Tamara Munzner, UBC CS, InfoVis Research

problem-driven work ↔ technique-driven work

theoretical foundations

evaluation

talk slides: www.cs.ubc.ca/~tmm/talks/alibaba17/hibar17.pdf

Problem-driven work

- arguably: "applied research"
- 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

Technique-driven & foundations work

- arguably: "basic research"
- techniques (in my case)
  - scalable algorithms & systems
    - typical evaluation: computational benchmarks
    - new layout & interaction techniques
      - typical evaluation: controlled experiments on human subjects
- foundations
  - motivated by and informing applied research
  - methodology of how to do this work better

Evaluation: broadly interpreted

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

anthropology/
ethnography

design

computer
science

cognitive
psychology

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*)

Observe target users after deployment (*field study*)

Measure adoption
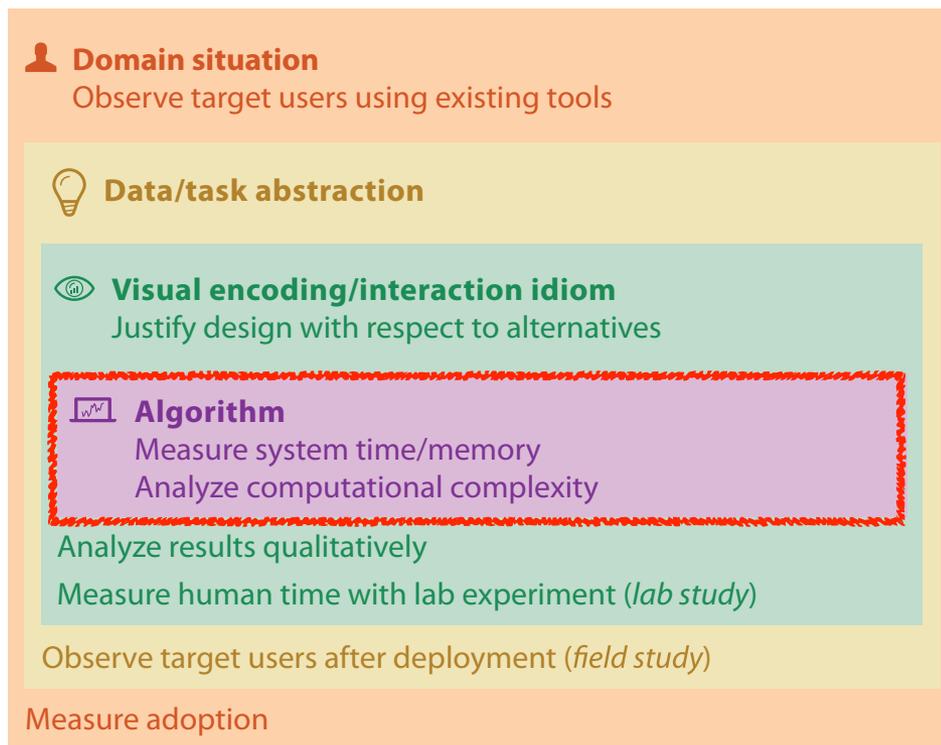
problem-
driven work

technique-
driven work

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

HIBAR framing

- seems very natural
- aligns with how I work & think

Problem-driven: Tech industry

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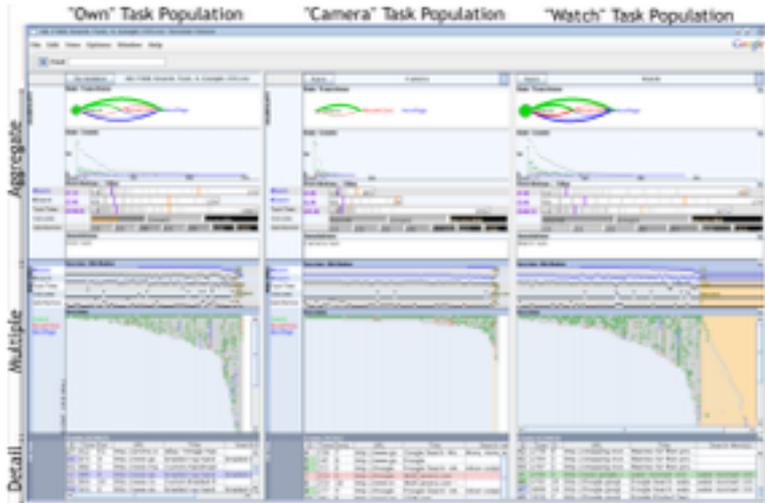
Heidi Lam

