

# InfoVis Group Research

Tamara Munzner

[@tamaramunzner](#)

**Department of Computer Science**

University of British Columbia

*CPSC 344 Outro*

*27 Nov 2019*

**<http://www.cs.ubc.ca/~tmm/talks.html#344-outro19>**

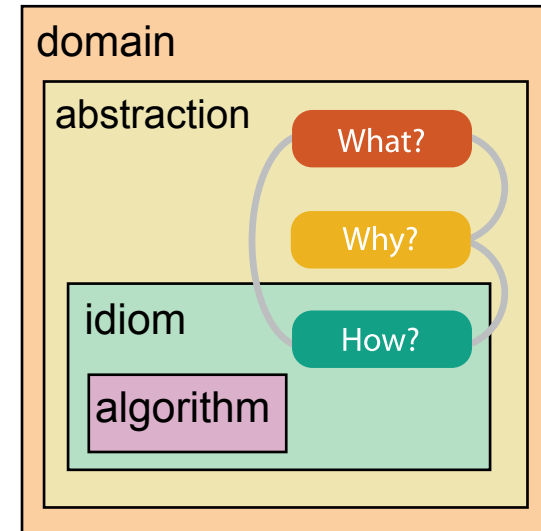
# Visualization (vis) defined & motivated

**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

 **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

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

# Evaluation: broadly interpreted

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

