InfoVis Group Research

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CPSC 344 Outro
2 Dec 2020

http://www.cs.ubc.ca/~tmm/talks.html#344-outro20

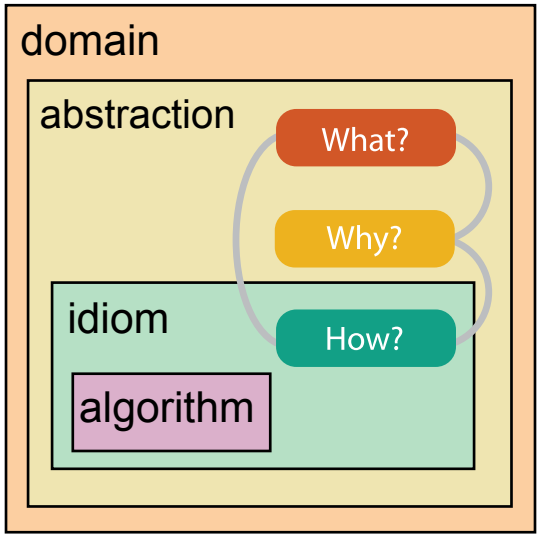
Visualization (vis) defined & motivated

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

Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods.

Nested model: Four levels of visualization design

- *domain situation*
  - who are the target users?
- *abstraction*
  - translate from specifics of domain to vocabulary of vis
    - **what** is shown? **data** abstraction
    - **why** is the user looking at it? **task** abstraction
- *idiom*
  - **how** is it shown?
    - **visual encoding** idiom: how to draw
    - **interaction** idiom: how to manipulate
- *algorithm*
  - efficient computation

