Making Data Accessible Through Visualization

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www.cs.ubc.ca/~tmm/talks.html#salon19

@tamaramunzner
Visualization defined & motivated

Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

• suitable when human in the loop needs details
  • often: interplay between human judgement and automatic computation

### Anscombe’s Quartet

<table>
<thead>
<tr>
<th>Identical statistics</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>x mean</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x variance</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y mean</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y variance</td>
<td>3.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x/y correlation</td>
<td>0.816</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Datasaurus Dozen

Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing. CHI 2017. Matejka & Fitzmaurice
Interactive Authoring of Visual Timelines from Unstructured Text

http://about.timelinecurator.org

http://timelinecurator.org
The general case for curation

- build for human in the loop as continuing need
  - automatic processing to accelerate not replace
  - assume computational results good but not perfect
    - for the indefinite future!
- visual feedback to accelerate
Manual creation process
Structured creation process

TimelineJS
timeline.knightlab.com/
## Timeline authoring model

- time required for each task

<table>
<thead>
<tr>
<th></th>
<th>Browse</th>
<th>Extract</th>
<th>Format</th>
<th>Show</th>
<th>Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Drawing</td>
<td>slow</td>
<td>slow</td>
<td>slow</td>
<td>slow</td>
<td>slow</td>
</tr>
<tr>
<td>Structured Creation</td>
<td>slow</td>
<td>slow</td>
<td>slow</td>
<td>automated</td>
<td>fast</td>
</tr>
<tr>
<td>TimeLine Curator</td>
<td>fast</td>
<td>automated</td>
<td>automated</td>
<td>fast</td>
<td>fast</td>
</tr>
</tbody>
</table>
The importance of being brisk

• high-profile use case: eureka moment
  – success: enable what was impossible before
  – vis tools for new insights & discoveries

• workhorse use case: workflow speedup
  – success: vis tools accelerate your prior workflow
    • sometimes enables the previously infeasible

• TLC use cases
  – started with speedup use case, for presentation
    • make this doc into a timeline now!
  – two other use cases nudge towards exploration
    • comparison between multiple timelines
    • speculative browsing
TimeLineCurator: Speculative Browsing

https://vimeo.com/jofu/tlc
Nested model: Four levels of visualization design

- **domain situation**
  - who are the target users?

- **abstraction**
  - translate from specifics of domain to vocabulary of visualization
    - **what** is shown? **data** abstraction
    - **why** is the user looking at it? **task** abstraction
      - often must transform data, guided by task

- **idiom**
  - **how** is it shown?
    - **visual encoding** idiom: how to draw
    - **interaction** idiom: how to manipulate

- **algorithm**
  - efficient computation

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A Nested Model of Visualization Design and Validation.

A Multi-Level Typology of Abstract Visualization Tasks
https://www.cs.ubc.ca/labs/imager/tr/2013/MultiLevelTaskTypology/
Different threats to validity at each level

- **Domain situation**
  You misunderstood their needs

- **Data/task abstraction**
  You're showing them the wrong thing

- **Visual encoding/interaction idiom**
  The way you show it doesn't work

- **Algorithm**
  Your code is too slow
Interdisciplinary: need methods from different fields at each level

• mix of qualitative and quantitative approaches

- anthropology/ethnography
  - Domain situation
    - Observe target users using existing tools
  - Data/task abstraction
    - Visual encoding/interaction idiom
      - Justify design with respect to alternatives
    - Algorithm
      - Measure system time/memory
      - Analyze computational complexity
  - Analyze results qualitatively
  - Measure human time with lab experiment (lab study)
- design
- computer science
- psychology
- anthropology/ethnography
  - Observe target users after deployment (field study)
  - Measure adoption
More Information

• papers, videos, software, talks, courses
  http://www.cs.ubc.ca/group/infovis
  http://www.cs.ubc.ca/~tmm

• book page (including tutorial lecture slides)
  http://www.cs.ubc.ca/~tmm/vadbook
  – 20% promo code for book+ebook combo: HVN17

• Viz@UBC Initiative
  https://dfp.ubc.ca/initiatives/viz-ubc

• this talk
  www.cs.ubc.ca/~tmm/talks.html#salon19