Ch 12: Facet Across Multiple Views
Paper: BallotMaps

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CPSC 547, Information Visualization
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http://www.cs.ubc.ca/~tmm/courses/547-17
News

• pitches: email slides by noon Thu (Subject: 547 pitch)
  – 3 min per pitch (http://www.cs.ubc.ca/~tmm/courses/547-17/projectdesc.html#pitches page updated)
    • do practice!
  – say explicitly if actively looking for partner
  – if you’re sure you’re already partnered, then second person should build after what first person says. tell me when you send slides so you’re back to back
  – external people will go at the end

• Thu to read
  – VAD Ch. 13: Reduce Items and Attributes
  – no second reading, use time to think about projects, prepare/practice your pitches

• reminder: no class next week (reading week!)

• presentation length update: 25 min slot (20 min present, 5 min discuss)
Exercise followup

• groups discuss solutions
• we discuss BallotMaps published solution
BallotMaps

• ballots in the UK are alphabetically ordered
  – govt: not sufficient to affect electoral outcome
  – researcher hunch: it matters!

• how to support visual exploration of dataset
  – Greater London elections 2010
  – geographic location, candidate name, alphabetical position in ballot, # candidate votes, party, elected/lost
  – compare geographic regions of voting and spatial position of candidate name on ballot paper
  – color coding will not save the day

Deriving data: BallotMaps

- deriving new data
  - alphabetical position within the party
  - vote order within party
  - (#, % of party votes)

- bars all same length if name order bias does not exist
  - hmmm
Deriving data: BallotMaps

• BallotMap showing electoral success (or otherwise) of each candidate for the three main parties in wards (small rectangles) in each London borough (grid squares) in the 2010 local government elections. Vertical ordering of candidates within each borough is by ballot paper position within party (top row first, middle row second, bottom row third).

• bias exists in regions where systematic structure in bar lengths visible
  – yes in some
  – no in others

BallotMaps

- alpha position within party (vertical position) and voting rank within party for the three main parties in each ward (vertical bars) in each borough (grid squares)
- if no name order bias existed, dark and light cells randomly distributed
- voting data show that darker cells (indicating a candidate most votes within their party) are more common in the upper third (listed first on the ballot paper within their party) and lighter cells (least their on the ballot paper)

BallotMaps

- derived data
  - signed chi
    - take into account multiple parties
  - residual
    - take into account alphabetical bias
      - “name order bias”

Table 2. Secondary derived variables constructed for visual exploration in HiDE

<table>
<thead>
<tr>
<th>Name variable</th>
<th>Votes variable</th>
<th>Combined variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha position in party (1-3)</td>
<td>% party votes</td>
<td>Signed chi</td>
</tr>
<tr>
<td></td>
<td># party votes</td>
<td>Residual</td>
</tr>
<tr>
<td></td>
<td>Vote order in party (1-3)</td>
<td></td>
</tr>
</tbody>
</table>

The signed chi statistic [25] was calculated to give an indication as to the variation in votes acquired by candidates relating to issues other than party affiliation as

$$\chi = \frac{obs - exp}{\sqrt{exp}}$$

where the expected number of votes for each candidate was one third of the total party votes for their ward (each candidate in the sample stood in a ward with two other candidates from the same party) and the observed value was the actual number of votes received by the candidate. Thus positive values of $\chi$ indicate that the candidate received more than the expected number of votes if only political party was assumed to influence candidate choice, while negative values indicate fewer than expected votes were received.

The residual measure was designed to identify anomalies that did not show name ordering bias and was calculated as the difference between the percentage of party votes received by a candidate and that expected for an average candidate with the same ‘alpha’ (alphabetical) position with their party. Thus while the chi statistic assesses the degree of name order bias, the residual identifies candidates that have greater or fewer votes than predicted given their party affiliation having taken any name order bias into account.
Deriving data: BallotMaps

- does inferred ethnicity of name matter?
  - English/Celtic on right
  - “foreign” on left
  - derived: more/fewer votes than expected

- degree of name order bias shown by strength of green/purple separation
  - varies by region and name ethnicity

Facet

- **Juxtapose**

- **Partition**

- **Superimpose**
Juxtapose and coordinate views

→ Share Encoding: Same/Different
  → Linked Highlighting

→ Share Data: All/Subset/None

→ Share Navigation
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

Idiom: bird’s-eye maps

- encoding: same
- data: subset shared
- navigation: shared
  - bidirectional linking

- differences
  - viewpoint
  - (size)

- overview-detail

System: Google Maps

Idiom: **Small multiples**

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

**System: Cerebral**

# Coordinate views: Design choice interaction

<table>
<thead>
<tr>
<th>Encoding</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same</td>
<td>All: Redundant</td>
</tr>
<tr>
<td></td>
<td>Subset: Overview/Detail</td>
</tr>
<tr>
<td></td>
<td>None: Small Multiples</td>
</tr>
<tr>
<td>Different</td>
<td>All: Multiform</td>
</tr>
<tr>
<td></td>
<td>Subset: Multiform, Overview/Detail</td>
</tr>
<tr>
<td></td>
<td>None: No Linkage</td>
</tr>
</tbody>
</table>
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

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 attributes used to split
  – how many 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

![Partition into Side-by-Side Views](image)
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

• small-multiple bar charts
  – split by age into regions
    • one chart per region
  – compare: easy within age, harder across states
Partitioning: Recursive subdivision

- split by neighborhood
- then by type
- then time
  - years as rows
  - months as columns
- color by price

- neighborhood patterns
  - where it’s expensive
  - where you pay much more for detached type

Partitioning: Recursive subdivision

- switch order of splits
  - type then neighborhood
- switch color
  - by price variation
- type patterns
  - within specific type, which neighborhoods inconsistent

System: HIVE

Partitioning: Recursive subdivision

- different encoding for second-level regions
  - choropleth maps

Partitioning: Recursive subdivision

- size regions by sale counts
  – not uniformly
- result: treemap

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 achievable, 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

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

**Dynamic visual layering**

- interactive, from selection
  - lightweight: click
  - very lightweight: hover

- ex: 1-hop neighbors

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**System:** Cerebral

Further reading

  – Chap 12: Facet Into Multiple Views


