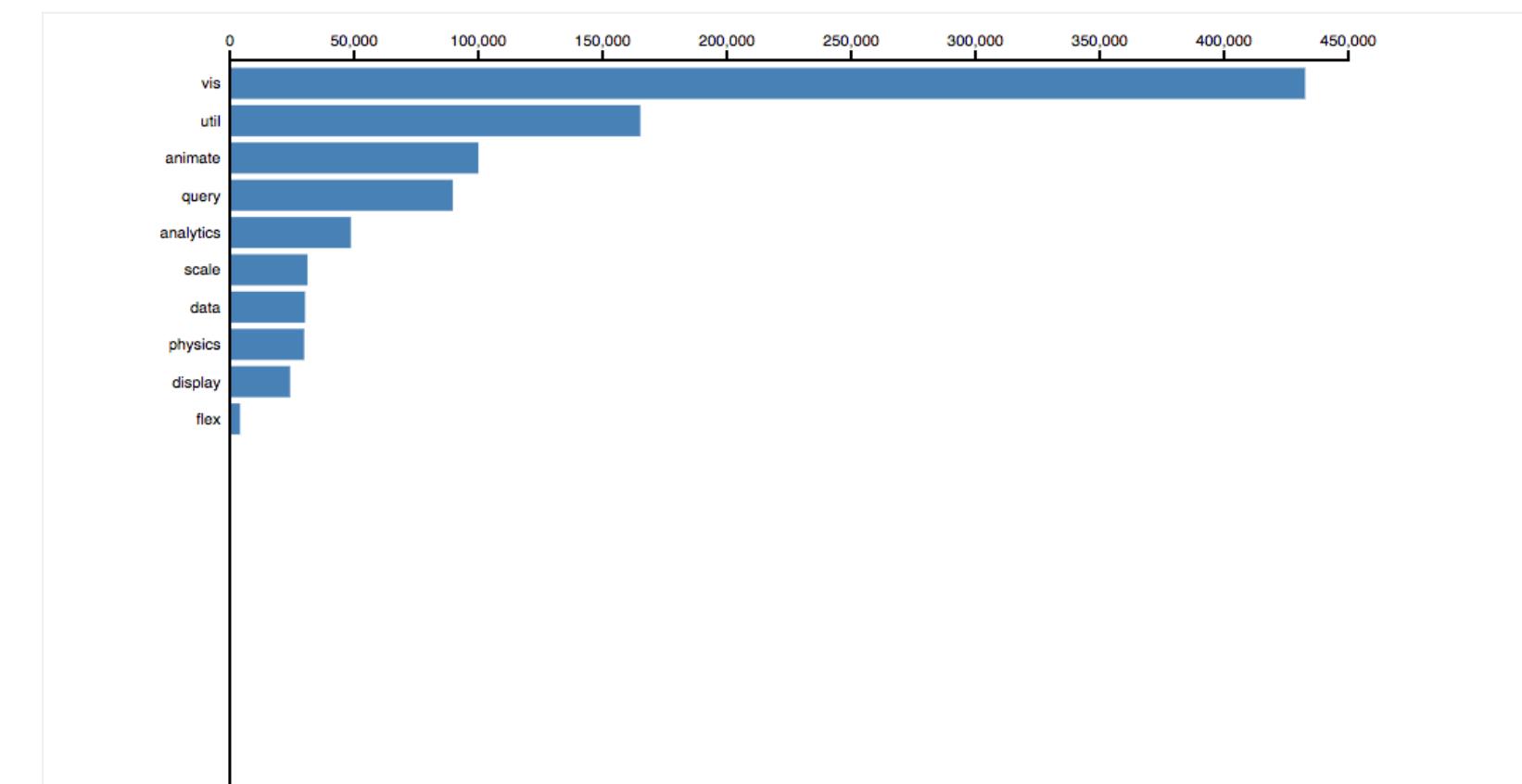
Four Ways to Slice Obama's 2013 Budget Proposal

Explore every nook and cranny of President Obama's federal budget proposal.



www.nytimes.com/interactive/2012/02/13/us/politics/2013-budget-proposal-graphic.html