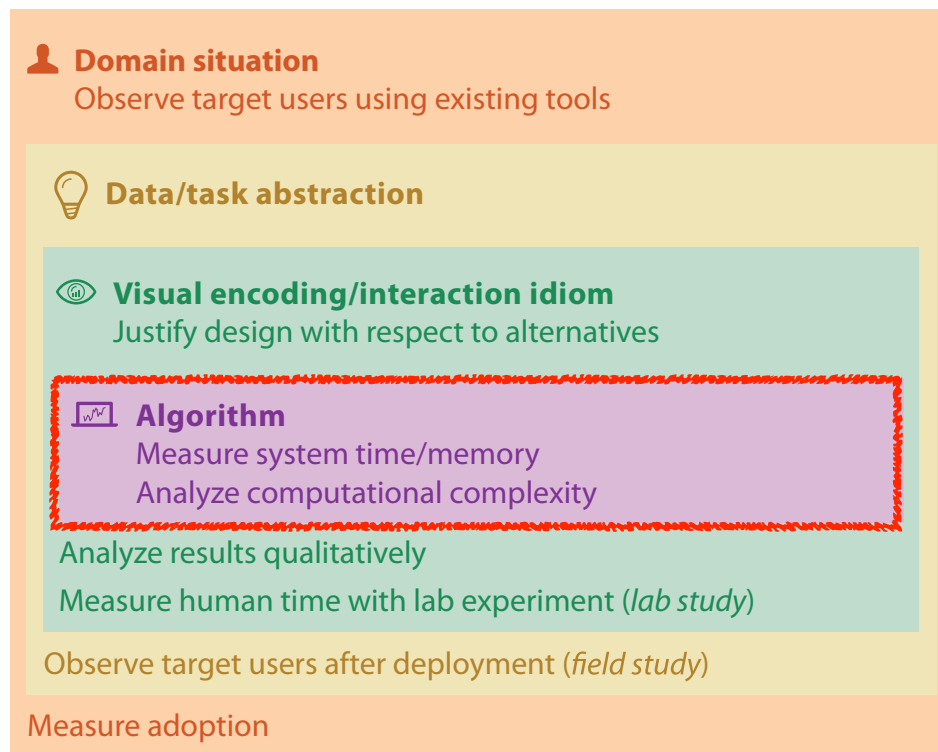
anthropology/  
ethnography

design

computer  
science

HCI/  
psychology

anthropology/  
ethnography

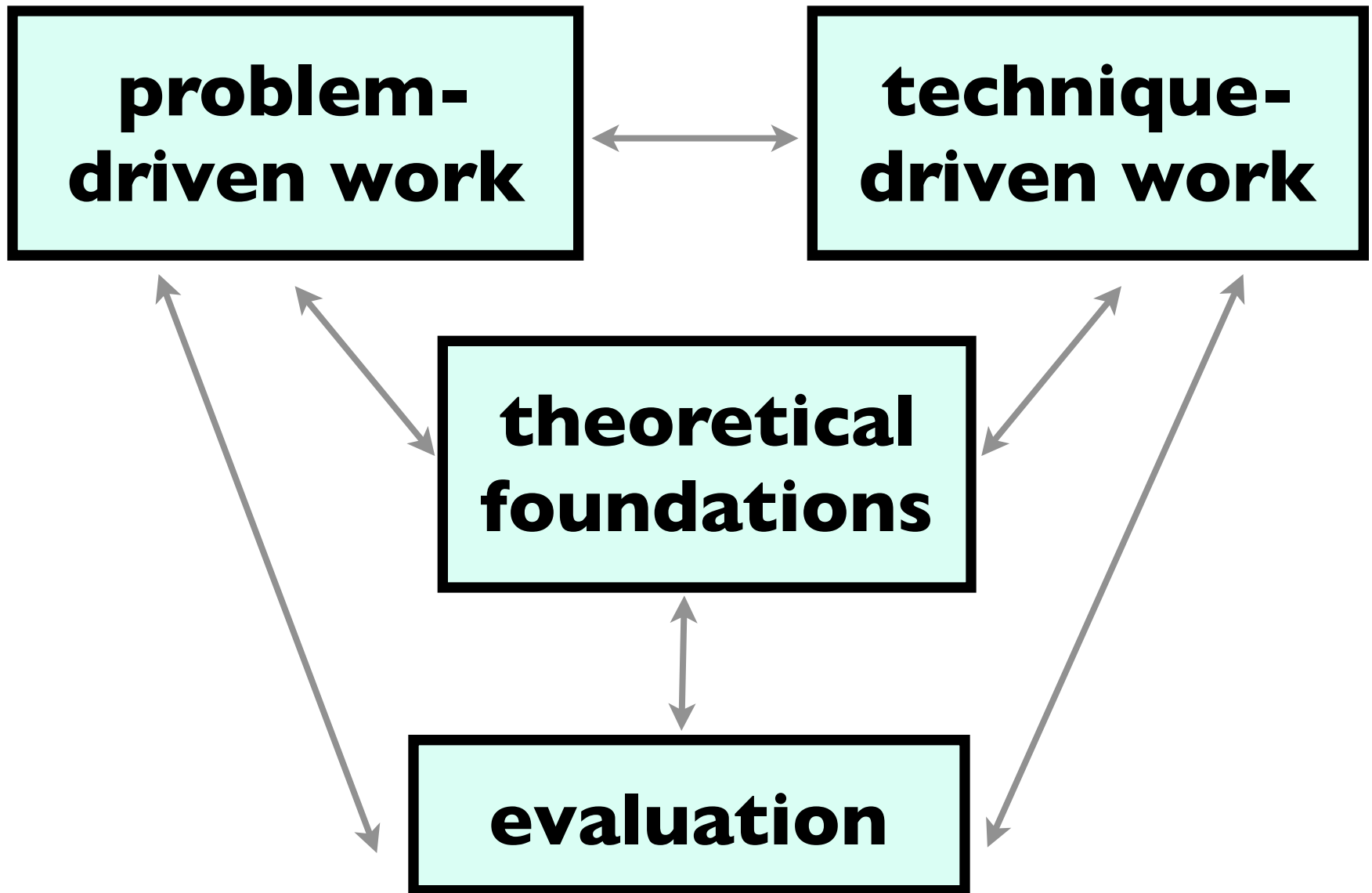


problem-  
driven work

↓

technique-  
driven work

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



# 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

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Heidi Lam



Diane Tang  
(Google)



SessionViewer: web log analysis

<https://youtu.be/T4MaTZd56G4>

Peter McLachlan



Stephen North  
(AT&T Research)