Diane Tang
(**Google**)

Peter McLachlan

Stephen North
(**AT&T Research**)
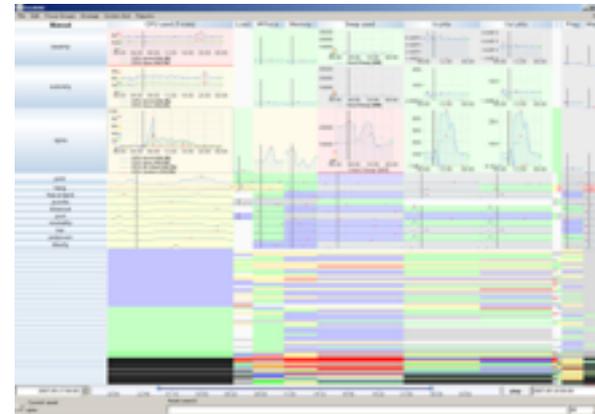
LiveRAC: systems time-series logs
https://youtu.be/ld0c3H0VSkw

Problem-driven: Energy, sustainability

Energy Manager

Matt Brehmer

Kevin Tate
(Pulse/EnerNOC)
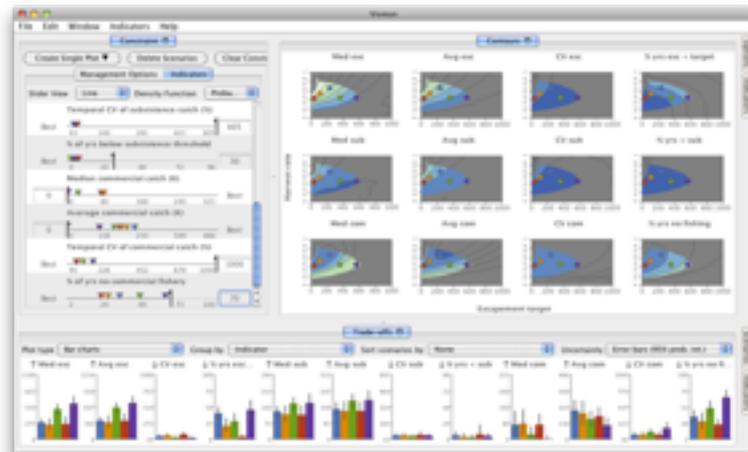
Maryam Booshehrian

Torsten Moeller (SFU)

Vismon

https://youtu.be/h0kHoS4VYmk

Problem-driven: Genomics

Aaron Barsky
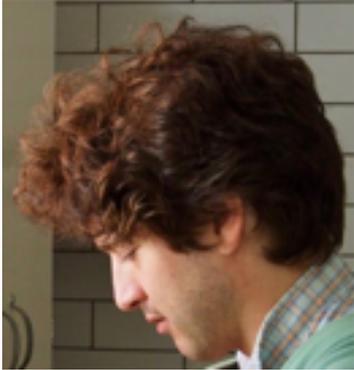
Jenn Gardy
(UBC Micro)

Robert Kincaid
(Agilent)

Cerebral
https://youtu.be/76HhG1FQngI
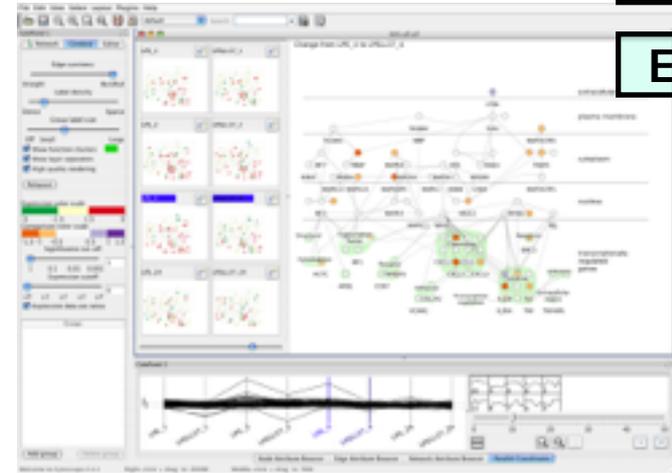
Miriah Meyer