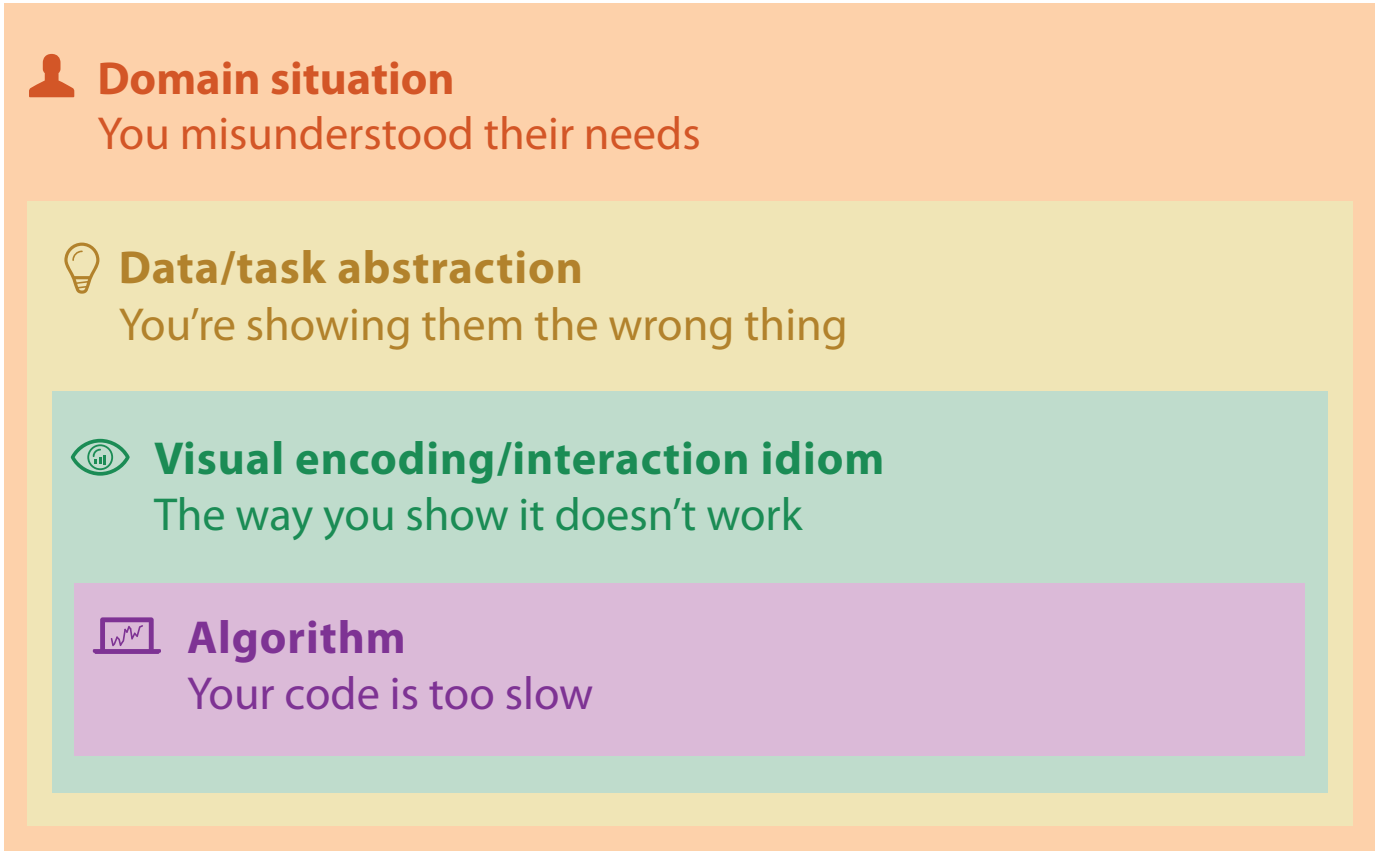


[A Nested Model of Visualization Design and Validation. *Munzner. IEEE TVCG 15(6):921-928, 2009 (Proc. InfoVis 2009).*]

[A Multi-Level Typology of Abstract Visualization Tasks. Brehmer and Munzner. IEEE TVCG 19(12):2376-2385, 2013 (Proc. InfoVis 2013).]

Why is validation difficult?

- different ways to get it wrong at each level



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Evaluation: broadly interpreted

- methods from many fields, qualitative & quantitative
  - controlled experiments in lab, field studies of deployed systems

