

Entry Points to Visualization: Different Methods for Different Problems



Tamara Munzner

Department of Computer Science
University of British Columbia



***Viz@UBC Kickoff: Lunchtime Lecture Series
12 March 2019***



www.cs.ubc.ca/~tmm/talks.html#vizatubc19-entry

[@tamaramunzner](https://twitter.com/tamaramunzner)

Visualization (vis) defined & motivated

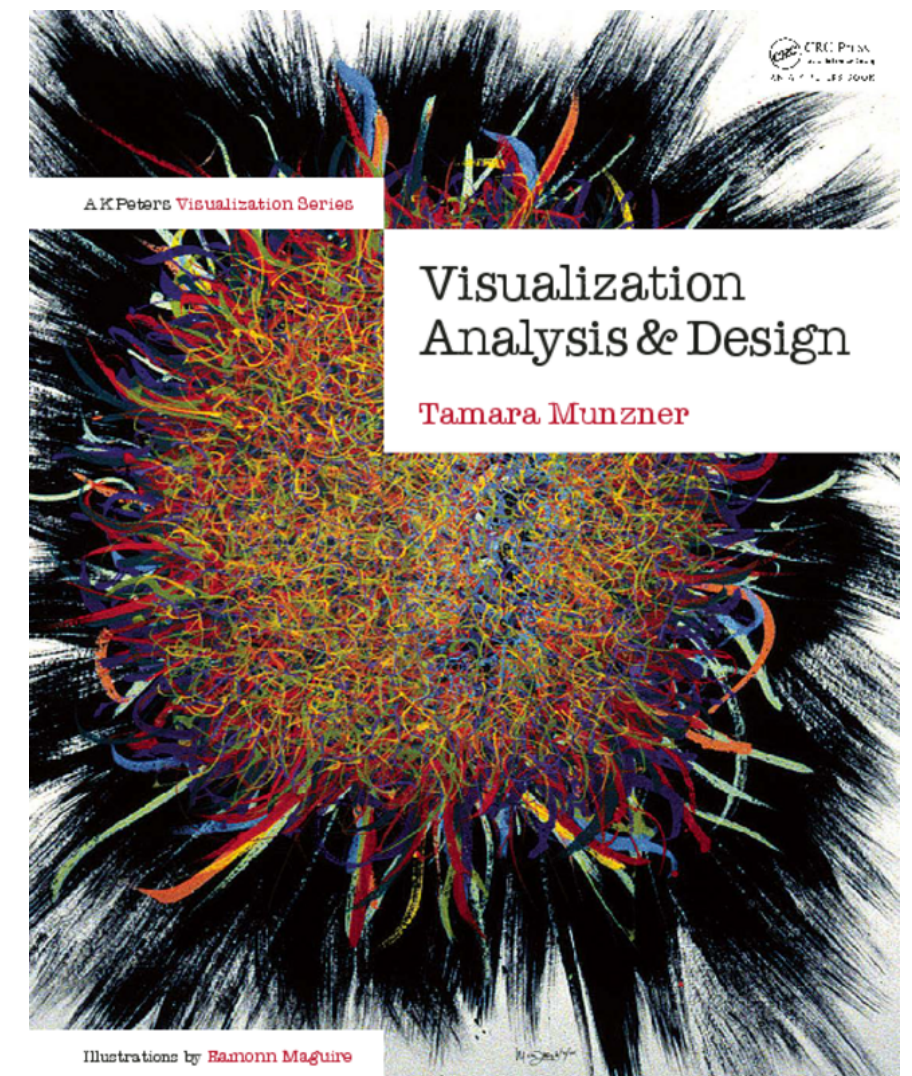
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.

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

- human in the loop needs details about data
 - *entry point*: exploratory data analysis
 - don't know exactly what questions to ask in advance
 - *entry point*: presentation of known results
 - *entry point*: interplay with automation
 - refining model, trustbuilding/monitoring, mixed-initiative
- external representation: perception vs cognition
- intended task, measurable definitions of effectiveness

more at:

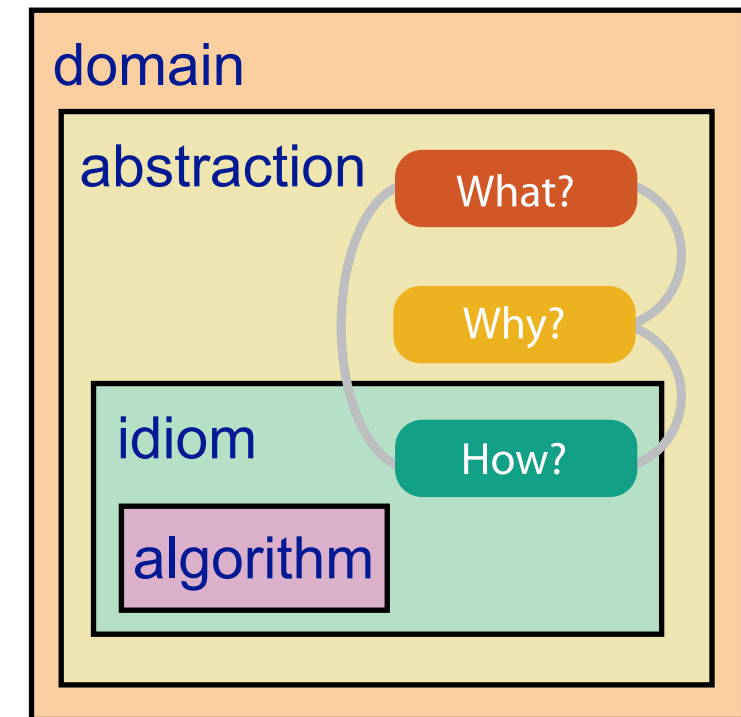
Visualization Analysis and Design, Chapter 1.
Munzner. *AK Peters Visualization Series*, CRC Press, 2014.



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
 - **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