Hanspeter Pfister
(Harvard)

MizBee

https://youtu.be/86p7brwuz2g
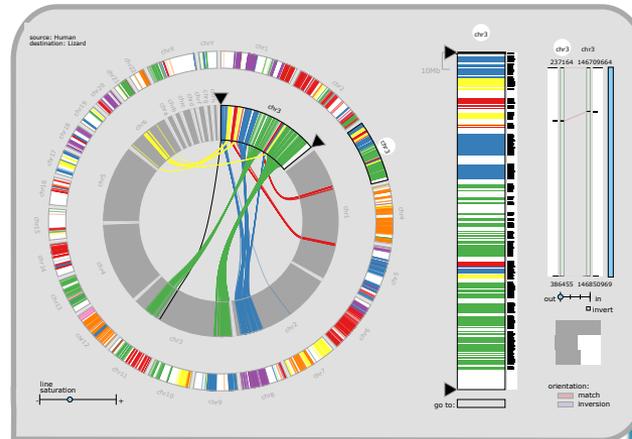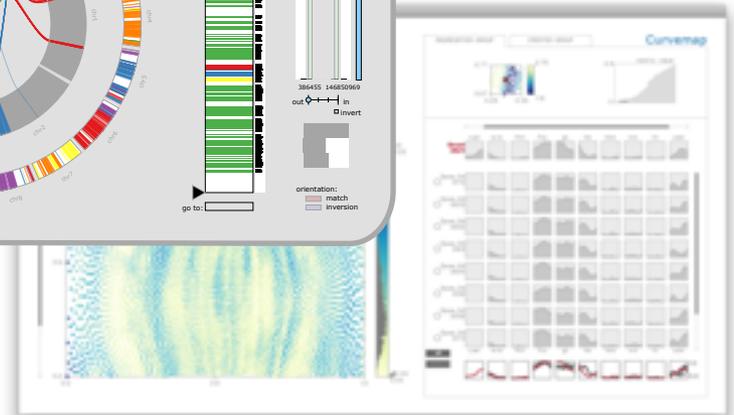
MulteeSum, Pathline

8

Problem-driven: Genomics, journalism

Joel Ferstay

Cydney Nielsen
(BC Cancer)
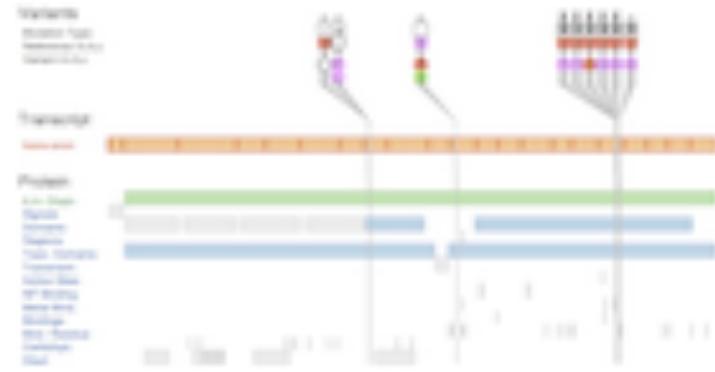
Variant View

**https://youtu.be/AHDnv_qMXxQ**

Jonathan Stray
**(Assoc Press)**

Overview

https://vimeo.com/71483614

Problem-driven: Autos, e-commerce
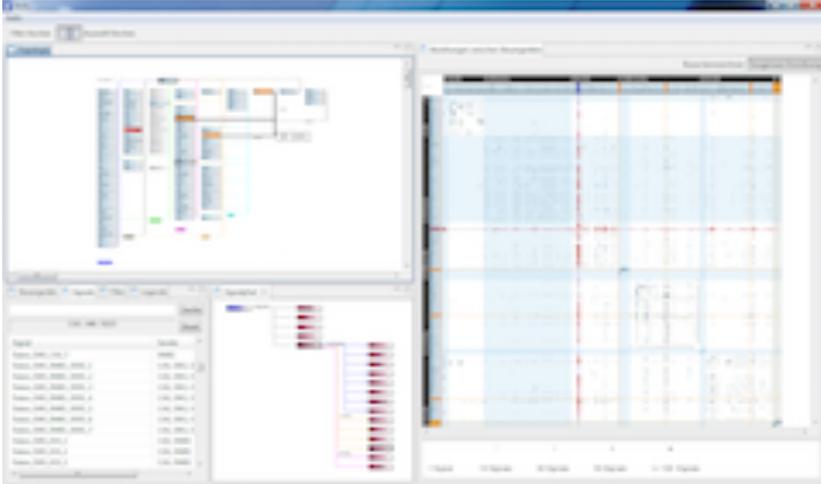
Michael Sedlmair