LiveRAC: systems time-series logs

<https://youtu.be/ld0c3H0VSkw>



# Problem-driven: Energy, sustainability

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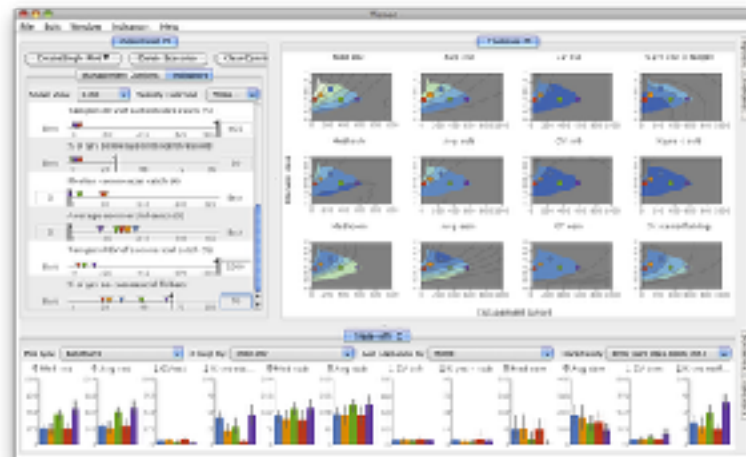


**Energy Manager**

**Matt Brehmer**



**Kevin Tate  
(Pulse/EnerNOC)**



**Vismon**

<https://youtu.be/h0kHoS4VYmk>

**Maryam Booshehrian**



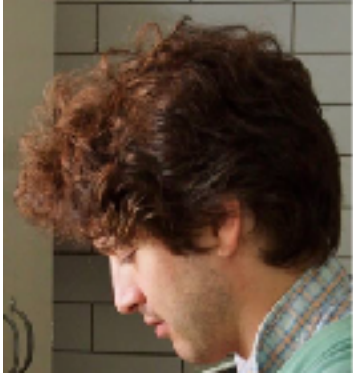
**Torsten Moeller (SFU)**



# Problem-driven: Genomics

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Aaron Barsky



Jenn Gardy  
(UBC Micro)



Robert Kincaid  
(Agilent)

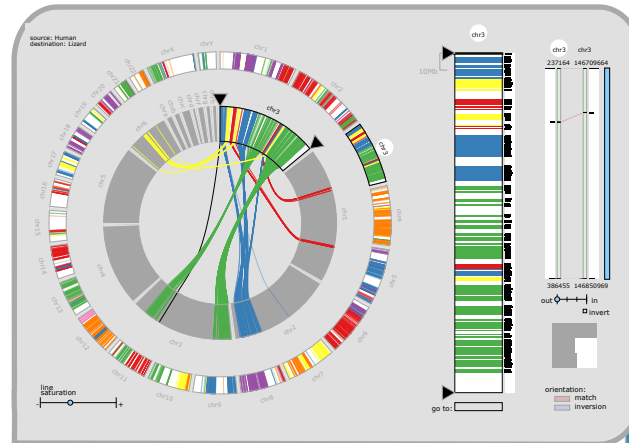


Cerebral  
<https://youtu.be/76HhG1FQngI>

Miriah Meyer

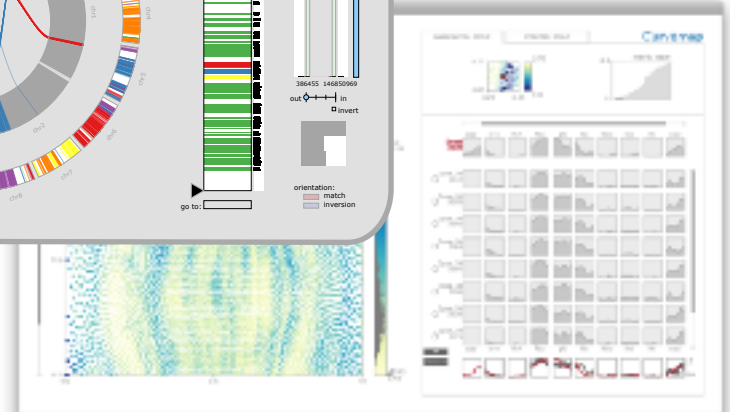


Hanspeter Pfister  
(Harvard)



