Ch 11: Manipulate View
Papers: Genealogical Graphs

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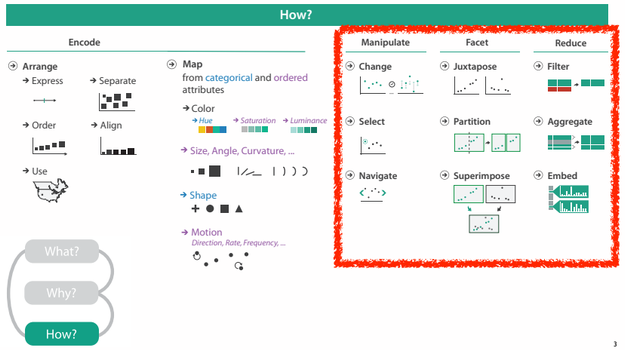
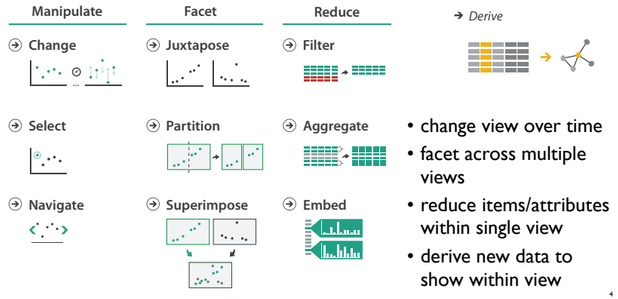
http://www.cs.ubc.ca/~tmm/courses/547-15

News

- marks for lectures 6-10 sent out this morning
- reminder: submit 3 separate questions
  - not 2, not 1

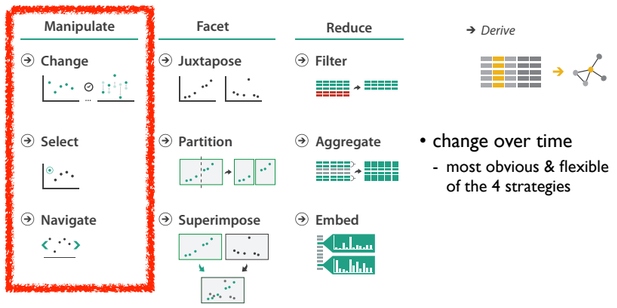


How to handle complexity: 3 more strategies + 1 previous



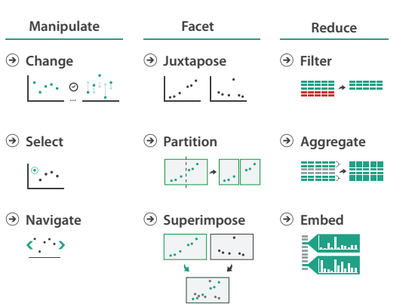
- change view over time
- facet across multiple views
- reduce items/attributes within single view
- derive new data to show within view

How to handle complexity: 3 more strategies + 1 previous

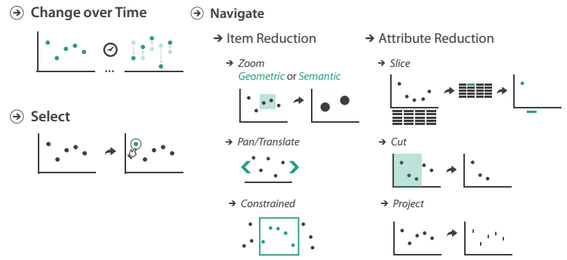


- change over time
  - most obvious & flexible of the 4 strategies

Idiom design choices: Interaction



Manipulate



Change over time

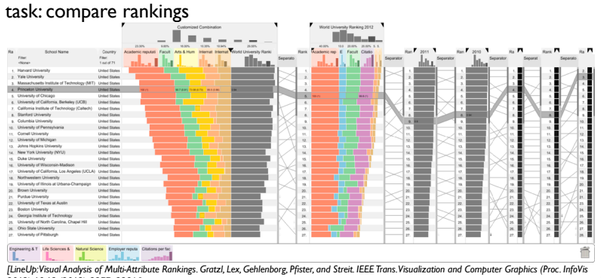
- change any of the other choices
  - encoding itself
  - parameters
  - arrange: rearrange, reorder
  - aggregation level, what is filtered...
- why change?
  - one of four major strategies
    - change over time
    - facet data by partitioning into multiple views
    - reduce amount of data shown 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** System: **LineUp**

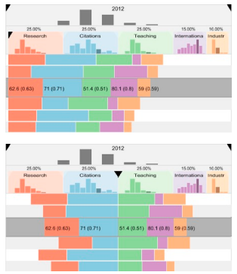
- data: tables with many attributes
- task: compare rankings



[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.]