RelEx (BMW)

https://youtu.be/89lsQXc6Ao4

current work:
Mobify clickstream collaboration

Kimberly Dextras-Romagnino
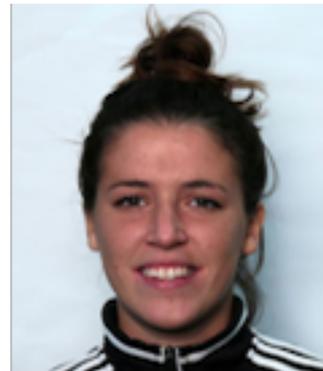
Technique-driven: Graph drawing

Daniel Archambault

David Auber
(Bordeaux)
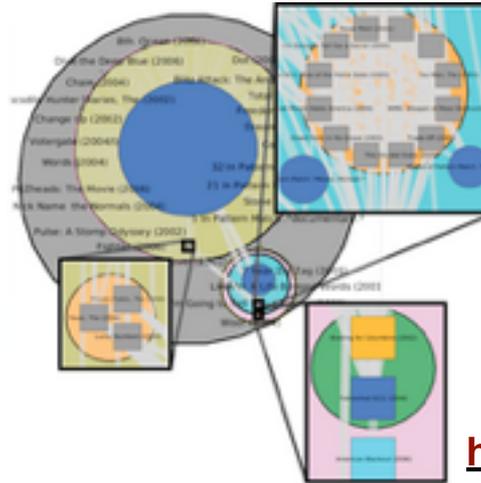
**TopoLayout
SPF
Grouse
GrouseFlocks
TugGraph**

https://youtu.be/AWXAe8zvkt8

Benjamin Renoust

Detangler

https://youtu.be/QOtnHSsUV6k
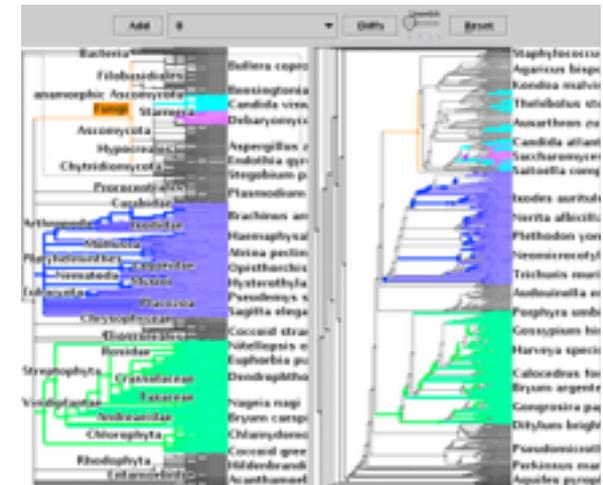
Guy Melançon
(Bordeaux)

TreeJuxtaposer

https://youtu.be/GdaPj8a9QEo

11

Evaluation experiments: Graph drawing

Dmitry Nekrasovski   Adam Bodnar   Joanna McGrenere
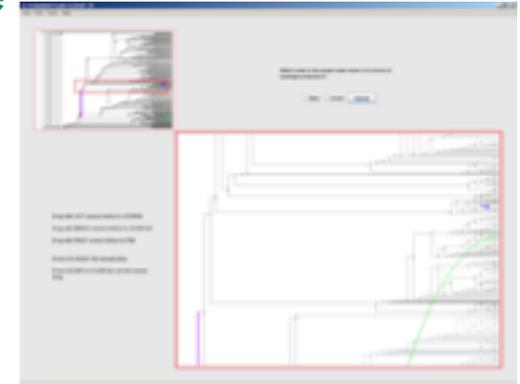
Stretch and squish navigation

