### CS49000-VIZ - Fall 2020 Introduction to Data Visualization

# **Facet** Lecture 15

#### Slides credit: Tamara Munzner, UBC

#### Facet





#### → Partition







2

# Juxtapose and coordinate views

#### → Share Encoding: Same/Different

→ Linked Highlighting



→ Share Data: All/Subset/None



→ Share Navigation



3

# Idiom: Linked highlighting

- 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.]

# System: **EDV**

# Idiom: **bird's-eye 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.]

# System: Google Maps

# Idiom: Small multiples

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



[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



# 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.]

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# 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



- - - across states



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

K	NY	FL	IL	PA

- 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.]

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



[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.]

- 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.]

 different encoding for second-level regions -choropleth maps



[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.]

# 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 achieveable, three with careful design



# 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, McDonnel, 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: I-hop neighbors

[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.]