MizBee

<https://youtu.be/86p7brwuz2g>



MulteeSum, Pathline

# Problem-driven: Genomics, journalism

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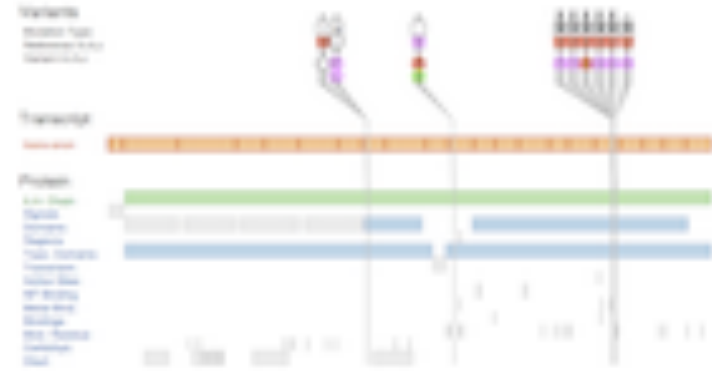
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Joel Ferstay



Cydney Nielsen  
(BC Cancer)



Variant View

[https://youtu.be/AHDnv\\_qMXxQ](https://youtu.be/AHDnv_qMXxQ)

Jonathan Stray  
(Assoc Press)

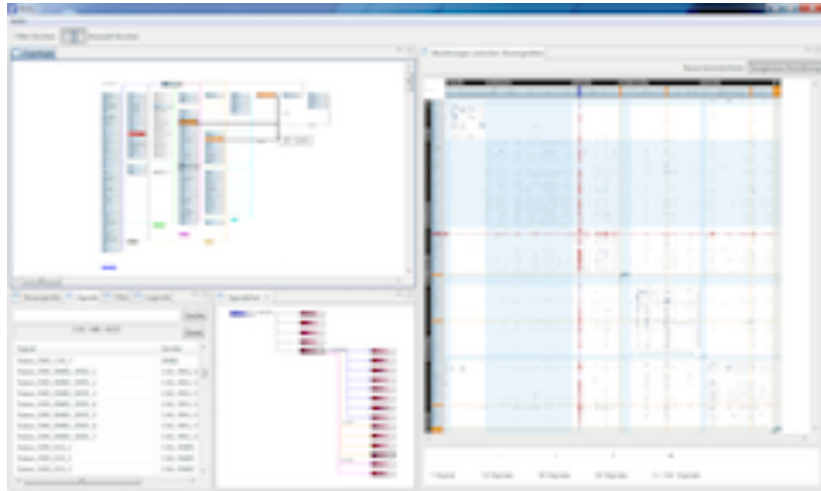


Overview

<https://vimeo.com/71483614>

# Problem-driven: Autos, e-commerce

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Michael Sedlmair

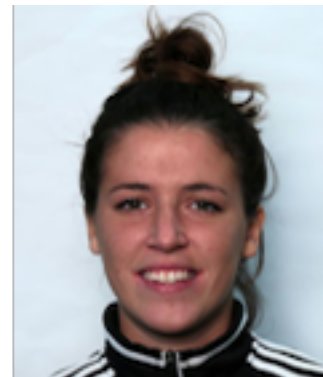


**RelEx (BMW)**

<https://youtu.be/89IsQXc6Ao4>



Kimberly Dextras-Romagnino



**Segmentifier (Mobify)**

<https://youtu.be/TobYDFeISOg>

# Technique-driven work

- **scalable algorithms & systems**
  - typical evaluation: computational benchmarks
- **new layout & interaction techniques**
  - typical evaluation: controlled experiments on human subjects

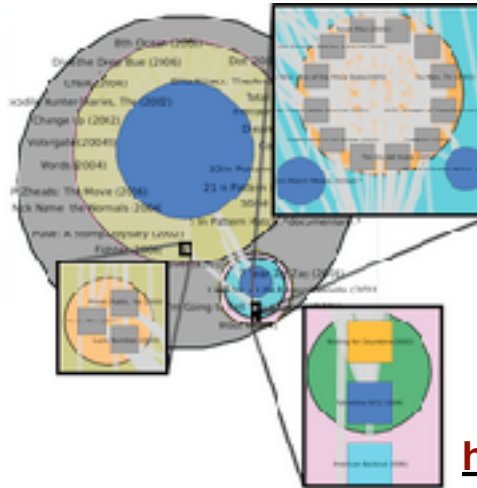
# Technique-driven: Graph drawing

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Daniel Archambault



David Auber  
(Bordeaux)