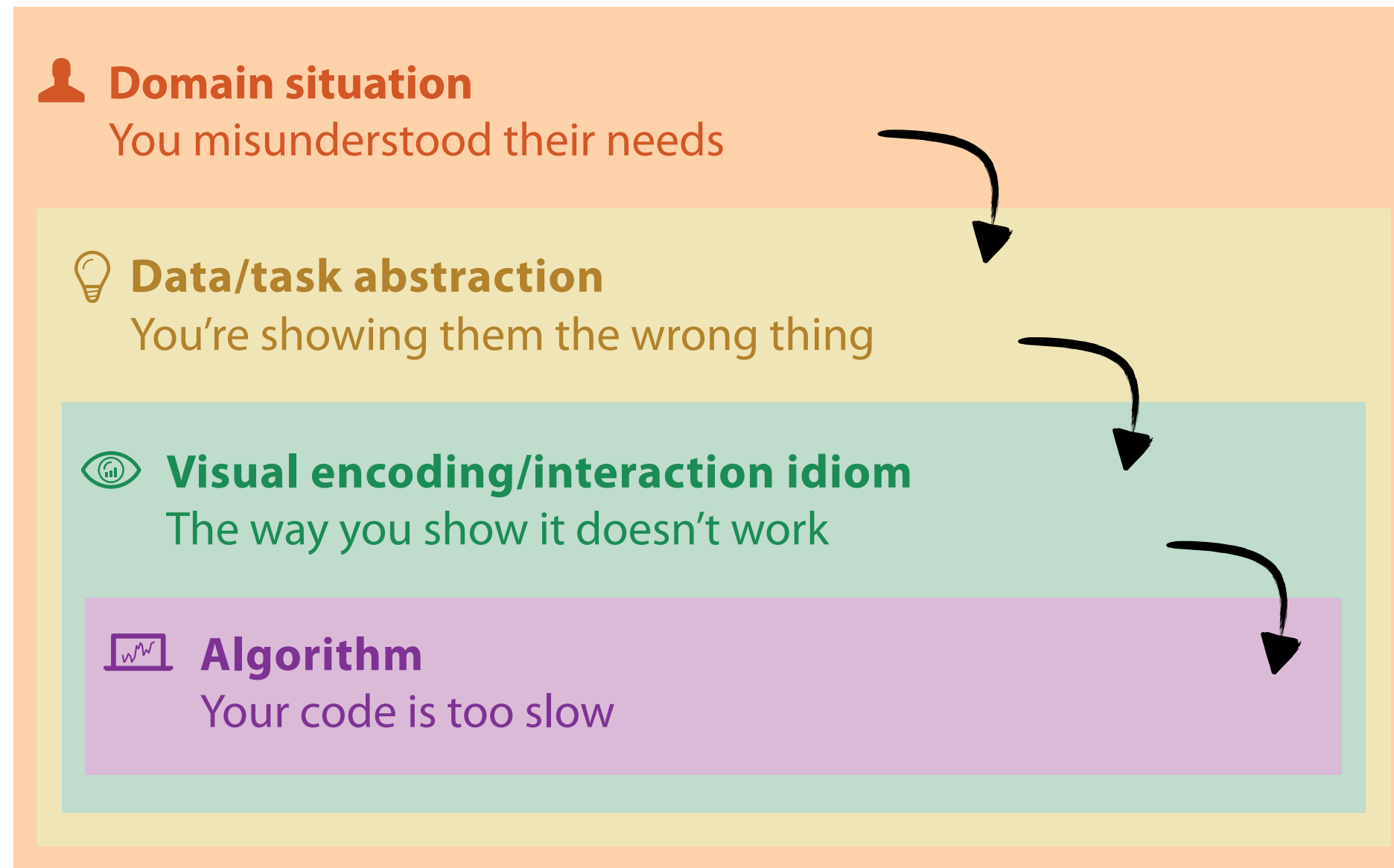
[A Nested Model of Visualization Design and Validation.
Munzner. *IEEE TVCG* 15(6):921-928, 2009
(Proc. InfoVis 2009).]



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

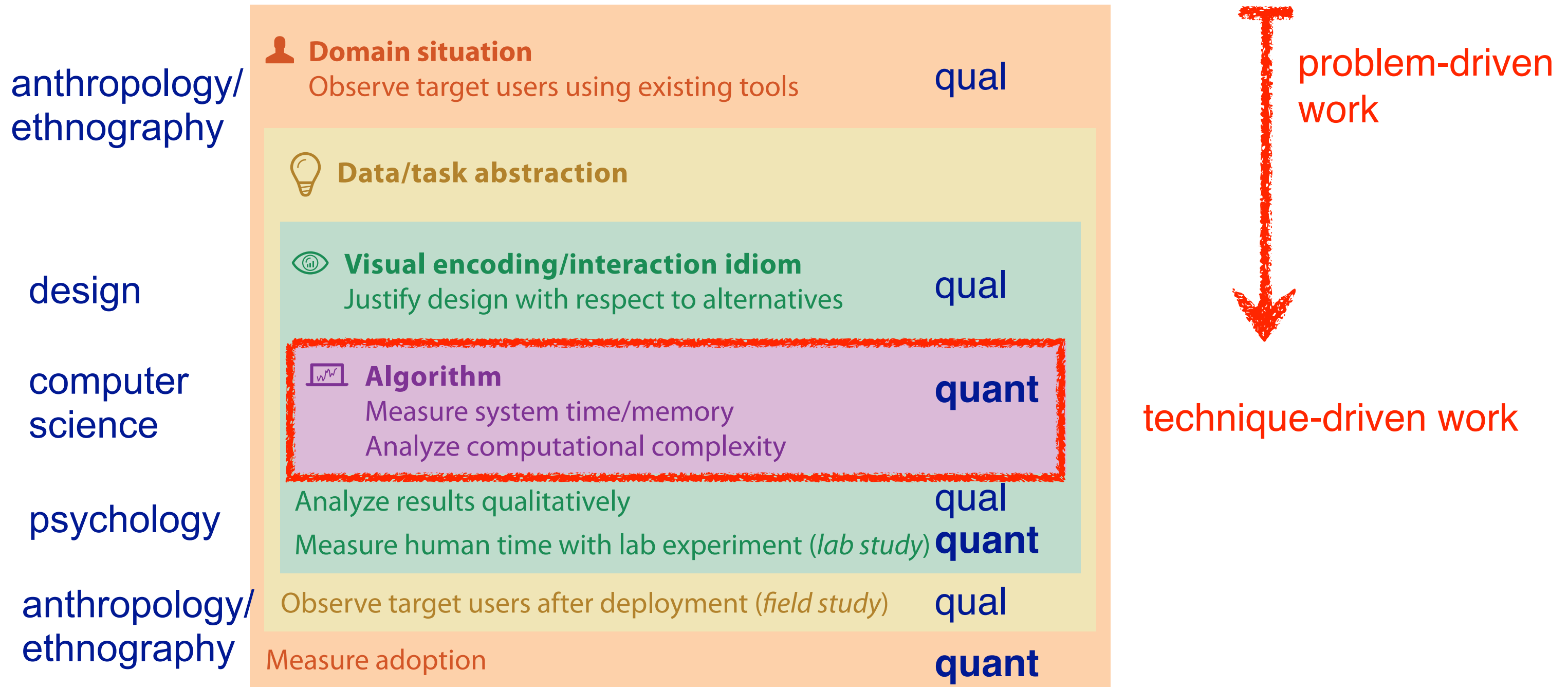
Different threats to validity at each level