Jessica Dawson   Joanna McGrenere
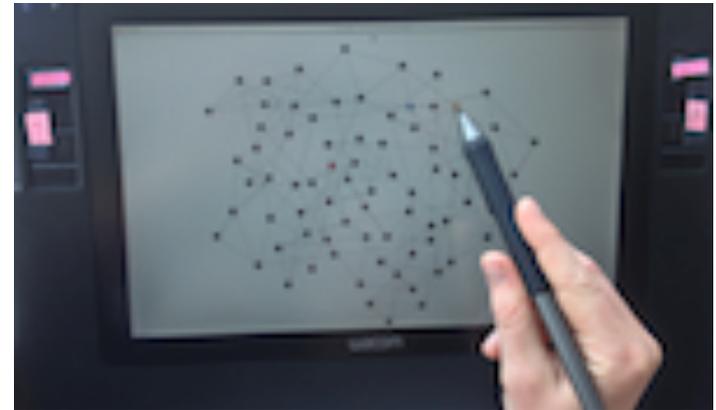
Search set model of path tracing

12

Technique: Dimensionality reduction

Stephen Ingram

Glimmer

DimStiller
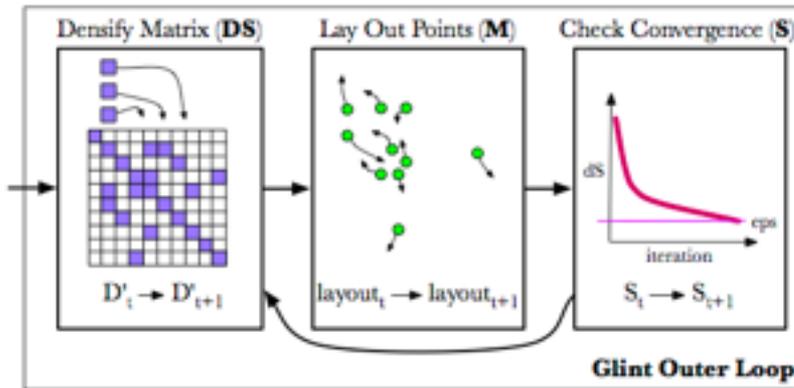
Glint
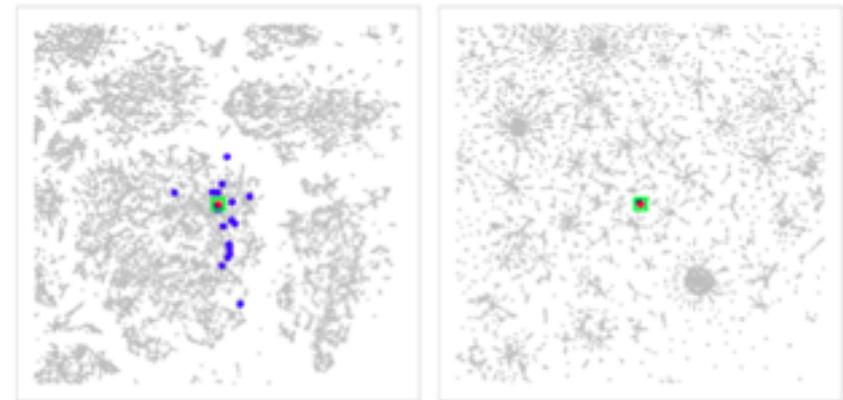
QSNE

Dimensionality reduction for documents

- derive low-dimensional target space from high-dimensional measured space

Task 1

In
HD data → Out
2D data

What?
- In High-dimensional data
- Out 2D data

Why?
- Produce
- Derive

Task 2

In
2D data → Out
Scatterplot
Clusters & points

What?
- In 2D data
- Out Scatterplot
- Out Clusters & points

Why?
- Discover
- Explore
- Identify

How?
- Encode
- Navigate
- Select

Task 3

In
Scatterplot
Clusters & points → Out
Labels for clusters

What?
- In Scatterplot
- In Clusters & points
- Out Labels for clusters

Why?
- Produce
- Annotate

Evaluation experiments: Dim. reduction
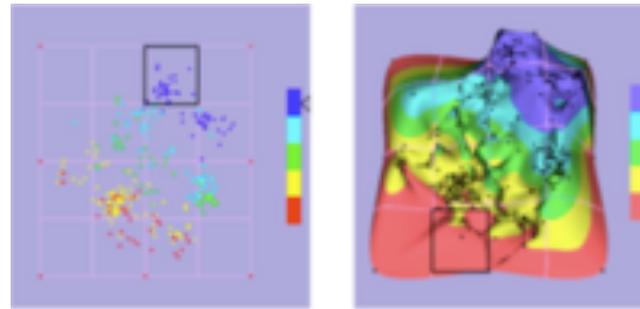
Melanie Tory