**TopoLayout**  
**SPF**  
**Grouse**  
**GrouseFlocks**  
**TugGraph**

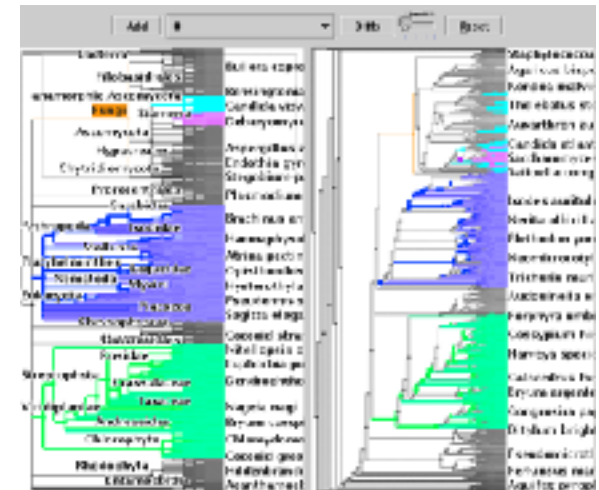
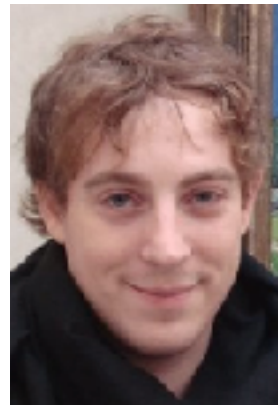
<https://youtu.be/AWXAe8zvkt8>



**Detangler**

<https://youtu.be/QOtnHSsUV6k>

Benjamin Renoust



Guy Melançon  
(Bordeaux)

**TreeJuxtaposer**

<https://youtu.be/GdaPj8a9QEO>

# Evaluation experiments: Graph drawing

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Dmitry Nekrasovski Adam Bodnar



Joanna McGrenere

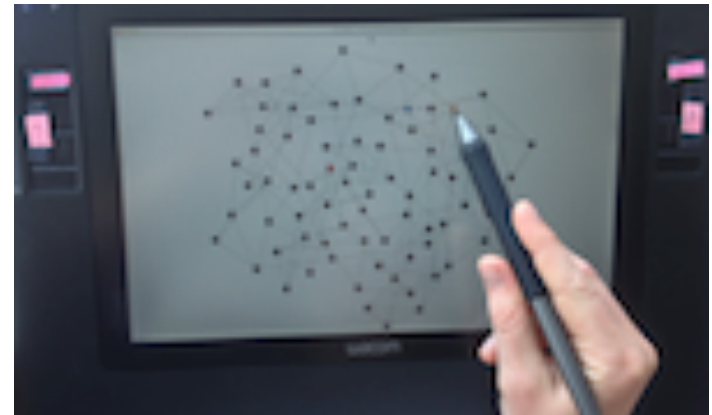


Stretch and squish navigation

Jessica Dawson



Joanna McGrenere



Search set model of path tracing

# Technique: Dimensionality reduction

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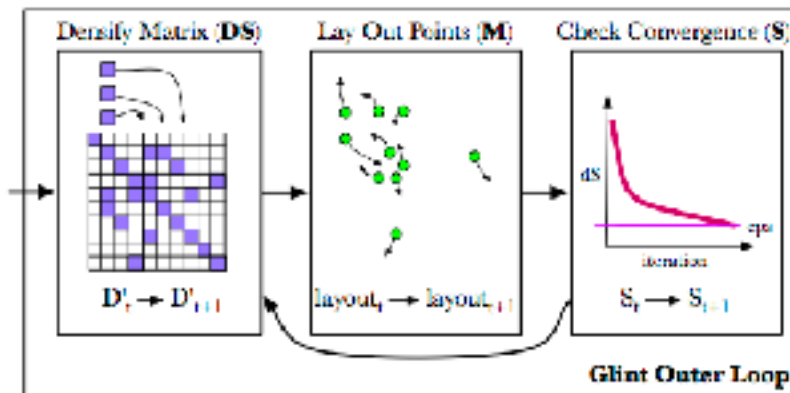
Stephen Ingram



