CompaRing: Reducing Costs of Visual Comparison

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Costs of Visual Comparison

• Costs in visualization in general (Lam, 2008)
  • Costs related to visualization
  • Costs related to interaction

• Costs of visual comparison
  • Compile set of objects to be compared
    → Costs for selecting objects
  • Carry out visual comparison
    → Costs for moving eyes back and forth between objects
  • Understand details and context
    → Costs for navigating between objects
Visual Comparison Techniques

• **Visual comparison** (Gleicher et al., 2011)
  - Superposition
  - Juxtaposition
  - Direct encoding

• **Problems**
  - Visualization
    - Specific layout/encoding that suits comparison
    - But original layout/encoding is lost
  - Interaction
    - Static solutions with little interaction
    - Interaction costs hardly considered
Approach

• Dynamic on-demand comparison technique plus base visualization

• Design goals
  • G1: Relocate objects to reduce distance to make comparison easier
  • G2: Show residue of original objects to maintain context
  • G3: Encode object differences to further support comparison
  • G4: Cost-efficient interaction

• **Idea: CompaRing** Inspired by (Baudisch et al., 2003; Kahn et al., 2004; Moscovich et al., 2009)
  • Dynamic rearrangement
  • Automatic selection
  • Navigation shortcuts
Dynamic Rearrangement

• Arrange objects according to ring pattern (Draper et al., 2009)
  • Juxtaposition of objects being compared (G1)
  • Smooth animation so that user can see where objects come from (G2)

• Indicator arcs
  • Hint at original object position and distance (G2)
  • Direct encoding of differences (G3)
• Cost reduction: The user does not need to collect the necessary information, but the system brings the information to the user!
Automatic Selection and Navigation Shortcuts

Selection
- Classic selection
  - Manually mark $n$ objects
- Automatic selection
  - Manually mark 1$^{st}$ object
  - Automatically compute and select the $n - 1$ most similar objects

Navigation
- Classic navigation
  - Manual zoom and pan operations
- Navigation shortcuts
  - CompaRing’s slots serve to trigger navigation
  - Automatic viewport animation

• Cost reduction: **Single click** vs. $n$ clicks
• Cost reduction: **Single click** vs. repeated manual operations
Demonstration

• Proof-of-concept prototype
  • Zoomable choropleth map
  • Random data
  • Similarity based on Euclidian distance
  • http://goo.gl/AHwJkT

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Results

• CompaRing for assisting comparison tasks
  • Dynamic rearrangement
  • Automatic selection
  • Navigation shortcuts

• Proof-of-concept based on choropleth maps

Reduced cost of visual comparison
Future Work

• Empirical proof / quantification of cost reduction
  • Controlled study

• Alternative layouts
  • Spirals, matrix, screen border, ...
  • Force-based implementation

• Generalization
  • Visualization techniques (e.g., map + multivariate glyphs, node-link diagram)
  • Visualization environments (e.g., display wall, touch surface)
The End

• Thanks!
• Questions?

• http://goo.gl/AHwJkT
Notes on Evaluation

• Previous studies on visual comparison
  • Comparison can be easier for objects being close to each other
    (Larsen and Bundesen, 1998; Plumlee and Ware, 2006)
  • Should be true for CompaRing, but controlled study needed

• Preliminary feedback
  • Informal hands-on session with visualization experts
  • Generally positive feedback
  • Comments and suggestions
    • Alternative ordering of slots: Slot position corresponds to object direction
    • Encoding of indicator arcs: Narrow means close vs. narrow means remote
    • Occlusion: Dim CompaRing during automatic navigation (already implemented)