Idiom: **Realign** System: **LineUp**

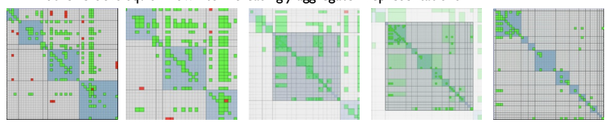
- stacked bars
  - easy to compare
    - first segment
    - total bar
- align to different segment
  - supports flexible comparison



[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.]

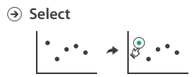
Idiom: **Animated transitions**

- 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



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

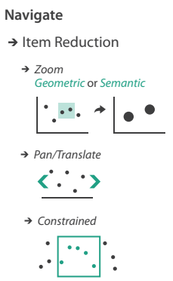
Select and highlight



- 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

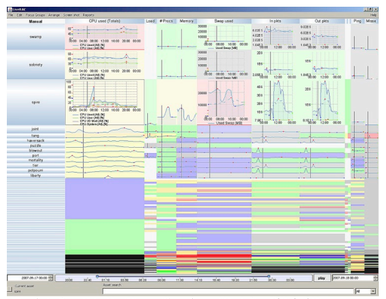
Navigate: Changing item visibility

- 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** System: **LiveRAC**

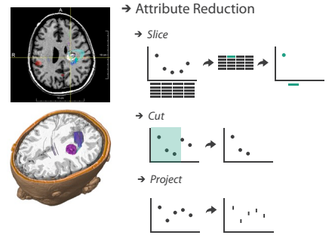
- visual encoding change
  - colored box
  - sparkline
  - simple line chart
  - full chart: axes and tickmarks



[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, ...



[Interactive Visualization of Multimodal Volume Data for Neurosurgical Tumor Treatment. Rieder, Ritter, Raspe, and Peitgen. Computer Graphics Forum (Proc. EuroVis 2008) 27:3 (2008), 1055–1062.]

Further reading: Ch 11 Manipulate

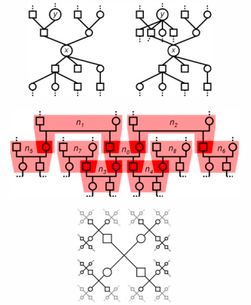
- Starting Simple - Adding Value to Static Visualisation Through Simple Interaction.. A. Dix and G. Ellis. Proc. Advanced Visual Interfaces (AVI) 1998, 124-134.
- Animated Transitions in Statistical Data Graphics Jeffrey Heer and George G. Robertson. IEEE TVCG (Proc. InfoVis 2007) 13(6): 1240-1247, 2007. [Archived version]
- Selection: 524,288 Ways To Say 'This Is Interesting'. Graham J. Wills. Proc. InfoVis 1996, p 54-61.
- Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics Ben Bederson, and James D Hollan, Proc UIST 94.
- LiveRAC - Interactive Visual Exploration of System Management Time-Series Data. Peter McLachlan, Tamara Munzner, Eleftherios Koutsofios, Stephen North. Proc. Conf. on Human Factors in Computing Systems (CHI) 2008, 1483-1492.
- Rapid Controlled Movement Through a Virtual 3D Workspace Jock Mackinlay, Stuart Card, and George Robertson. Proc SIGGRAPH '90, pp 171-176.
- Smooth and Efficient Zooming and Panning, Jack J. van Wijk and Wim A.A. Nuij, Proc. InfoVis 2003, p. 15-22.