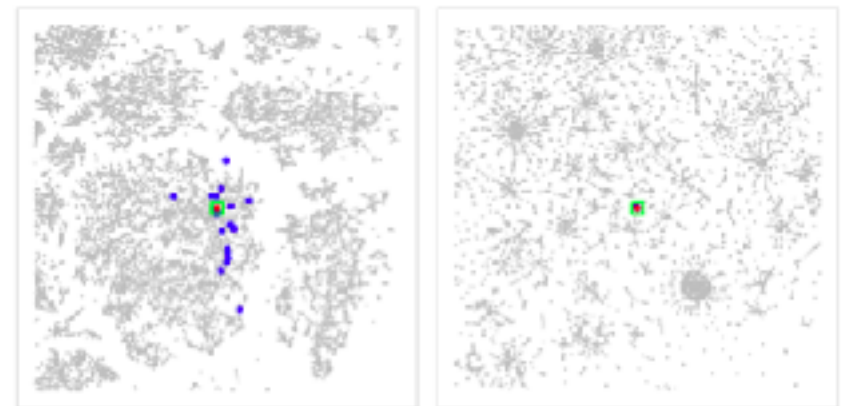
Glimmer



DimStiller



Glint



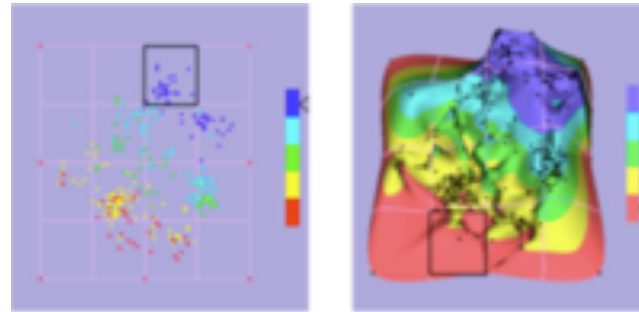
QSNE



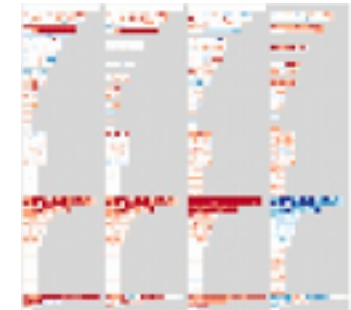
# Evaluation experiments: Dim. reduction