- cascading effects downstream

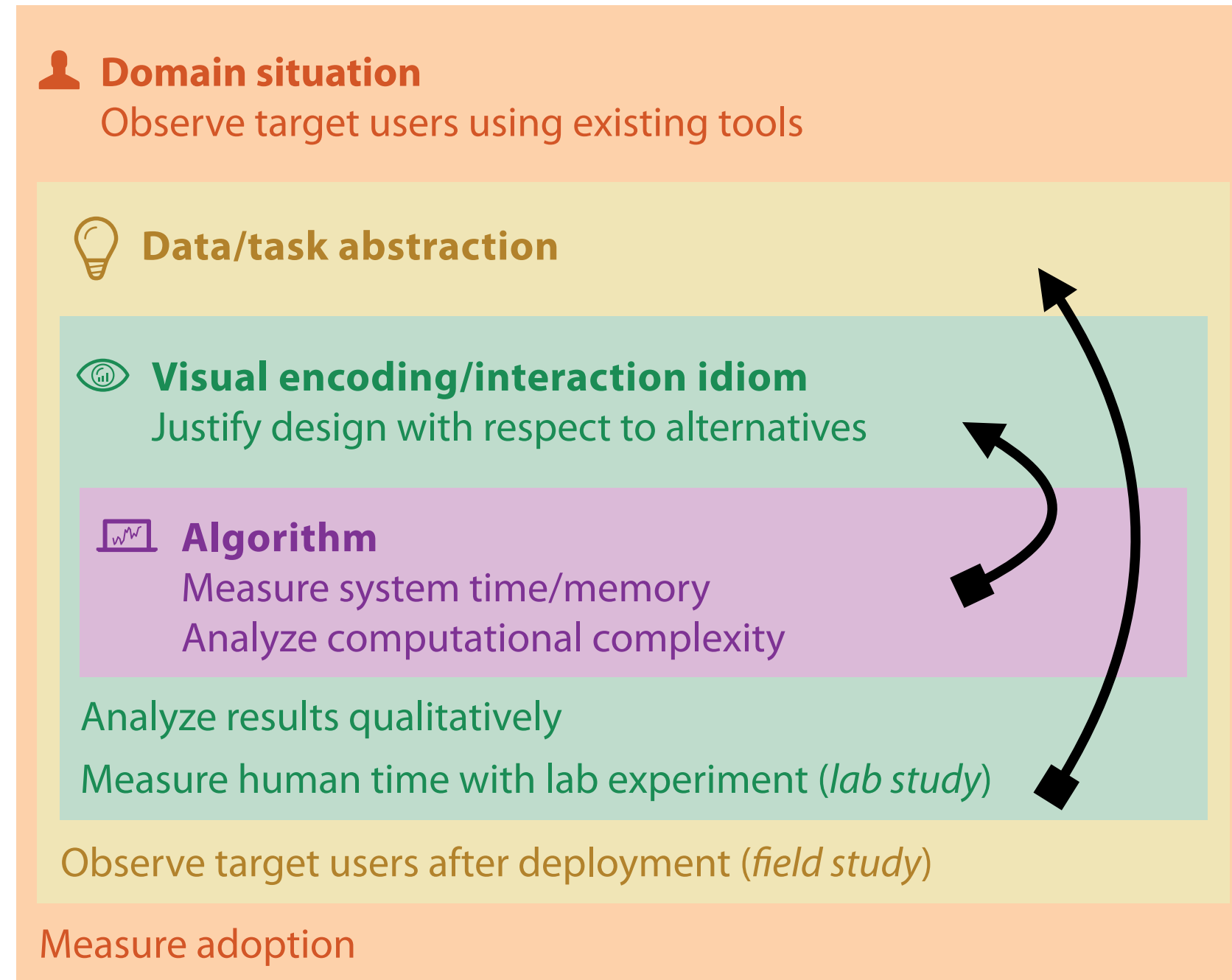


Different methods for different problems, from different fields

- interdisciplinary, mix of qual and quant approaches (typically)



Method mismatches: Common problem

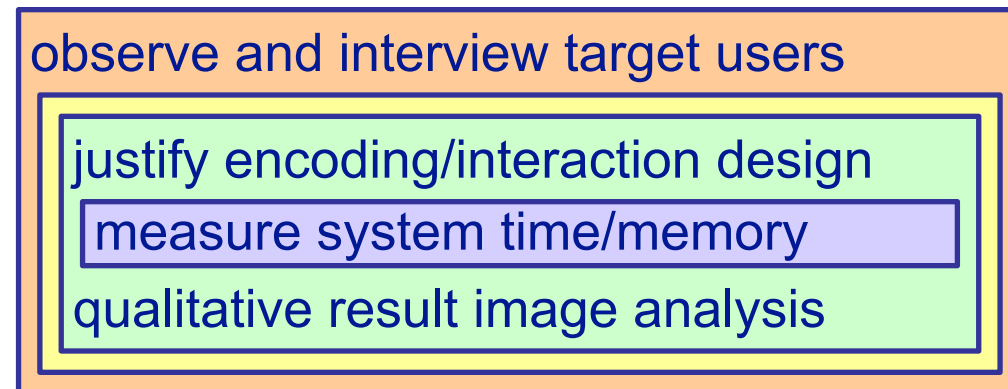


benchmarks
can't confirm
design

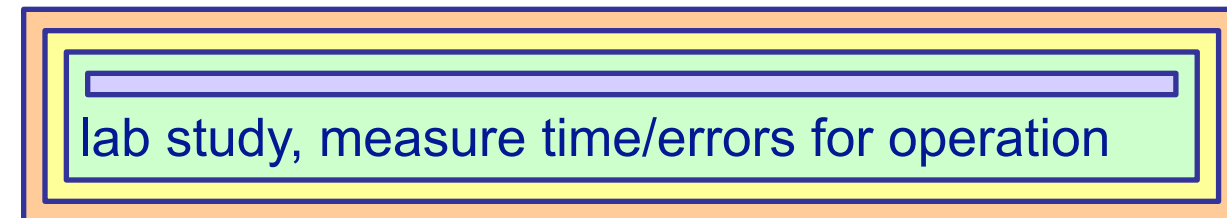
lab studies can't
confirm task
abstraction

Analysis examples: Single paper includes only subset of methods

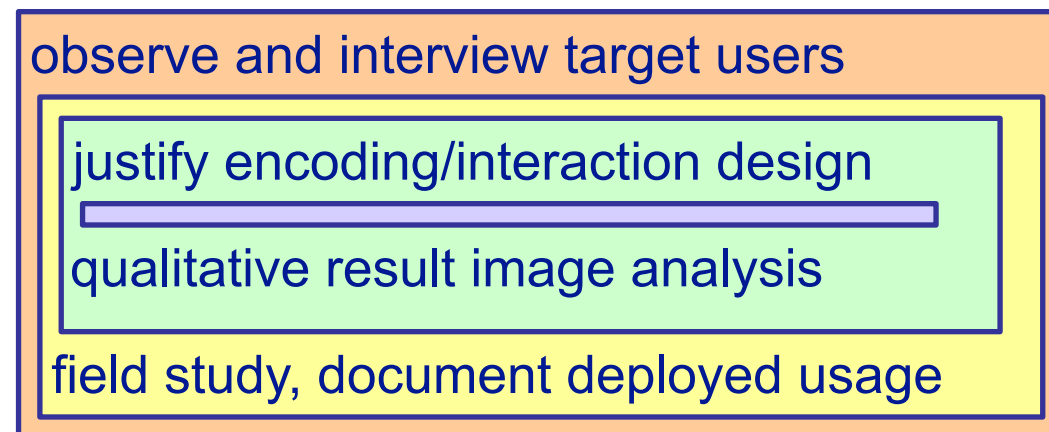
MatrixExplorer. Henry and Fekete. InfoVis 2006.