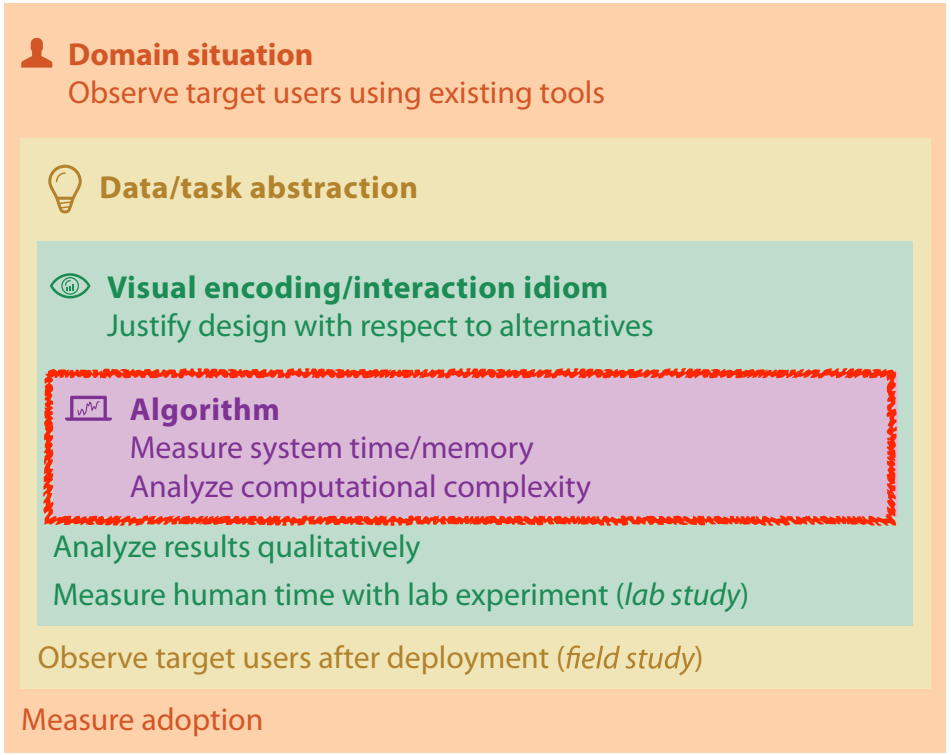
anthropology/ ethnography

design

computer science

HCI/ psychology

anthropology/ ethnography



problem-driven work

technique-driven work

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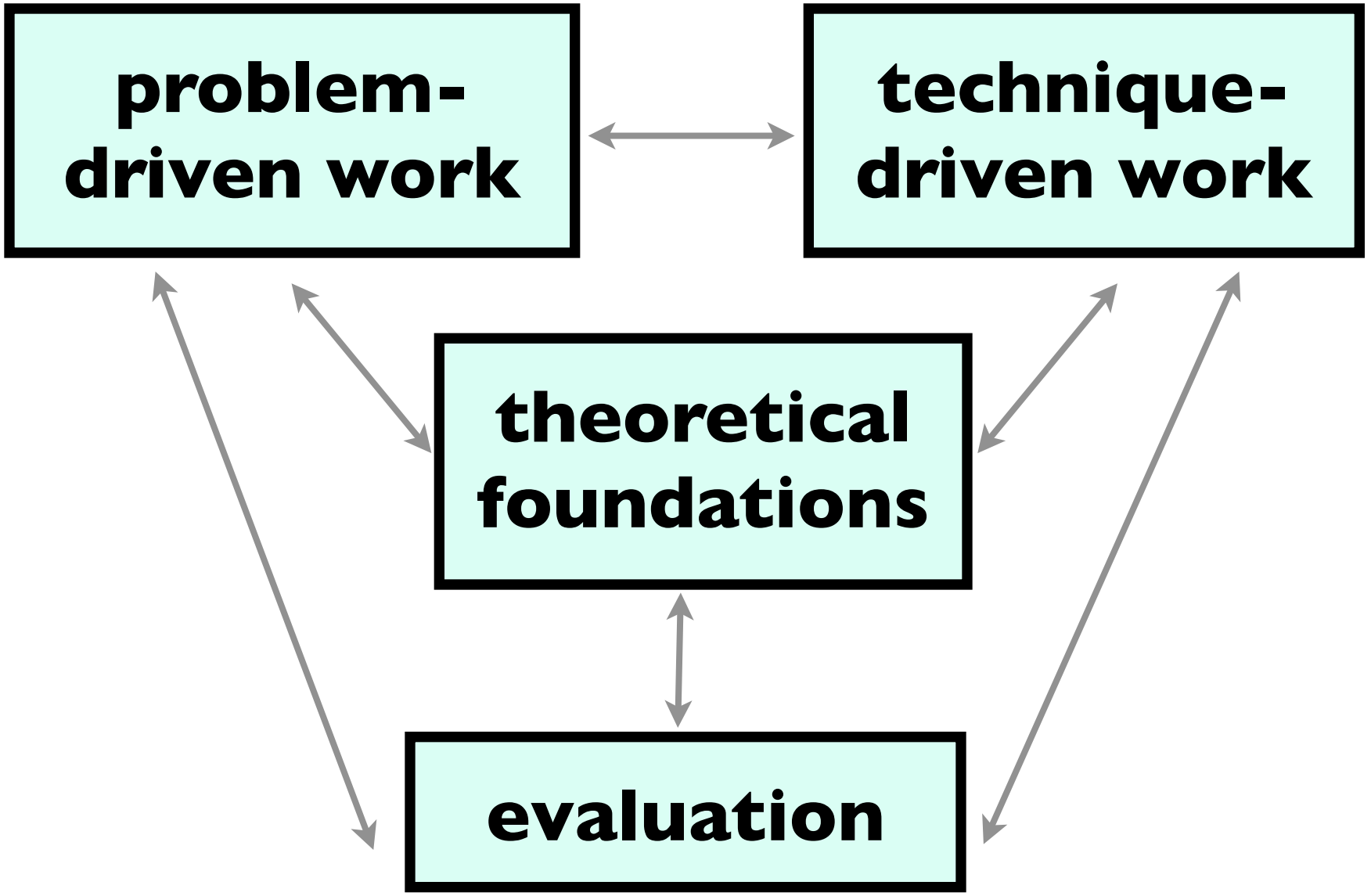

problem-driven work
technique-driven work
theoretical foundations
evaluation

Problem-driven work

- design studies
  - in collaboration with target users
    - real data, real tasks
    - intensive requirements analysis
  - iterative refinement
    - deploy tools/systems
  - typical evaluation: field studies

