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

---


Why is validation difficult?

- different ways to get it wrong at each level

Evaluation: broadly interpreted

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

problem-driven work

theoretical foundations

technique-driven work

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
Problem-driven: Tech industry

SessionViewer: web log analysis
https://youtu.be/T4MaTZd56G4

Peter McLachlan
(AT&T Research)

Stephen North

Heidi Lam
(Google)

LiveRAC: systems time-series logs
https://youtu.be/I1dc3H0VSw
Problem-driven: Energy, sustainability

Energy Manager

Matt Brehmer
(Pulse/EnerNOC)

Maryam Booshehrian

Torsten Moeller (SFU)

Vismon

https://youtu.be/h0kHoS4VYmk
Problem-driven: Genomics

Aaron Barsky
Jenn Gardy (UBC Micro)
Robert Kincaid (Agilent)

Miriah Meyer
Hanspeter Pfister (Harvard)

Cerebral
https://youtu.be/76HhG1FQngI

MizBee
https://youtu.be/86p7brwuz2g

MulteeSum, Pathline
Problem-driven: Genomics, journalism

Joel Ferstay (BC Cancer)

Cydney Nielsen (BC Cancer)

Variant View
https://youtu.be/AHDnv_qMXxQ

Jonathan Stray (Assoc Press)

Overview
https://vimeo.com/71483614
Problem-driven: Autos, e-commerce

Michael Sedlmair

RelEx (BMW)
https://youtu.be/89IsQXc6Ao4

Kimberly Dextras-Romagnino

Segmentifier (Mobify)
https://youtu.be/TobYDFelSOg
Technique-driven work

• scalable algorithms & systems
  – typical evaluation: computational benchmarks

• new layout & interaction techniques
  – typical evaluation: controlled experiments on human subjects
Technique-driven: Graph drawing

Daniel Archambault
(Bordeaux)

David Auber

TopoLayout
SPF
Grouse
GrouseFlocks
TugGraph

https://youtu.be/GdaPj8a9QEo
https://youtu.be/AWX Ae8zykt8

Benjamin Renouust

Detangler
https://youtu.be/QOt nHSsUV6k

Guy Melançon
(Bordeaux)

TreeJuxtaposer
https://youtu.be/GdaPj8a9QEo
Evaluation experiments: Graph drawing

Dmitry Nekrasovski  Adam Bodnar  Joanna McGrenere

Stretch and squish navigation

Jessica Dawson  Joanna McGrenere

Search set model of path tracing
Technique: Dimensionality reduction

Stephen Ingram

Glimmer

DimStiller

Glint

QSNE
Evaluation experiments: Dim. reduction

Points vs landscapes for dimensionally reduced data

Guidance on DR & scatterplot choices

Taxonomy of cluster separation factors
Evaluation in the field: Dim. reduction

DR in the Wild

Matt Brehmer  Michael Sedlmair  Melanie Tory  Stephen Ingram
Curation & Presentation: Timelines

Johanna Fulda (Sud. Zeitung)

Matt Brehmer

Bongshin Lee (Microsoft)

Benjamin Bach (Microsoft)

Nathalie Henry-Riche (Microsoft)

TimeLineCurator
https://vimeo.com/123246662

Timelines Revisited
timelinesrevisited.github.io/
Theoretical foundations

Papers Process & Pitfalls

Design Study Methodology

Michael Sedlmair  Miriah Meyer

Abstract Tasks

Matt Brehmer
Theoretical foundations

• book 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

www.cs.ubc.ca/~tmm/talks.html#344-outro19
@tamaramunzner
Grad course: CPSC 547

• teaching now

• final presentations Tue Dec 10
  – 3-7pm FSC 2330A
    • you’re invited!
      http://www.cs.ubc.ca/~tmm/courses/547-19/projects.html
Ugrad course: CSPC 436V

• brand new, pilot is Jan 2020
  – https://www.cs.ubc.ca/~tmm/courses/436V-20/

• 4th year majors course
  – theory: visualization foundations
  – tooling: D3.js