Hierarchical Bar Chart

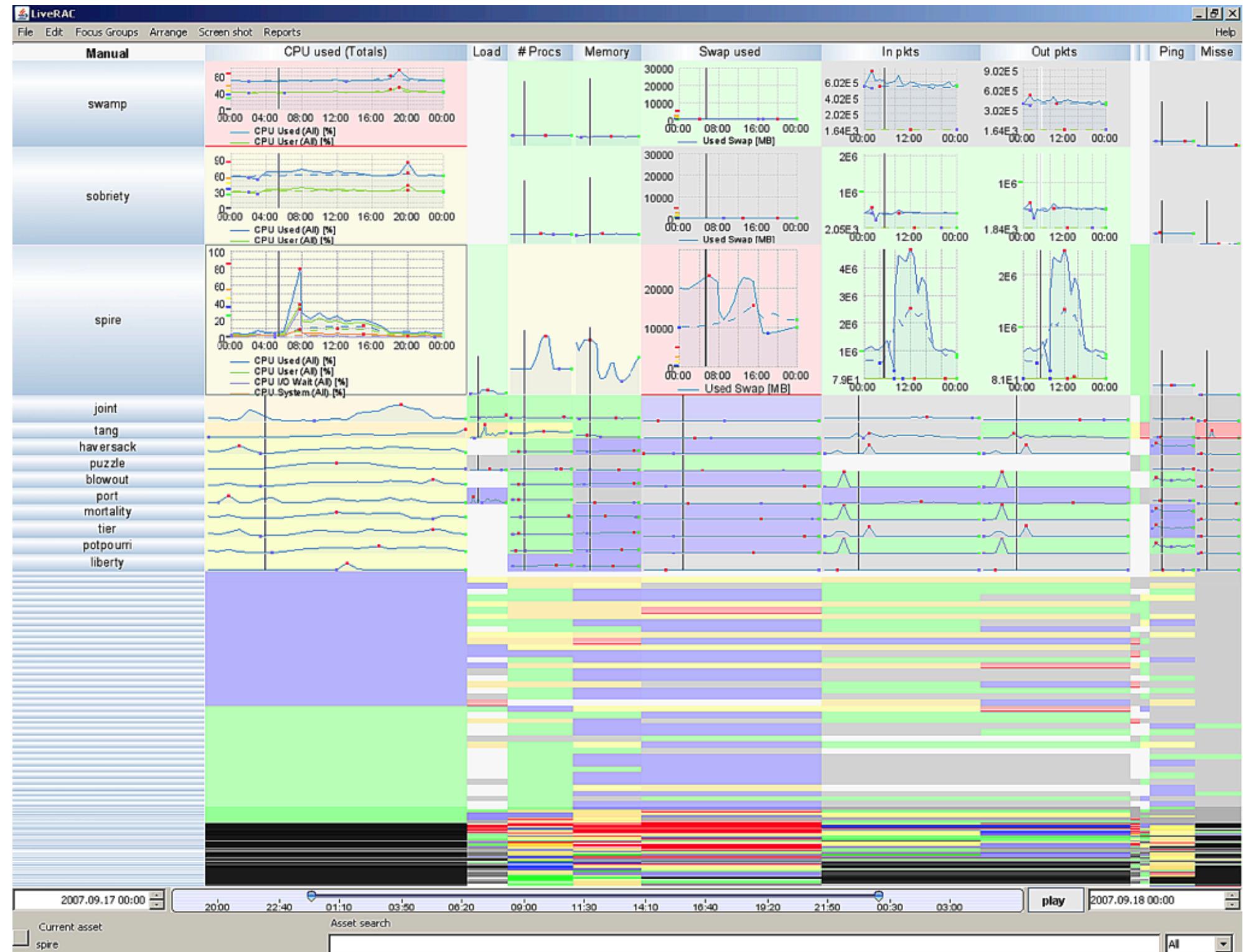


www.nytimes.com/interactive/2012/02/13/us/politics/2013-budget-proposal-graphic.html