- my strategy: opportunistic collaboration
  - many domains
  - both industrial and academic partners

Design studies

- log analysis
  - Google: web users
  - AT&T: web hosting server farms
  - Mobify: e-commerce clickstreams
  - EnerNOC: building energy management
  - Sensible Building Science: building usage patterns
- genomics
  - Harvard Med School: comparative functional genomics
  - Harvard/MIT: synteny relationships between species
  - BC Cancer: sequence variants in gene context
  - UBC Biodiversity: comparing gene/species phylogenetic trees
  - UBC/Agilent: protein-protein interaction networks
  - UBC/BCCDC: genomic epidemiology

Design studies

- many other domains
  - SFU/DFO: fisheries
  - BMW: in-car networks
  - Associated Press: large document collections for journalists

Technique-driven work

- scalable algorithms & systems
  - typical evaluation: computational benchmarks
- new visual encoding & interaction techniques
  - typical evaluation: controlled experiments on human subjects
  - typical evaluation: qualitative assessment

- areas
  - graph drawing, dimensionality reduction
  - human-in-the-loop curation of machine learning results
    - Tableau: VizCommender recommendation systems
    - TimeLineCurator

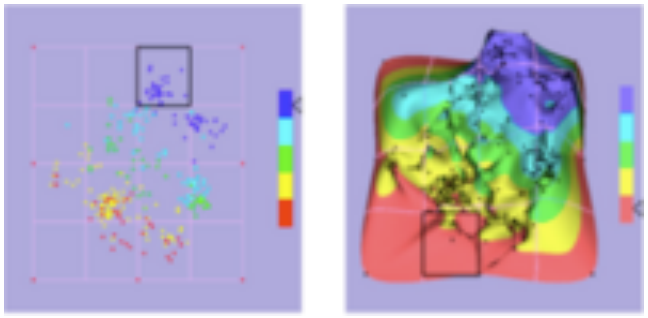
Evaluation

- quantitative & qualitative & mixed methods
- field studies
  - pre-design & post-deployment
- lab studies
  - in person & crowdsourced
- data studies
  - few people (experts), many datasets