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Melanie Tory



Points vs landscapes for dimensionally reduced data

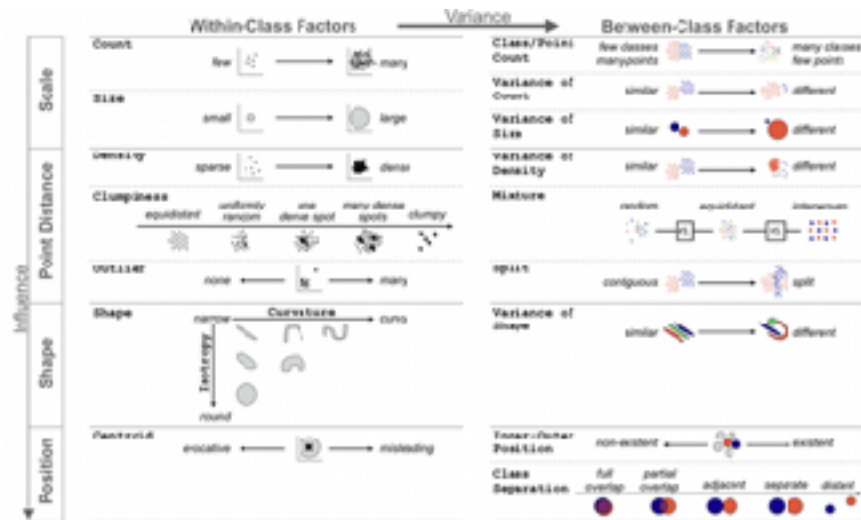


Guidance on DR & scatterplot choices

Michael Sedlmair



Melanie Tory



Taxonomy of cluster separation factors

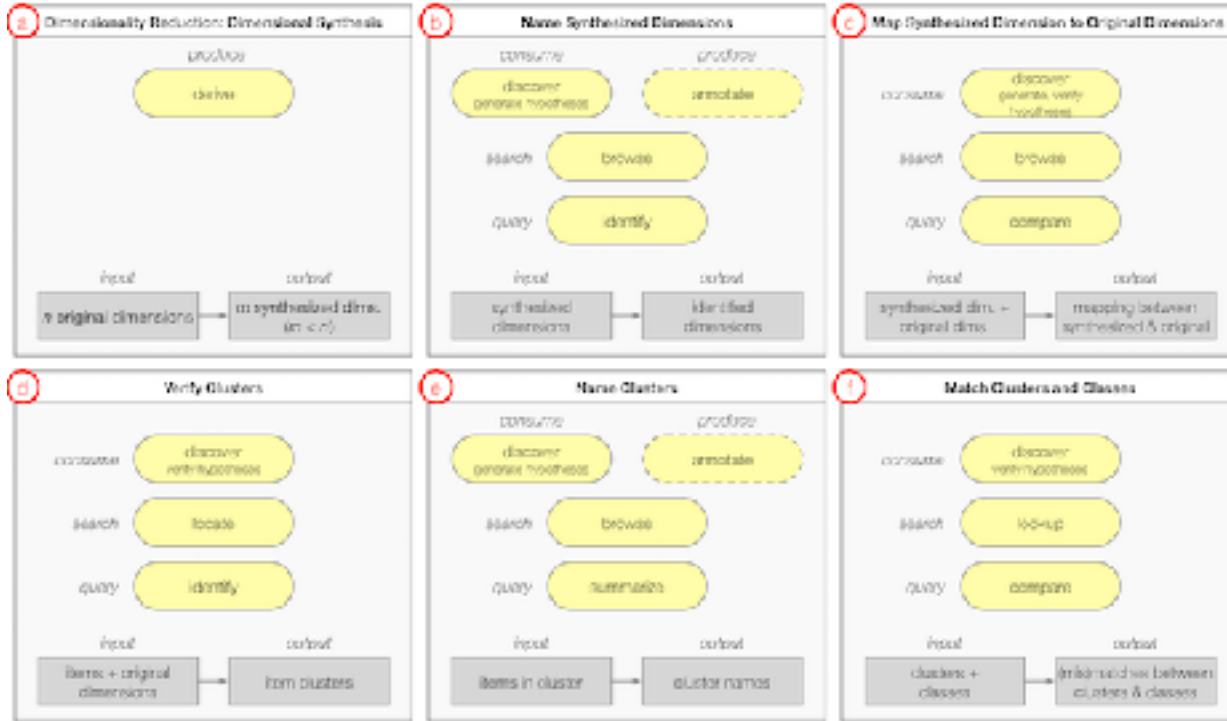
# Evaluation in the field: Dim. reduction

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DR in the Wild

Matt Brehmer

Michael Sedlmair

Melanie Tory

Stephen Ingram



# Curation & Presentation: Timelines

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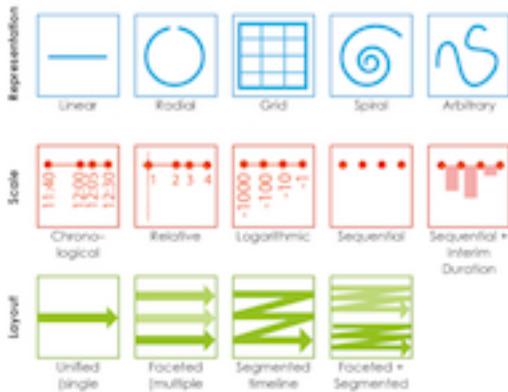
**TimeLineCurator**

<https://vimeo.com/123246662>

**Johanna Fulda**  
(Sud. Zeitung)



**Matt Brehmer**



**Timelines Revisited**

[timelinesrevisited.github.io/](https://timelinesrevisited.github.io/)

