

Lecture 11: Interaction

Information Visualization
CPSC 533C, Fall 2006

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17 Oct 2006

Topics

- Topic choices due this Friday 5pm
- Tell me the three topics you **do** want
- Tell me up to two times you **do not** want from the four possible (Nov 7, 9, 21, 23)
- Email subject: 533 submit topics
- No need to resend unless changed mind

Topic Choices

- application domains
 - software engineering
 - computer networks
 - databases / datamining
 - cartography
 - social networks
- data domains
 - time-series
 - text / document collections
 - tree / hierarchy
 - graphs / graph drawing
 - high dimensional
 - low dimensional (statistical graphics)
- techniques/approaches
 - interaction
 - focus+context
 - navigation/zooming
 - glyphs
 - animation
 - brushing/linking
- other
 - frameworks/taxonomies
 - perception
 - evaluation
- anything to add?

Proposals

- everybody must have met with me by end of this week
 - the 3 of you haven't yet, talk to me after class to set time
 - my schedule is very tight, office hours today 1:30-2:30 would be safest
- written proposals due next Fri Oct 27
 - format: HTML or PDF
 - length: at least 2 pages
- handin email should have
 - URL
 - Subject: 533 submit proposal

Proposal Expectations

- name/email address of team (1 or 2 people)
- description of domain, task, dataset
- personal expertise
- proposed infovis solution
 - should address **abstraction** of domain problem
- scenario of use
 - including sketch/mockup illustrations!
- implementation approach
 - high-level, what if any toolkits you'll use
- milestones
 - be specific, include dates
- previous work

Papers Covered

- Ware, Chapter 10: Interacting with Visualizations
- Ware, Chapter 11: Thinking with Visualizations
- The cognitive coprocessor architecture for interactive user interfaces George Robertson, Stuart K. Card, and Jock D. Mackinlay, Proc. UIST '89, pp 10-18.
- Visual information seeking: Tight coupling of dynamic query filters with starfield displays Chris Ahlberg and Ben Shneiderman, Proc SIGCHI '94, pages 313-317.
- SDM: Selective Dynamic Manipulation of Visualizations, Mei C. Chuah, Steven F. Roth, Joe Mattis, John Kolojechick, Proc. UIST '95

Further Reading

- Toolglass and magic lenses: the see-through interface. Eric A. Bier, Maureen C. Stone, Ken Pier, William Buxton, and Tony D. DeRose, Proc. SIGGRAPH'93, pp. 73-76.
- Visual Exploration of Large Structured Datasets. Graham J. Wills. In New Techniques and Trends in Statistics, 237-246. IOS Press, 1995.

Ware Interaction

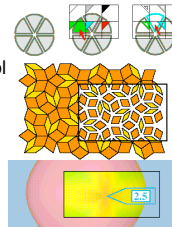
- low-level control loops, data manipulation
 - choice reaction time
 - depends on number of choices
 - selection time: Fitts' Law
 - depends on distance, target size
 - path tracing
 - depends on width
 - learning: power law of practice
 - also subtask chunking

Ware Interaction

- low-level control loops
 - two-handed interaction: Guiard's theory
 - coarse vs. fine control
 - e.g. paper vs. pen positioning
 - vigilance
 - difficult, erodes with fatigue
 - control compatability
 - learning/transfer: adaption time depends
 - hover/mouseover/tooltip
 - faster than explicit click

Toolglass/Lenses

- two-handed interaction
- toolglass: semi-transparent interactive tool
 - e.g. click-through buttons
- magic lens:
 - e.g. scaling, curvature



Toolglass and magic lenses: the see-through interface. Eric A. Bier, Maureen C. Stone, Ken Pier, William Buxton, and Tony D. DeRose, Proc. SIGGRAPH'93, pp. 73-76.