Further reading: General

- Topology-Aware Navigation in Large Networks. Tomer Moscovich, Fanny Chevalier, Nathalie Henry, Emmanuel Pietriga, Jean-Daniel Fekete. Proc CHI 2009, p 2319-2328.
- Tuning and testing scrolling interfaces that automatically zoom. Andy Cockburn, Joshua Savage, Andrew Wallace. Proc CHI 05.
- Critical Zones in Desert Fog: Aids to Multiscale Navigation. Susanne Jul and George W. Furnas, Proc. UIST 98
- Effective View Navigation. George W. Furnas, Proc. SIGCHI 97, pp. 367-374 DOI
- Unfolding the Earth: Myriahedral Projections. Jarke J. van Wijk. The Cartographic Journal, Vol. 45, No. 1, pp.32-42, February 2008.

Genealogical graphs

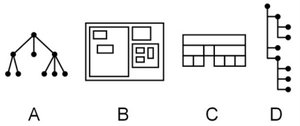
- family tree is a misnomer
  - single person has tree of ancestors, tree of descendants
  - pedigree collapse inevitable
    - diamond in ancestor graph
- crowding problem
  - exponential
- fractal layout
  - poor info density
  - no spatial ordering for generations



[Fig 2, 6, 7. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

Layouts

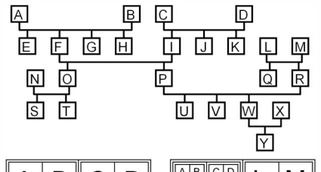
- rooted trees: standard layouts
  - connection
  - containment
  - adjacent aligned position
  - indented position

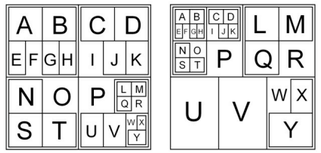


[Fig 8. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

Layouts

- free trees
  - no root
- adapting rooted methods
  - temporary root for given focus
  - containment (nested)

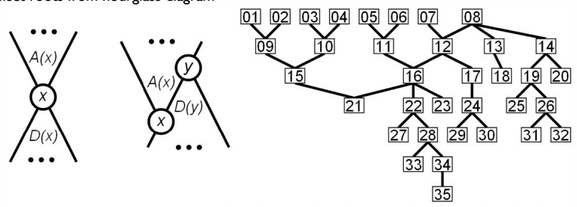




[Fig 9. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

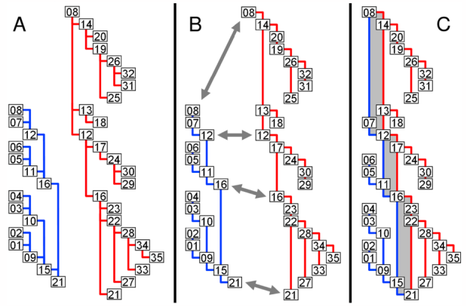
Dual trees abstraction

- 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



[Fig 10. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

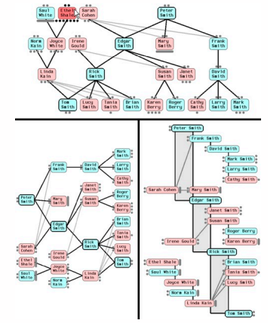
Indented, flipped, combined



[Fig 11. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

Another example

- vertical connection
- horizontal connection
- indented
- upcoming chapters
  - layering
  - aggregation



[Fig 13. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

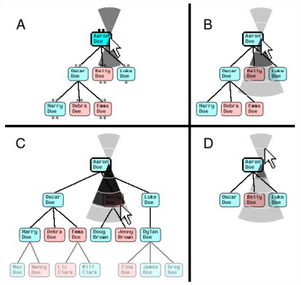
Interaction as fundamental to design

- 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

[Fig 14. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

Custom widget

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



[Fig 14. Interactive Visualization of Genealogical Graphs. Michael J. McGuffin, Ravin Balakrishnan. Proc. InfoVis 2005, pp 17-24.]

Next Time

- to read
  - VAD Ch. 12: Facet into Multiple Views
  - Paper: Interactive Coordinated Multiple-View Visualization of Biomechanical Motion Data. Daniel F. Keefe, Marcus Ewert, William Ribarsky, Remco Chang. IEEE Trans. Visualization and Computer Graphics (Proc. Vis 2009), 15(6):1383-1390, 2009.
- 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!