Idiom: Semantic zooming

System: LiveRAC

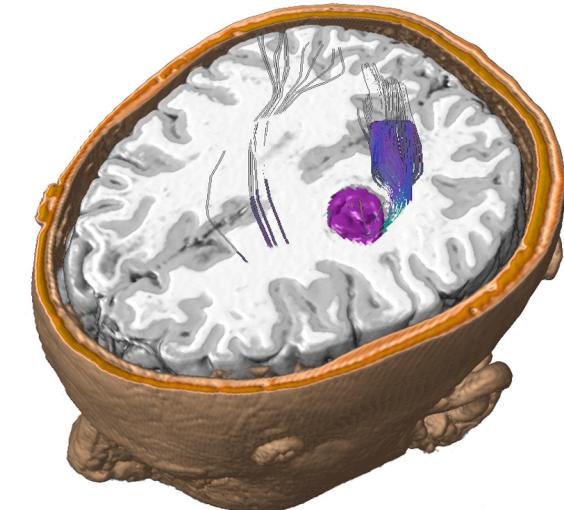
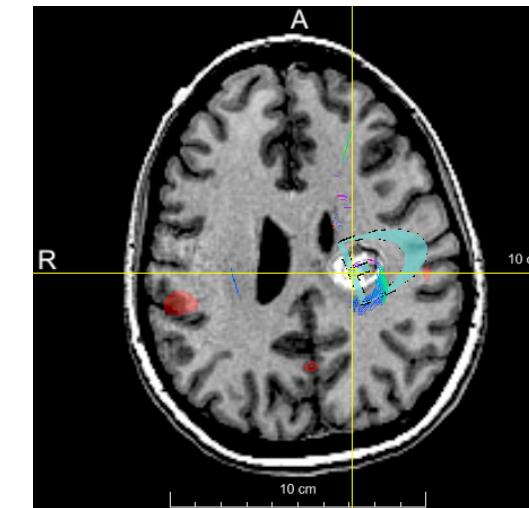
- visual encoding change
 - colored box
 - sparkline
 - simple line chart
 - full chart: axes and tickmarks
- time interval can be selected (pan & zoom)



[LiveRAC - Interactive Visual Exploration of System Management Time-Series Data. McLachlan, Munzner, Koutsofios, and North. Proc. ACM Conf. Human Factors in Computing Systems (CHI), pp. 1483–1492, 2008.]

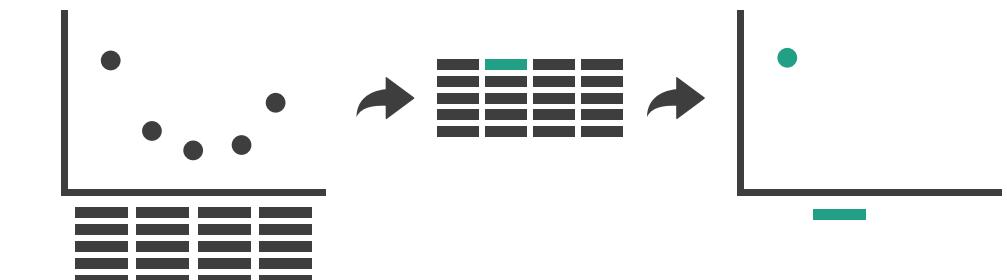
Navigate: Reducing attributes

- continuation of camera metaphor
 - slice
 - show only items matching specific value for given attribute: slicing plane
 - axis aligned, or arbitrary alignment
 - cut
 - show only items on far slide of plane from camera
 - project
 - change mathematics of image creation
 - orthographic
 - perspective
 - many others: Mercator, cabinet, ...

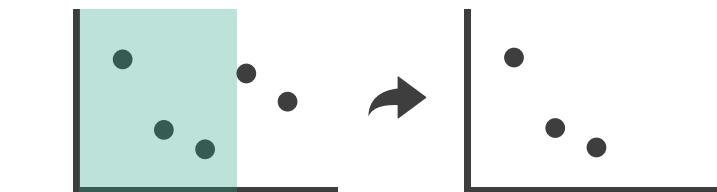


→ Attribute Reduction

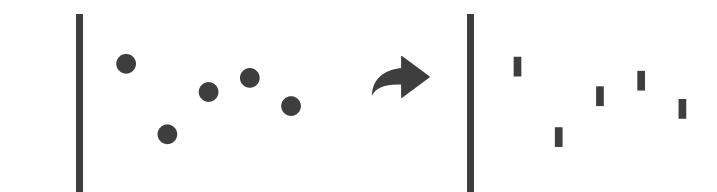
→ Slice



→ Cut



→ Project



Next Time

- to read
 - VAD Ch. 12: Facet into Multiple Views

LiveRAC: Interactive Visual Exploration of System Management Time-Series Data