**Bongshin Lee**  
(Microsoft)



**Benjamin Bach**  
(Microsoft)



**Nathalie Henry-Riche**  
(Microsoft)

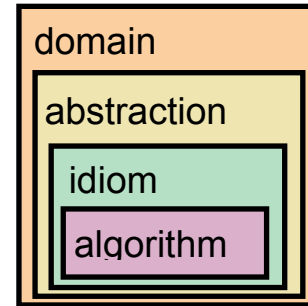


# Theoretical foundations

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- Type Pitfalls
  - + Design in Technician's Clothing
  - + Application Binago versus Design Study
  - + All That Coding Means I Deserve A Systems Paper
  - + Neither Fish Nor Fowl
- Visual Encoding Pitfalls
  - + Unjustified Visual Encoding
  - + Hammer In Search Of Nail
  - + 2D Good, 3D Better
  - + Color Camouflage
- Results Pitfalls
  - + Uniformed By Time
  - + Fear and Loathing of Complexity
  - + Straw Man Comparison
  - + Tiny Toy Datasets
  - + But My Friends Liked It
  - + Unjustified Tasks
- Writing Style Pitfalls
  - + Deadly Detail Dump

## Papers Process & Pitfalls

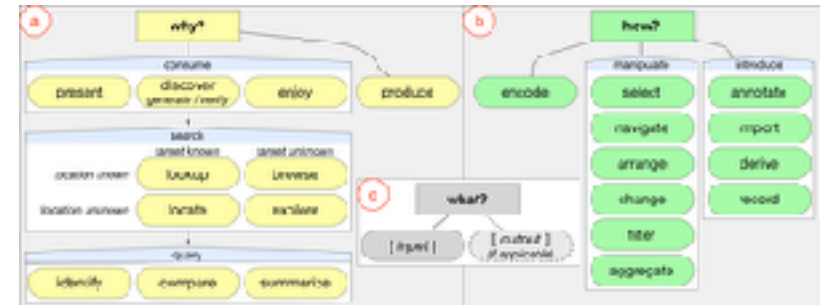


## Nested Model



## Design Study Methodology

Michael Sedlmair    Miriah Meyer



## Abstract Tasks

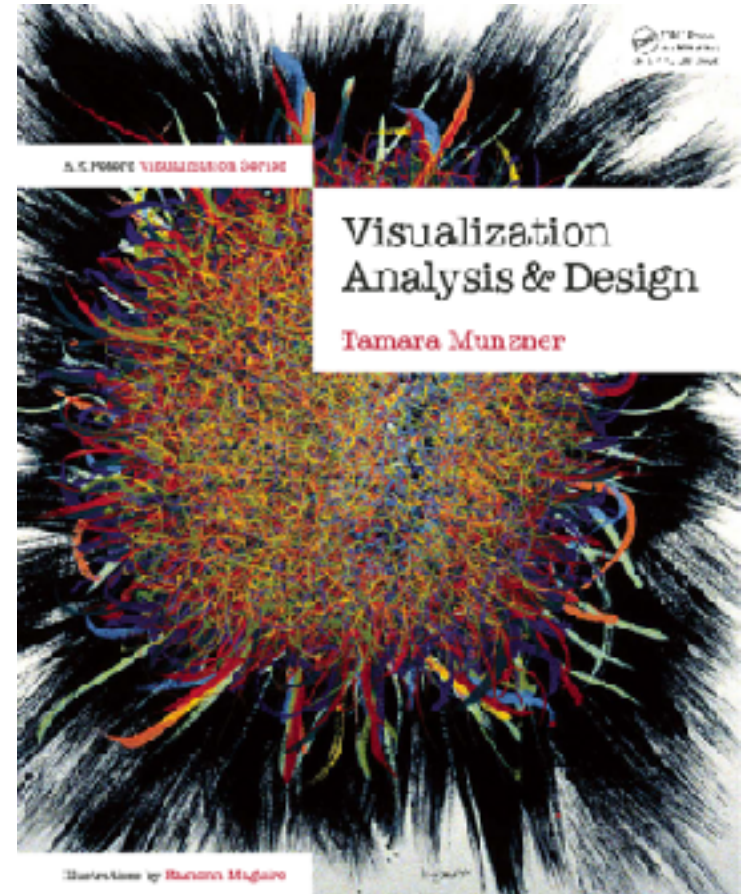
Matt Brehmer



# Theoretical foundations

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- 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**

# 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