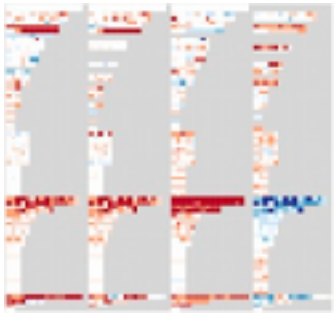
Evaluation experiments: Dim. reduction

T P F E

Melanie Tory



Points vs landscapes for dimensionally reduced data



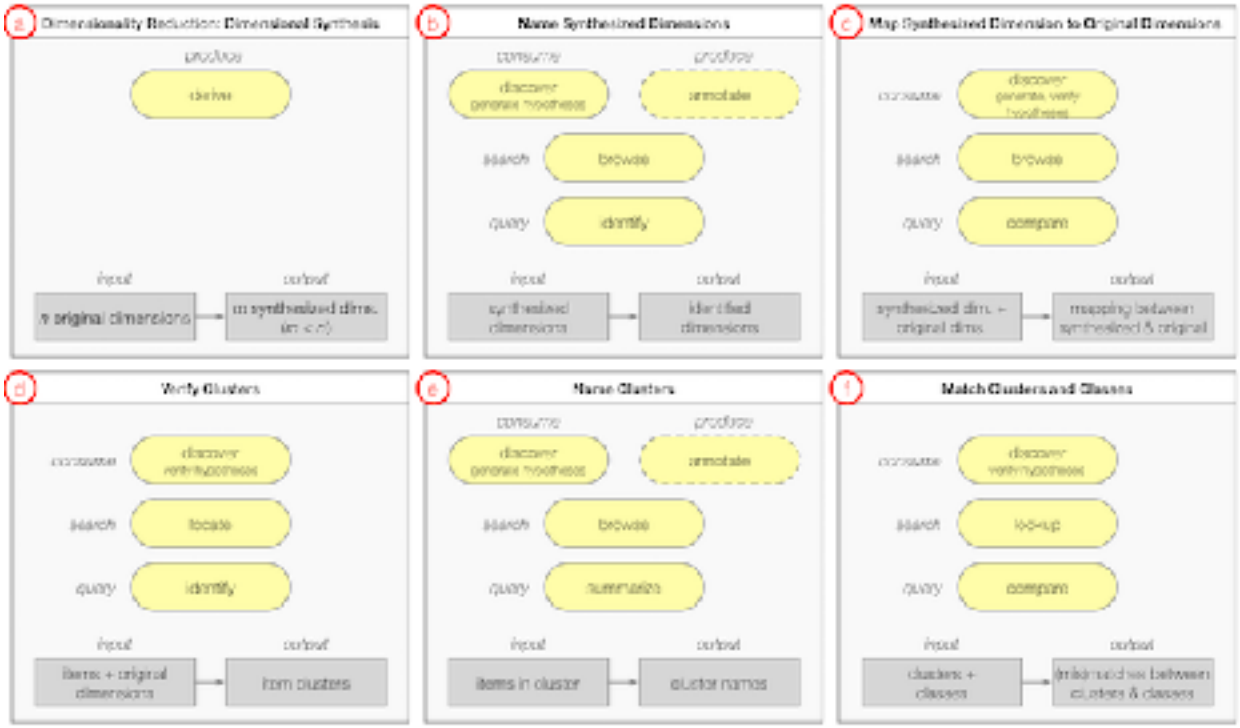
Guidance on DR & scatterplot choices

Michael Sedlmair

Melanie Tory

Taxonomy of cluster separation factors

Evaluation in the field: Dim. reduction



DR in the Wild

Matt Brehmer

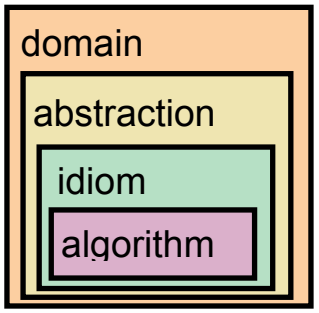
Michael Sedlmair

Melanie Tory

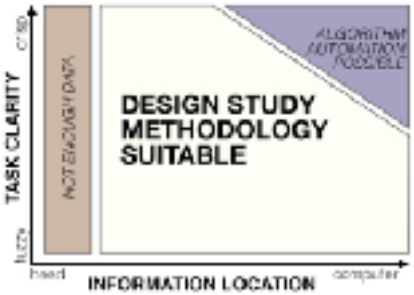
Stephen Ingram

Theoretical foundations

Papers Process & Pitfalls



Nested Model



Design Study Methodology

Abstract Tasks

Michael Sedlmair

Miriah Meyer

Matt Brehmer

More info

- book (free through UBC library)
  http://www.cs.ubc.ca/~tmm/vadbook

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

Visualization Analysis & Design

Grad course: CPSC 547

- teaching now
- final presentations Thu Dec 10
  - 3-7pm
    - you're invited!
    - https://www.cs.ubc.ca/~tmm/courses/547-20/projects.html
    - https://bit.ly/36ufd5T
      (shortened) zoom URL

547 Projects

- Geographic-Financial.
- UCoD - Simplifying Supply Chain Structures in the Browser.
- Country vs. Country: Food & Allergy Edition.
- Visualizing Linguistic Diversity in Vancouver.
- Visualizing Compiler Passes with FirstPass.
- EnergyFlowVis: Visualizing Energy Use Flows for UBC Campus.
- Disease Outbreak Radar: A Tool for Epidemiologists.
- Bewilder: Handling Web Resource Complexity in Online Learning/Research.
- Visualizing Mobility and COVID-19.
- Android App Similarity Visualization.
- Firest: Visualizing the Current State and Impact of Wildfires Across Canada.
- Smart Intersection Vis.
- AMR-TV: Antimicrobial Resistance Transmission Visualizer.
- Visualizing Simulation of Evolutionary Trend of Language in Color Naming.
- Did We Save Our Tigers?
- README: A Literature Survey Assistant.

Ugrad course: CSPC 436V

- new, second offering is Jan 2022
  - first offering https://www.cs.ubc.ca/~tmm/courses/436V-20/
  - substantial changes in the works for online version
- 4th year majors course
  - theory: visualization foundations
  - tooling: D3.js
  - prereq: CPSC 310