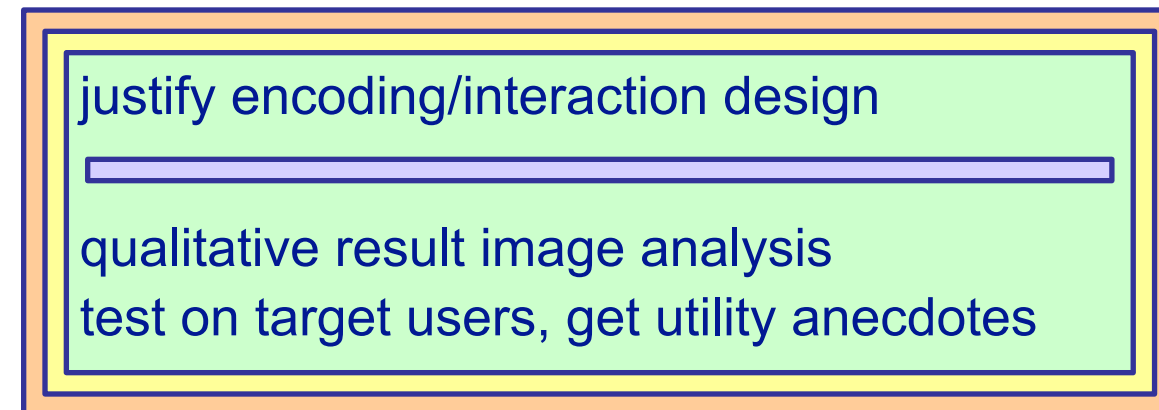
Effectiveness of animation in trend visualization. Robertson et al. InfoVis 2008.



LiveRAC. McLachlan, Munzner, Koutsofios, and North. CHI 2008.



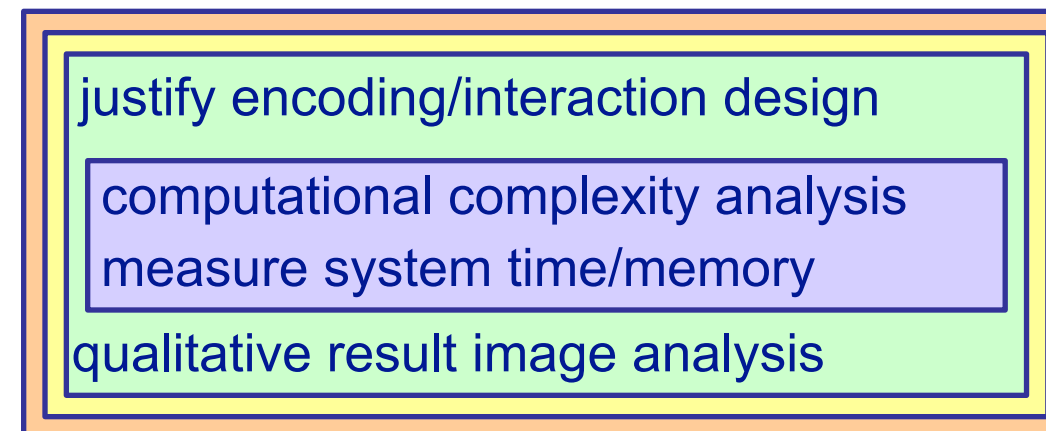
Interactive visualization of genealogical graphs. McGuffin and Balakrishnan. InfoVis 2005.



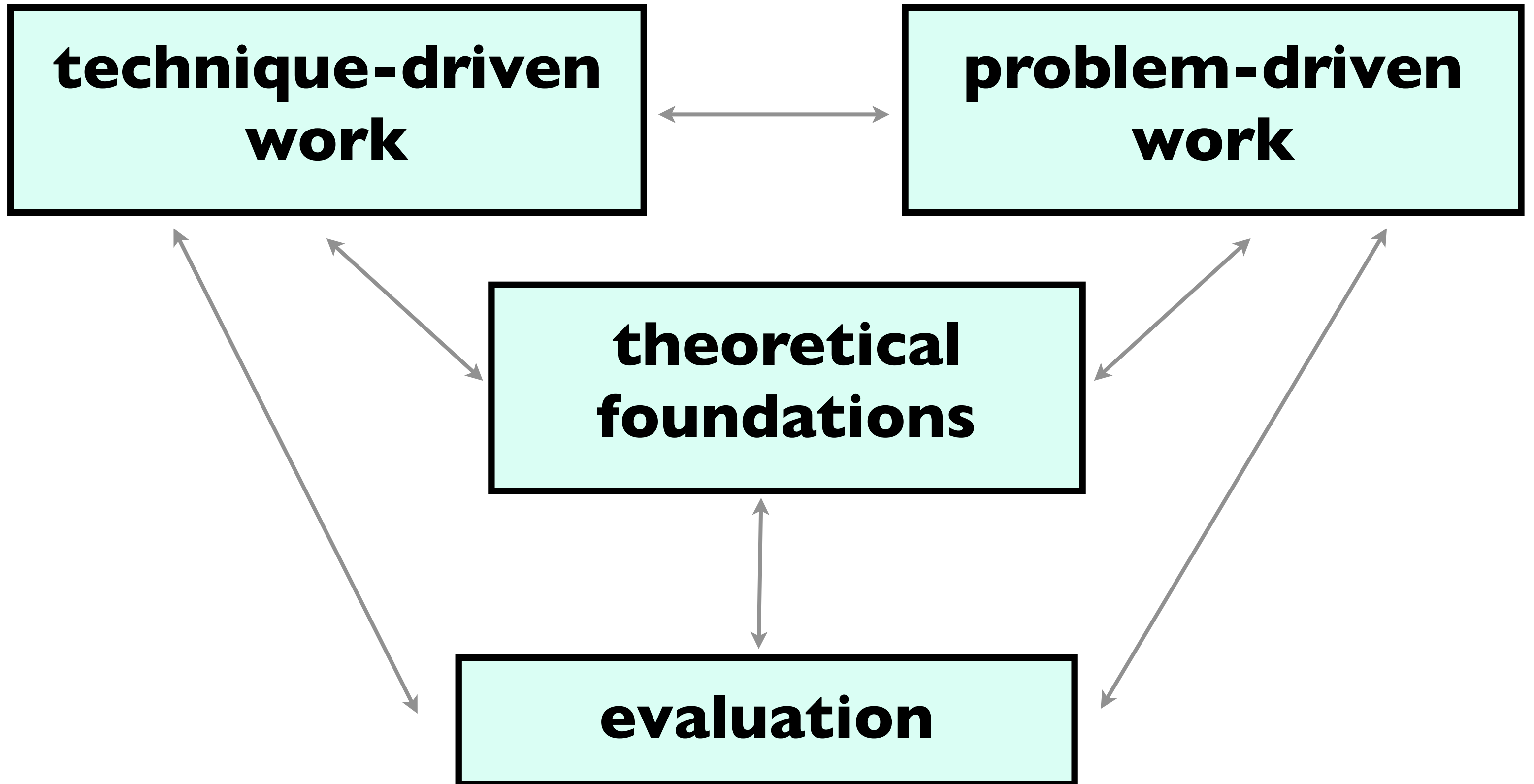
An energy model for visual graph clustering. (LinLog) Noack. Graph Drawing 2003



Flow map layout. Phan et al. InfoVis 2005.