Points vs landscapes for dimensionally reduced data
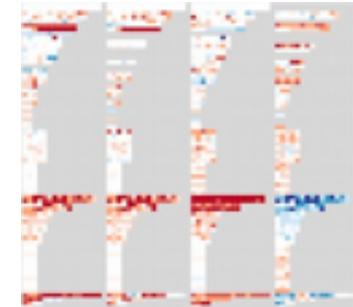
Guidance on DR & scatterplot choices

Michael Sedlmair   Melanie Tory
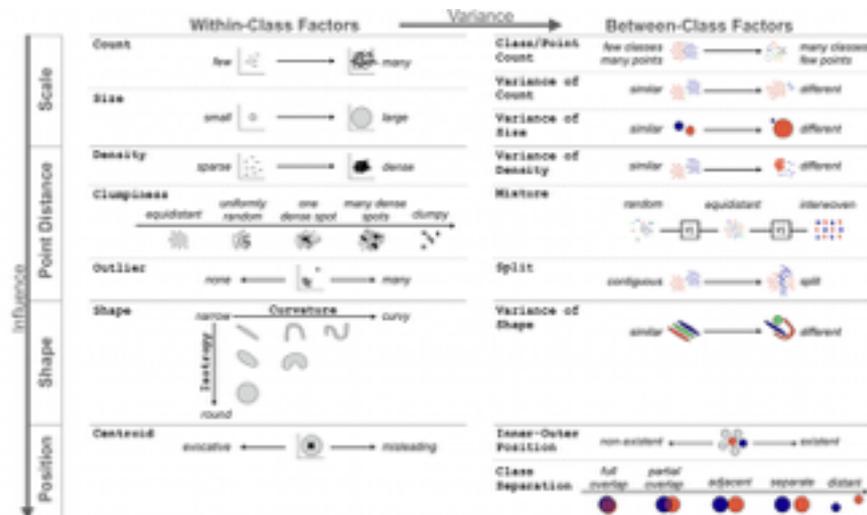
Taxonomy of cluster separation factors

Evaluation in the field: Dim. reduction

DR in the Wild

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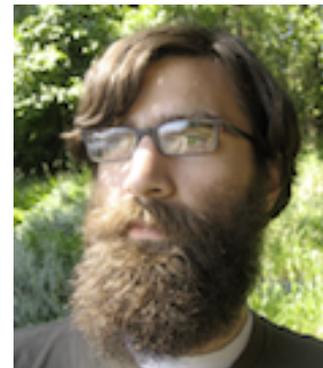
Curation & Presentation: Timelines

