Visualization Challenges, Past & Future

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Visualization Challenges, Past & Future

Analysis framework: Four levels, three questions
• domain situation
  - who are the target users?
• abstraction
  - translate from specifics of domain to vocabulary of visualization
  - what is shown? data abstraction
• idiom
  - paper is it shown?
    - visual encoding idiom; how to draw
    - interaction idiom; how to manipulate
• algorithm
  - efficient computation

Different threats to validity at each level

• Domain situation
  - the informational & data needs
  - Data task abstraction
    - you're showing from the wrong thing
• Data task abstraction
  - domain abstraction
    - you're showing from the wrong thing
    - visual encoding/interaction idiom
  - You're showing the wrong thing
• Algorithms
  - efficient computation

Evaluation: use methods from different fields at each level
• avoid mismatches
  - anthropology/ethnography
  - design
  - computer science
cognitive psychology
anthropology

Design Study Methodology
Reflections from the Trenches and from the Stacks

Challenge: Guidelines for problem-driven work
• lessons learned from the trenches: 20 between us

Methodology for problem-driven work
• definitions
• 9-stage framework
• 32 pitfalls & how to avoid them
• comparison to related methodologies

Past research: Four themes
• technique-driven work
• problem-driven work
• theoretical foundations
• evaluation
### Past victories

**grand victories:** explosive growth of visualization

- past: Manhattan project, eliminate polio, feature-length CG film...
- future: cure cancer, reverse climate change...
- validation! not sufficient — but very helpful!
- enabling technologies as roads
- visualization as road-building
- facilitates journeys to any destination

### Visualization Challenges: Better, Faster, Bigger

- validation
  - better controlled experiments
  - replication crisis / credibility revolution
- from domain to abstractions
  - faster closing the loop
- idioms
  - faster rapid prototyping beyond single-view visual encoding
  - complex multi-view workflows

### Visualization Challenges: Better

- validation
  - better controlled experiments
  - replication crisis / credibility revolution
- from domain to abstractions
  - faster closing the loop
- idioms
  - faster rapid prototyping beyond single-view visual encoding
  - complex multi-view workflows
- algorithms
  - bigger data

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**Munzner is one of the world's very top researchers in University of California, San Diego.**

It emphasizes abstraction, design principles, and the — Chris Johnson, Scientific Computing and Imaging Institute, visualization.

"Munzner's new book is thorough and beautiful. It belongs on the shelf of anyone touched and enriched by "Munzner." A must read for researchers, sophisticated technique-driven visualization? not sufficient — but very helpful!

**Documents with Nearest Neighbor Queries.**

Ingram & Munzner. Neurocomputing 2015

―Kwan-Liu Ma, Department of Computer Science, St. Pölten University of Applied Sciences

―Wolfgang Aigner, Institute for Creative Media Technologies, Eindhoven University of Technology

―Jarke van Wijk, Department of Mathematics and Computer Science, Eindhoven University of Technology

Munzner elegantly synthesizes an astounding amount of replication crisis / credibility revolution

better controlled experiments

faster closing the loop

faster closing the loop

better controlled experiments

complex multi-view workflows

multiple-view workflows for energy portfolio analysis. Brehmer, Ng, Tate, & Munzner. TVCG (Proc. InfoVis 2015)


Analysis & Design

More Information

- this talk
- book page (including lecture slides & videos)
- papers, videos, software, talk, courses
- twitter: @tamaramunzner

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### Design study methodology: 32 pitfalls

<table>
<thead>
<tr>
<th>Pitfall</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF-21</td>
<td>mistaking technique-driven for problem-driven work</td>
<td>design</td>
</tr>
<tr>
<td>PF-22</td>
<td>canonical prototyping</td>
<td>implement</td>
</tr>
<tr>
<td>PF-23</td>
<td>usability: too little / too much</td>
<td>implement</td>
</tr>
<tr>
<td>PF-24</td>
<td>premature end: insufficient display time built into schedule</td>
<td>display</td>
</tr>
<tr>
<td>PF-25</td>
<td>usage study not case study: non-real world/author</td>
<td>display</td>
</tr>
<tr>
<td>PF-26</td>
<td>timing necessary but not sufficient for validation</td>
<td>display</td>
</tr>
<tr>
<td>PF-27</td>
<td>failing to improve guidelines: confound, refine, reject, propose</td>
<td>reject</td>
</tr>
<tr>
<td>PF-28</td>
<td>insufficient writing time built into schedule</td>
<td>write</td>
</tr>
<tr>
<td>PF-29</td>
<td>no technique contribution + good design study</td>
<td>write</td>
</tr>
<tr>
<td>PF-30</td>
<td>much domain background in paper</td>
<td>write</td>
</tr>
<tr>
<td>PF-31</td>
<td>story told taxonomically vs focus on final results</td>
<td>write</td>
</tr>
<tr>
<td>PF-32</td>
<td>premature end: win race vs. Service music for data</td>
<td>write</td>
</tr>
</tbody>
</table>

**Must be first!**

**Am I ready?**

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### Visualization Analysis & Design

**Visual Design: Abstraction, and Analysis of a Visual Document Making Tool for Informational Journalism.**