Different angles of attack for different problems



Technique-driven work

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

Technique-driven: Graph/network drawing

T

P

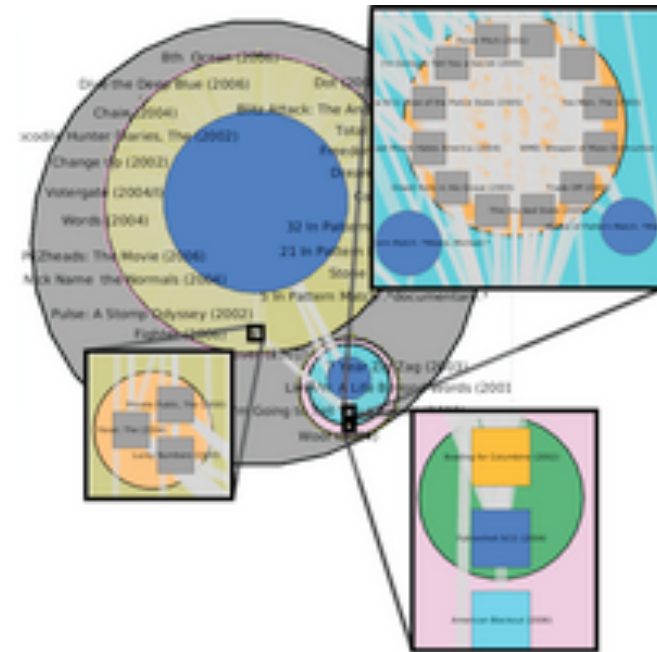
F

E

Daniel Archambault



David Auber (Bordeaux)



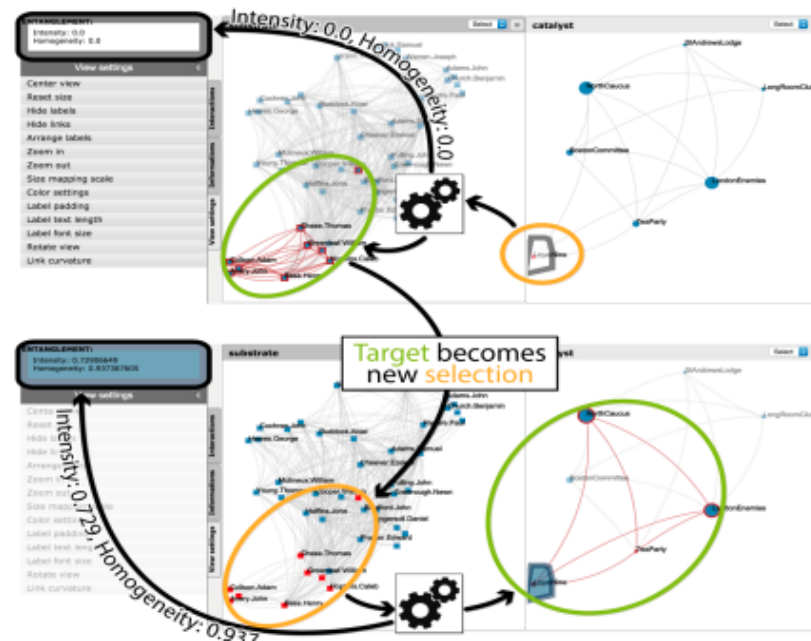
<https://youtu.be/AWXAe8zvkt8>

TopoLayout
SPF
Grouse
GrouseFlocks
TugGraph

Benjamin Renoust



Guy Melançon (Bordeaux)