Ware Interaction

- exploration and navigation loops
 - navigation
 - next time
 - rapid zooming
 - next time
 - distortion
 - previous
 - multiple windows, linked highlighting
 - more today
 - dynamic queries
 - more today

Ware Thinking with Viz

- problem solving loops
 - external representations
 - "cognitive cyborgs"
- cost of knowledge
 - Pirolli/Rao: information foraging/scent theory
 - attention as most limited resource

Visual Working Memory

- characteristics
 - different from verbal working memory
 - low capacity (3-5?)
 - locations egocentric
 - controlled by attention
 - time to change attention: 100ms
 - time to get gist: 100ms
 - not fed automatically to longterm memory

Visual Working Memory

- multiple attributes per object stored
 - position (egocentric), shape, color, texture
 - integration into glyphs allows more info
- change blindness (Rensink)
 - world is its own memory
- inattentional blindness
- attracting attention
 - motion (or appear/disappear?)

Memory and Loops

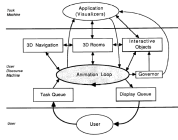
- long term memory
 - chunking
 - memory palaces (method of loci)
- nested loops
 - problem-solving strategy
 - visual query construction
 - pattern-finding loop
 - eye movement control loop
 - intrasaccadic image-scanning loop

InfoVis Implications

- visual query patterns
- navigation/interaction cost
- multiple windows vs. zoom

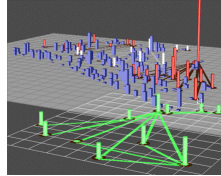
Cognitive Co-Processor

- animated transitions
 - object constancy
 - fixed frame rate required
- architectural solution
 - split work into small chunks
 - animation vs. idle states
 - governor controls frame rate
- [video: 3D rooms]



SDM

- sophisticated selection, highlighting, object manipulation
- [video]

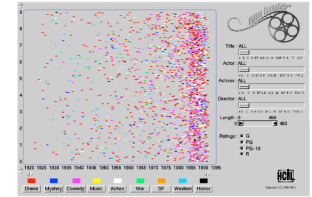


Dynamic Queries: HomeFinder

- filter with immediate visual feedback
- "starfield": scatterplot
- [video]

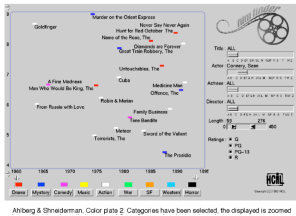


DQ 2: FilmFinder



Atberg & Shredeman, Color plot 1, The FilmFinder

DQ 2: FilmFinder



Atberg & Shredeman, Color plot 2, Categories have been selected, the displayed is zoomed

More Linked Views

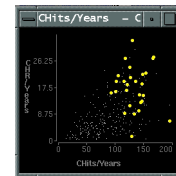
key infovis interaction principle
 so far: Ware, Trellis, cluster calendar,
 brushing: linked highlighting
 Becker and Cleveland, "Brushing Scatterplots",
 Technometrics 29, 127-142
 new examples:
 EDV
 Attribute Explorer

EDV

Exploratory Data Visualizer

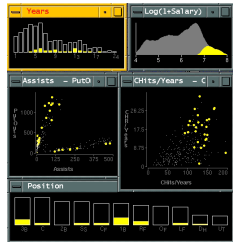
Graham J. Wills. *Visual Exploration of Large Structured Datasets*. In *New Techniques and Trends in Statistics*, 237-246. IOS Press, 1995.

Highlighting (Focusing)
 Focus user attention on a subset of the data within one graph (from Wills 95)



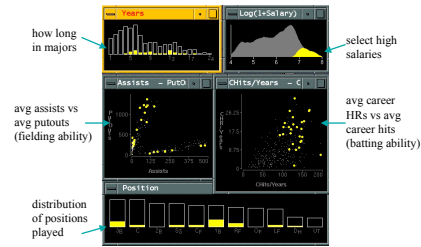
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Link different types of graphs:
 Scatterplots and histograms and bars
 (from Wills 95)



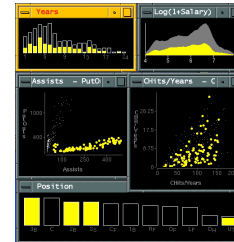
[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Baseball data:
 Scatterplots and histograms and bars
 (from Wills 95)



[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Linking types of assist behavior
 to position played (from Wills 95)



[www.sims.berkeley.edu/courses/is247/s02/lectures/Lecture3.ppt]

Influence/Attribute Explorer

- Visualization for Functional Design, Bob Spense, Lisa Tweedie, Huw Dawkes, Hua Su, InfoVis 95

[video]