TimeLineCurator

https://vimeo.com/123246662

Timelines Revisited

timelinesrevisited.github.io/

**Johanna Fulda
(Sud. Zeitung)**

Matt Brehmer

**Bongshin Lee
(Microsoft)**

**Benjamin Bach
(Microsoft)**

**Nathalie Henry-Riche
(Microsoft)**

Theoretical foundations

Papers Process & Pitfalls

Nested Model

domain
abstraction
idiom
algorithm

Design Study Methodology

ALGORITHM AUTOMATION POSSIBLE

DESIGN STUDY METHODOLOGY SUITABLE

TASK CLARITY — crisp / fuzzy
NOT ENOUGH DATA
INFORMATION LOCATION — head / computer
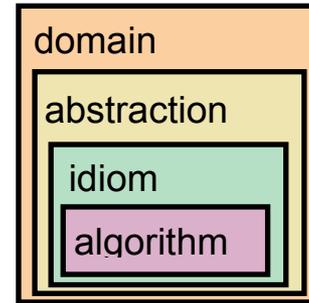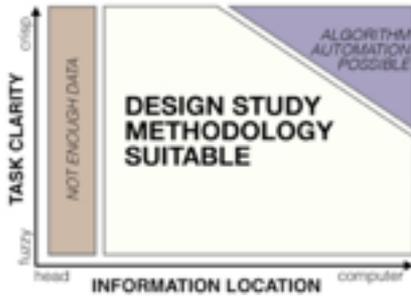
Michael Sedlmair   Miriah Meyer
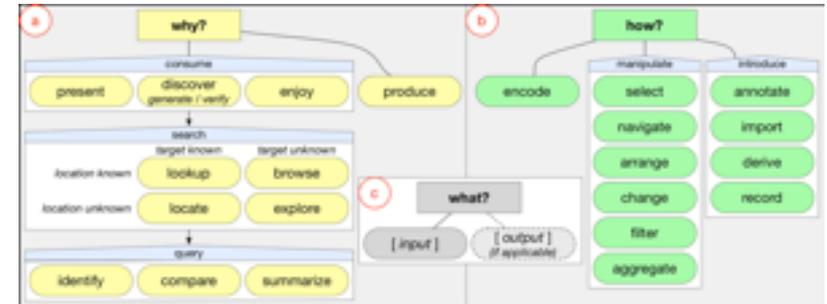
Abstract Tasks   Matt Brehmer
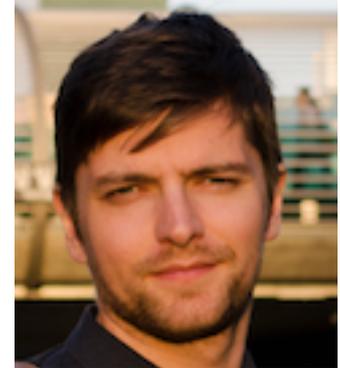
Theoretical foundations
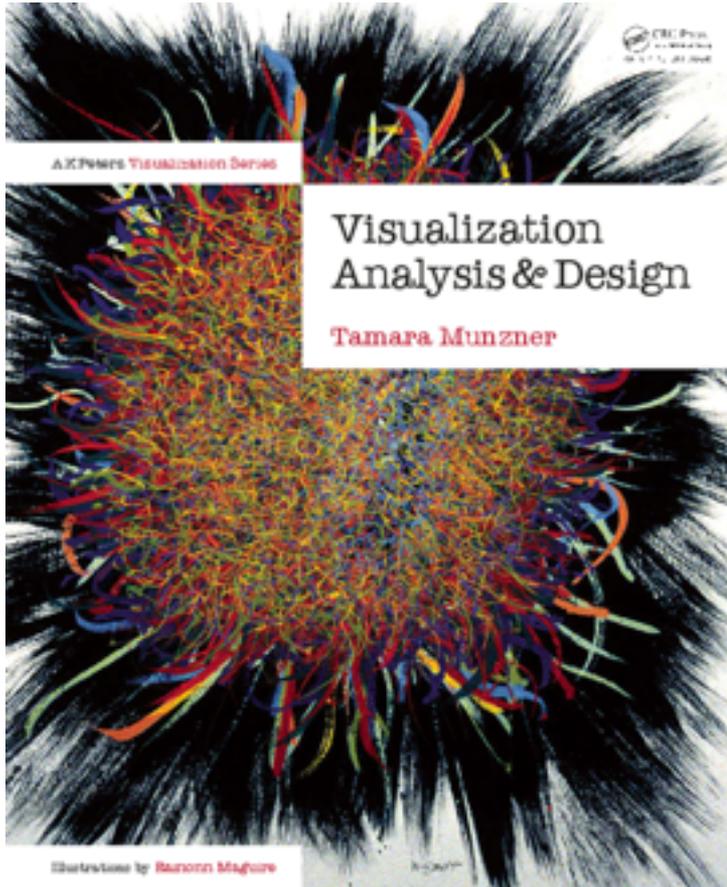
Visualization Analysis & Design