Detangler

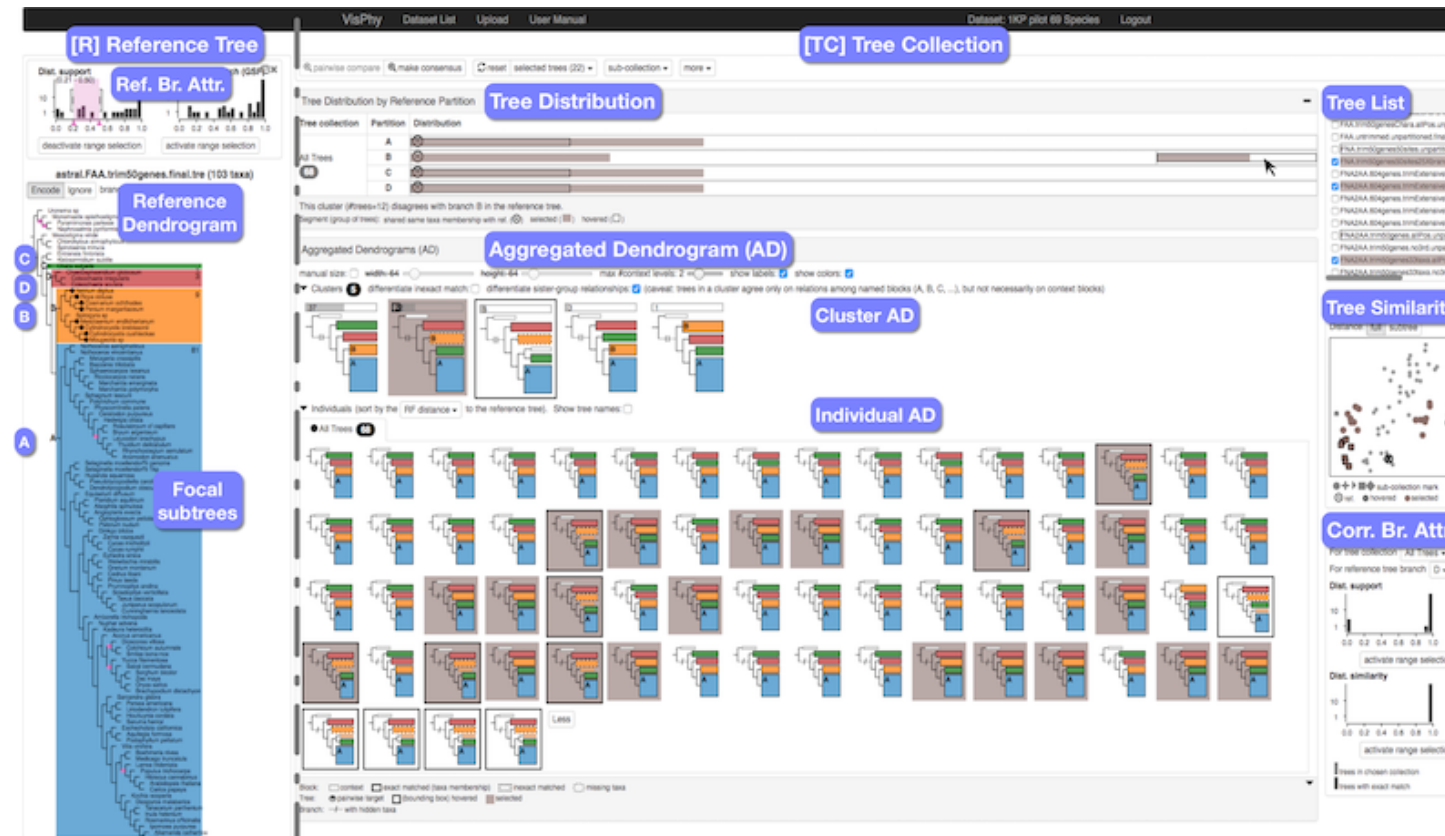
<https://youtu.be/QOtnHSsUV6k>

Technique-driven: Tree drawing

T
F
E
P

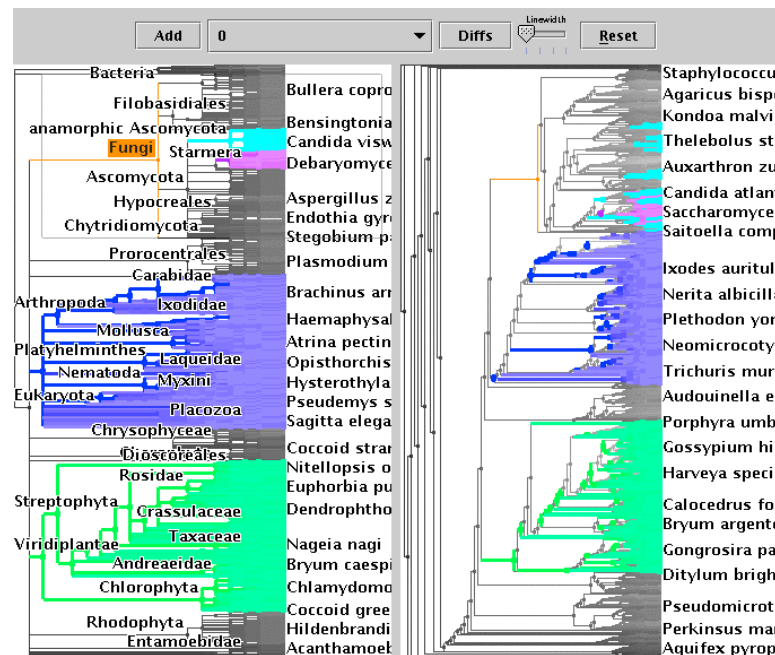
Zipeng Liu

Shing Hei Zhan



Aggregated Dendrograms

<https://youtu.be/2SLcz7KNLJw>



TreeJuxtaposer

<https://youtu.be/GdaPj8a9QEo>

Evaluation experiments: Graph/tree drawing

T F P
E

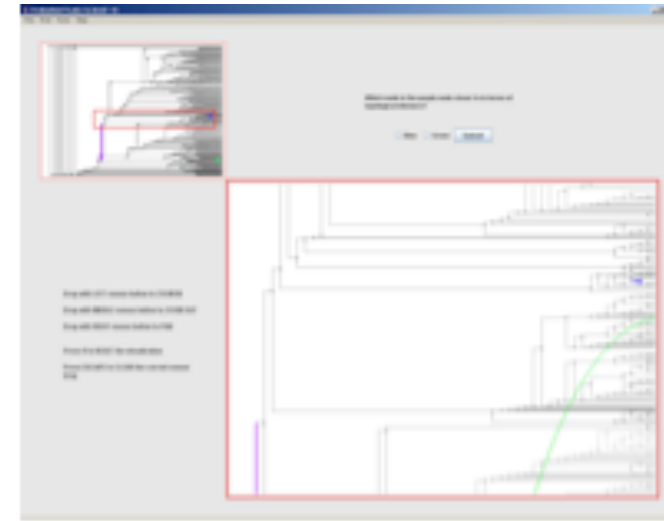
Dmitry
Nekrasovski



Adam Bodnar



Joanna
McGrenere



Stretch and squish navigation

lab study led to
“focus+context”
idiom
disenchantment

Jessica Dawson



Joanna
McGrenere



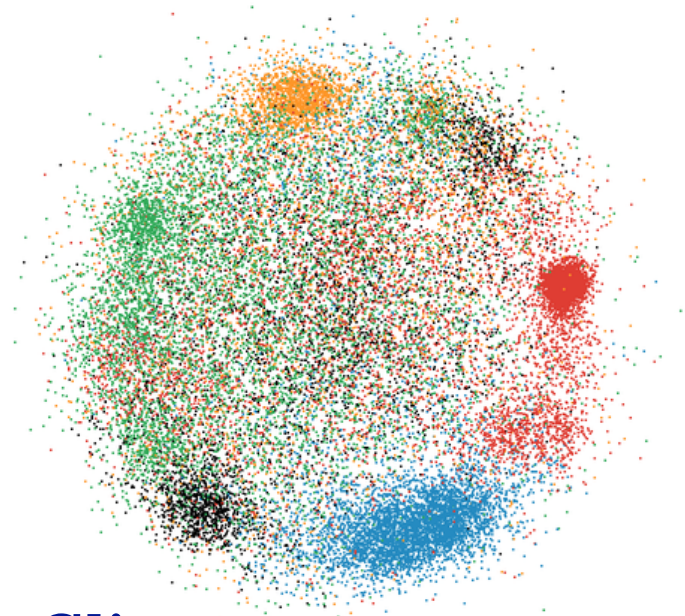
Search set model of path tracing

- 1 qualitative study: coding observational video
- 2 create & implement behavioral model
- 3 multiple regression to untangle factor relationships

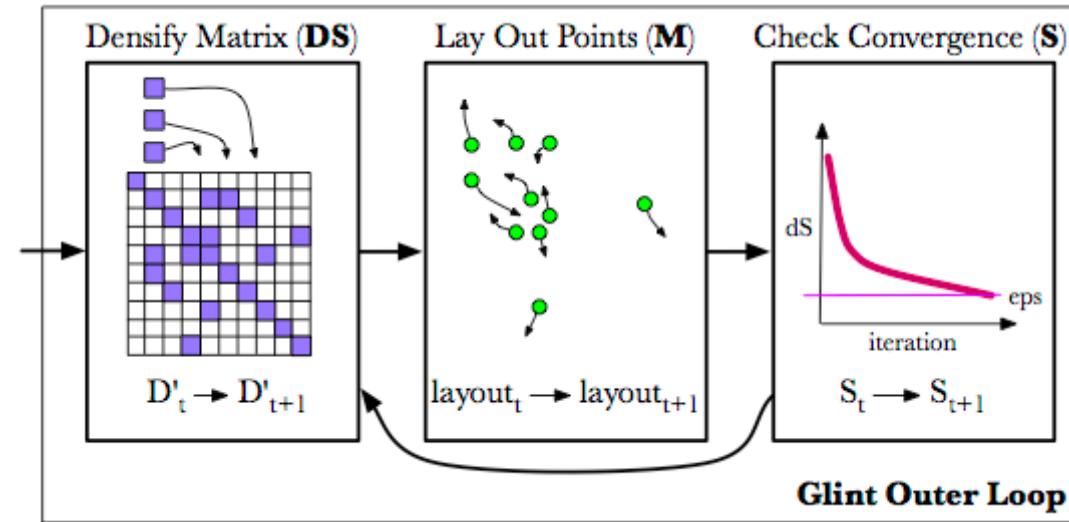
Technique-driven: Dimensionality reduction

