Ch 11: Manipulate View
Papers: Genealogical Graphs

Tamara Munzner
Department of Computer Science
University of British Columbia

CPSC 547, Information Visualization
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http://www.cs.ubc.ca/~tmm/courses/547-15
News

• marks for lectures 6-10 sent out this morning

• reminder: submit 3 separate questions
  – not 2, not 1
Encode

Arrange
- Express
- Separate

Order
- Align

Use

Map from categorical and ordered attributes
- Color
  - Hue
  - Saturation
  - Luminance
- Size, Angle, Curvature, ...

Shape
- + • ■ △

Motion
- Direction, Rate, Frequency, ...

Manipulate
- Change
- Select
- Navigate

Facet
- Juxtapose
- Partition
- Superimpose

Reduce
- Filter
- Aggregate
- Embed

Map Color Motion Size, Angle, Curvature, ...
Hue Saturation Luminance Shape Direction, Rate, Frequency, ...
from categorical and ordered attributes

How?
How to handle complexity: 3 more strategies

+ 1 previous

Manipulate

- Change
- Select
- Navigate

Facet

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- Partition
- Superimpose

Reduce

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- Embed

Derive

- change view over time
- facet across multiple views
- reduce items/attributes within single view
- derive new data to show within view
How to handle complexity: 3 more strategies

<table>
<thead>
<tr>
<th>Manipulate</th>
<th>Facet</th>
<th>Reduce</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change</td>
<td>Juxtapose</td>
<td>Filter</td>
</tr>
<tr>
<td>Select</td>
<td>Partition</td>
<td>Aggregate</td>
</tr>
<tr>
<td>Navigate</td>
<td>Superimpose</td>
<td>Embed</td>
</tr>
</tbody>
</table>

- **Change over time**
  - Most obvious & flexible of the 4 strategies

**Derive**
### Idiom design choices: Interaction

<table>
<thead>
<tr>
<th>Manipulate</th>
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</tr>
</thead>
<tbody>
<tr>
<td>→ Change</td>
<td>→ Juxtapose</td>
<td>→ Filter</td>
</tr>
<tr>
<td><img src="image1" alt="Change Diagram" /></td>
<td><img src="image2" alt="Juxtapose Diagram" /></td>
<td><img src="image3" alt="Filter Diagram" /></td>
</tr>
<tr>
<td>→ Select</td>
<td>→ Partition</td>
<td>→ Aggregate</td>
</tr>
<tr>
<td><img src="image4" alt="Select Diagram" /></td>
<td><img src="image5" alt="Partition Diagram" /></td>
<td><img src="image6" alt="Aggregate Diagram" /></td>
</tr>
<tr>
<td>→ Navigate</td>
<td>→ Superimpose</td>
<td>→ Embed</td>
</tr>
<tr>
<td><img src="image7" alt="Navigate Diagram" /></td>
<td><img src="image8" alt="Superimpose Diagram" /></td>
<td><img src="image9" alt="Embed Diagram" /></td>
</tr>
</tbody>
</table>
Manipulate

- **Change over Time**
- **Select**

- **Navigate**
  - **Item Reduction**
    - **Zoom**
      - Geometric or Semantic
    - **Pan/Translate**
    - **Constrained**

- **Attribute Reduction**
  - **Slice**
  - **Cut**
  - **Project**
Change over time

• change any of the other choices
  – encoding itself
  – parameters
  – arrange: rearrange, reorder
  – aggregation level, what is filtered...

• why change?
  – one of four major strategies
   • change over time
   • facet data by partitioning into multiple views
   • reduce amount of data shown within view
     – embedding focus + context together
  – most obvious, powerful, flexible
  – interaction entails change
Idiom: Re-encode  System: Tableau

made using Tableau, http://tableausoftware.com
Idiom: **Reorder**

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

**System:** **LineUp**

Idiom: **Realign**

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

System: **LineUp**

Idiom: **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

Select and highlight

• selection: basic operation for most interaction

• design choices
  – how many selection types?
    • click vs hover: heavyweight, lightweight
    • primary vs secondary: semantics (eg source/target)

• highlight: change visual encoding for selection targets
  – color
    • limitation: existing color coding hidden
  – other channels (eg motion)
  – add explicit connection marks between items
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
Idiom: **Semantic zooming**

- visual encoding change
  - colored box
  - sparkline
  - simple line chart
  - full chart: axes and tickmarks

System: **LiveRAC**

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, ...

Further reading: Ch 11 Manipulate


- **Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics** Ben Bederson, and James D Hollan, Proc UIST 94.


Further reading: General


• **Tuning and testing scrolling interfaces that automatically zoom.** Andy Cockburn, Joshua Savage, Andrew Wallace. Proc CHI 05.


• **Effective View Navigation.** George W. Furnas, Proc. SIGCHI 97, pp. 367-374 DOI

Genealogical graphs

• family tree is a misnomer
  – single person has tree of ancestors, tree of descendants
  – pedigree collapse inevitable
    • diamond in ancestor graph

• crowding problem
  – exponential

• fractal layout
  – poor info density
  – no spatial ordering for generations

Layouts

• rooted trees: standard layouts
  – connection
  – containment
  – adjacent aligned position
  – indented position

Layouts

• free trees
  – no root

• adapting rooted methods
  – temporary root for given focus
  – containment (nested)

Dual trees abstraction

- explore canonical subsets and combinations, easy to interpret, scales well
- no crossings, nodes ordered by generation
- doubly rooted: x leftmost descend, y rightmost ancestor
  - offset roots from hourglass diagram

Another example

- vertical connection
- horizontal connection
- indented

- upcoming chapters
  - layering
  - aggregation

Interaction as fundamental to design

• navigation
  – topological navigation via collapse/expand on selection
    • parents, children
    • expand can trigger rotation
      – collapsing others
      – layout driven by navigation
  – geometric zoom/pan
  – constrained navigation: automatic camera framing
• animated transitions
  – 3 phases: fade out, move, fade in
• mouseover hover
  – preview dots: expand if collapsed

Custom widget

- popup marking menu
  - flick up or down, ballistic
  - subtree drag-out widget

Next Time

• to read
  – VAD Ch. 12: Facet into Multiple Views

• one week from today: pitches
  – no reading, think about project and prepare slides
  – 2 minutes each
  – send me your slides by noon Thu
    • number of slides up to you. practice, time yourself!

• last week of October: no classes!