Research agenda: interleaved angles of attack

problem-driven work ⟷ **technique-driven work**

theoretical foundations

evaluation
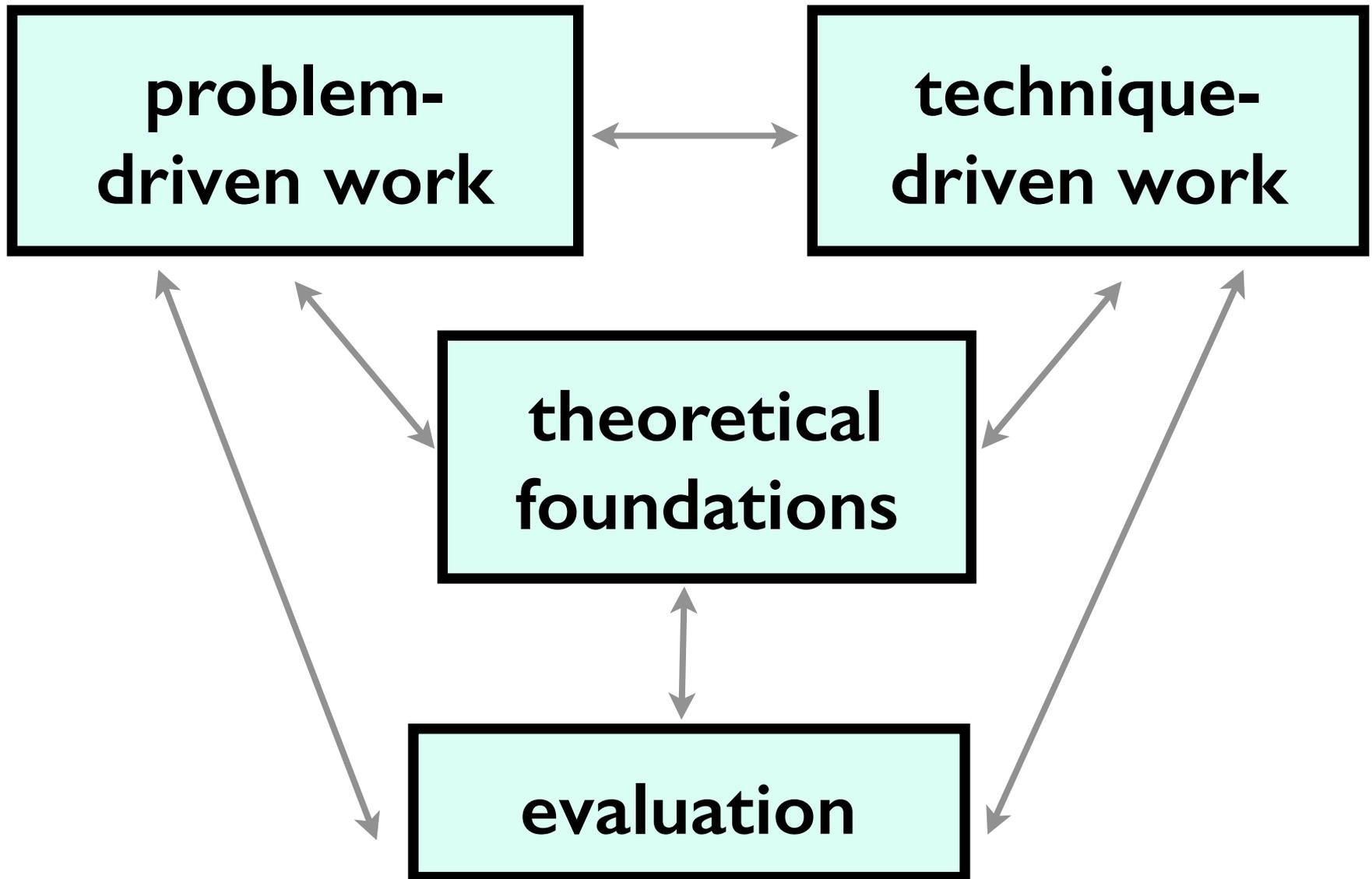
HIBAR successes

- all four work types very accepted in CS/visualization
  - publishable in major venues through different paper types
  - high impact - citations, followup work
  - frequently even in same venues: basic and applied
    - methodology: how to do this kind of work
  - possibly due to being a young field?
    - no huge chasms dividing us (or at least, not *these* chasms…)
    - visualization in specific, CS in general
  - in short: reward structures of field well aligned for HIBAR
    - and thus UBC is happy too
- multiple angles as drivers for own research agenda
  - leapfrog between, challenge of previous as impetus for next

HIBAR obstacles

- scalability challenges as career progresses
  - success disaster: way more collaboration possibilities than time
    - visualization as central glue/enabler
  - gated by time, not money
  - how could institutional/UBC support help somebody like me?
    - don't know but would love to figure out
    - many initiatives exacerbate the problem in short term
      - but I engage with some in hopes of long term helping