T
F
E
P

Stephen Ingram



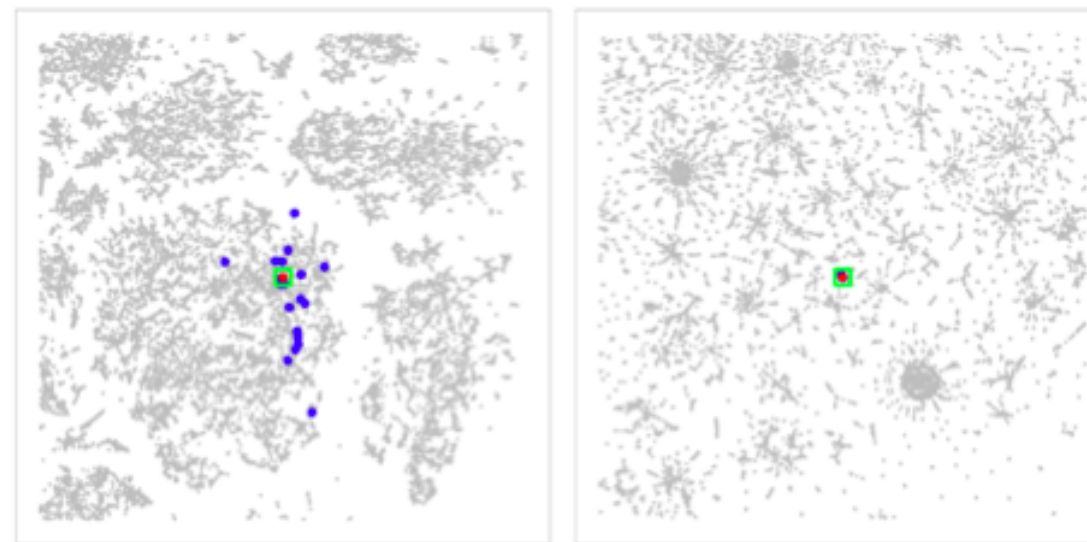
Glimmer



Glint



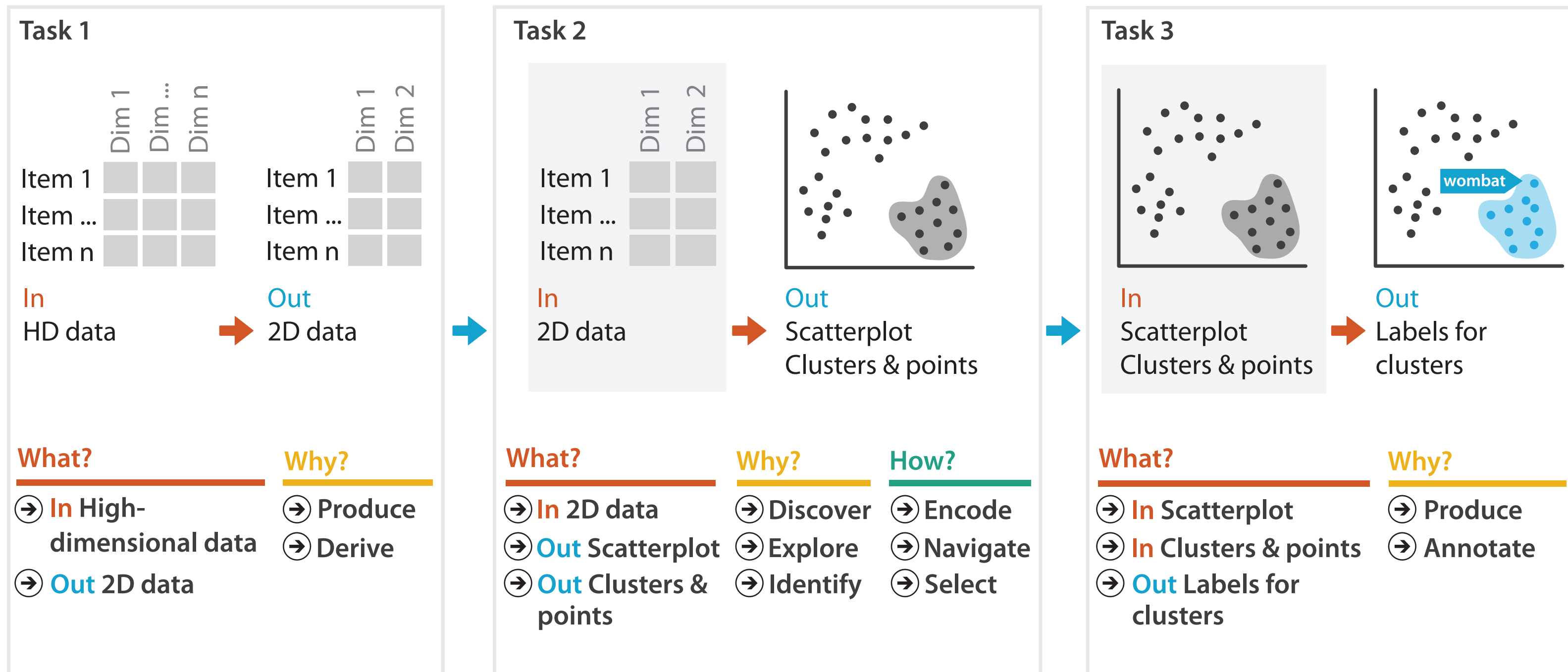
DimStiller



QSNE

Dimensionality reduction for documents

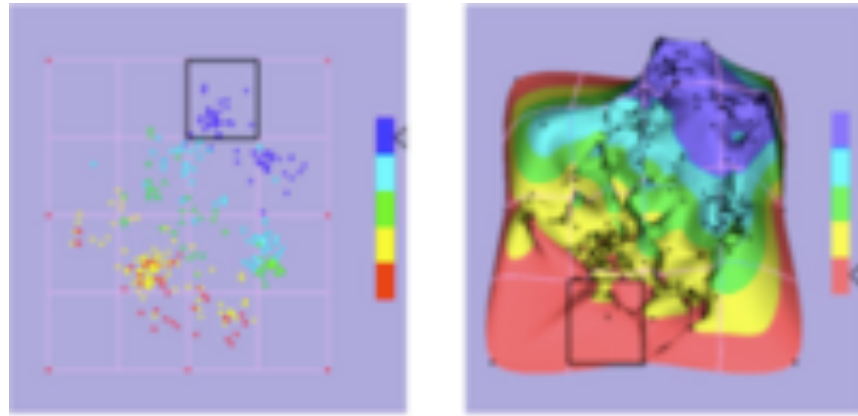
- derive low-dimensional target space from high-dimensional measured space



Evaluation experiments: Dimensionality reduction

T F E P

Melanie Tory

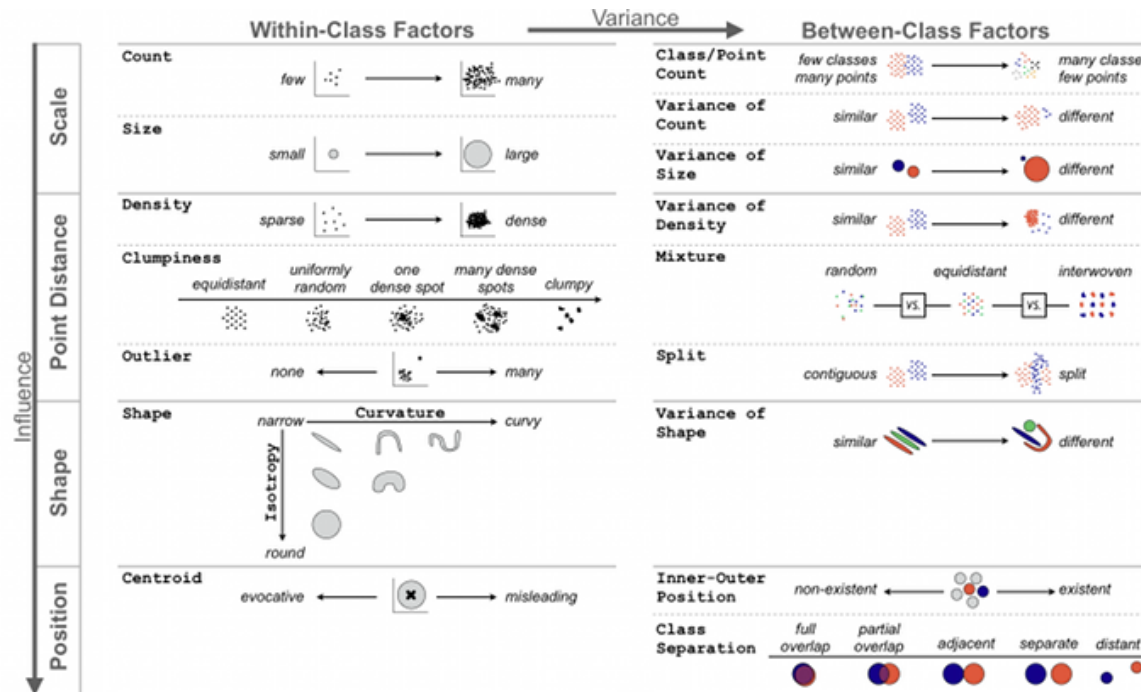


Points vs landscapes for dimensionally reduced data

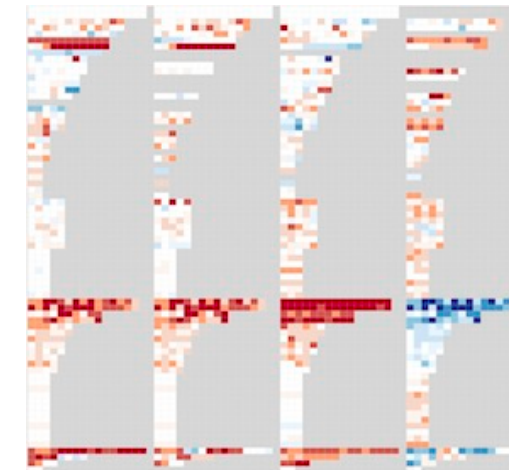
traditional user study:
many people for short time,
few datasets

data studies: many datasets, few people for
long time (experts qual+quant coding)

Michael Sedlmair Melanie Tory



Taxonomy of cluster separation factors



Guidance on DR & scatterplot choices

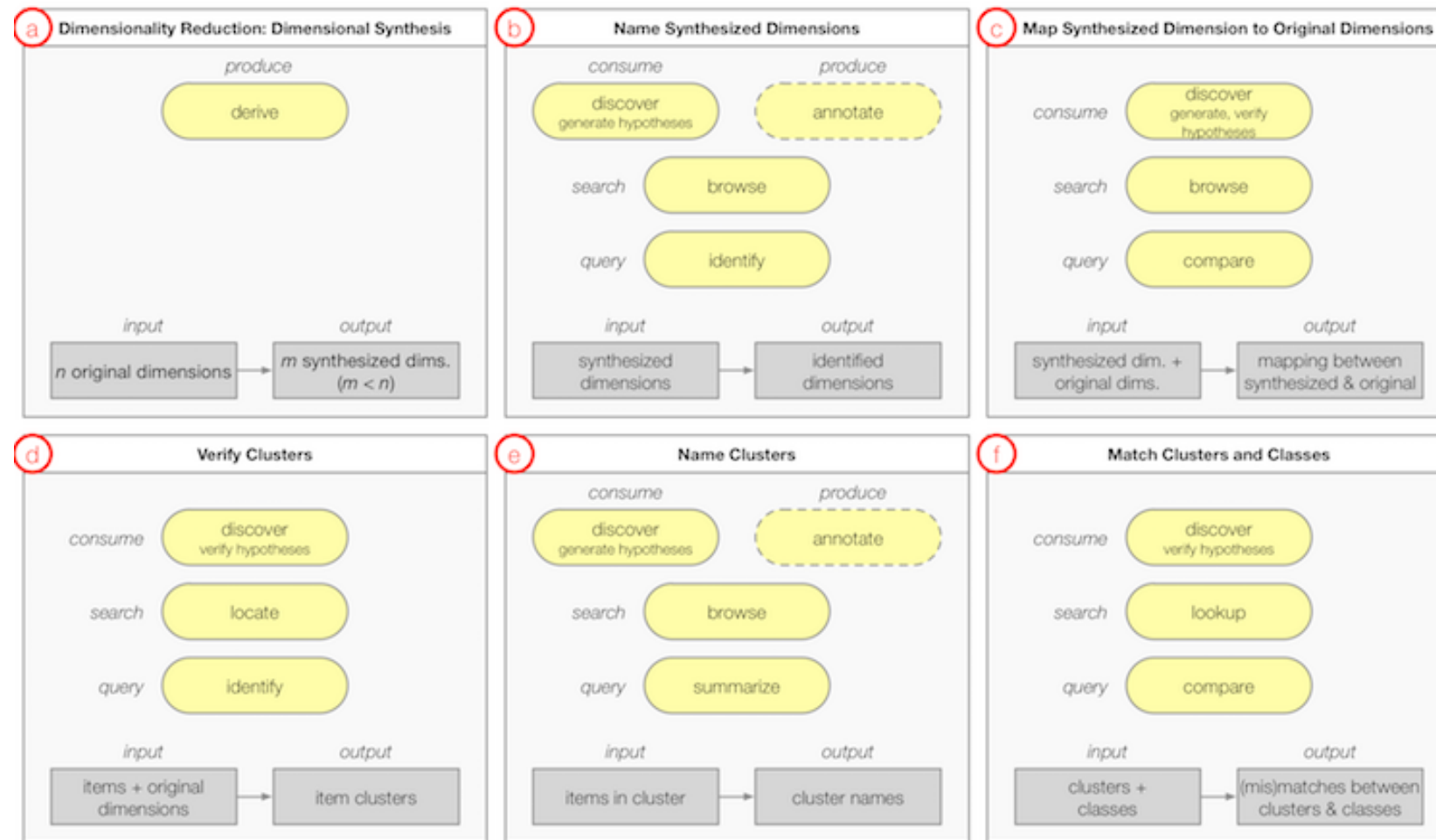
Evaluation in the field: Dimensionality reduction

T

P

F

E



DR in the Wild

interview study & qualitative coding led to task abstractions: specific to data type, agnostic to domain

Matt Brehmer Michael Sedlmair Melanie Tory Stephen Ingram



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: Genomics

T

P

F

E

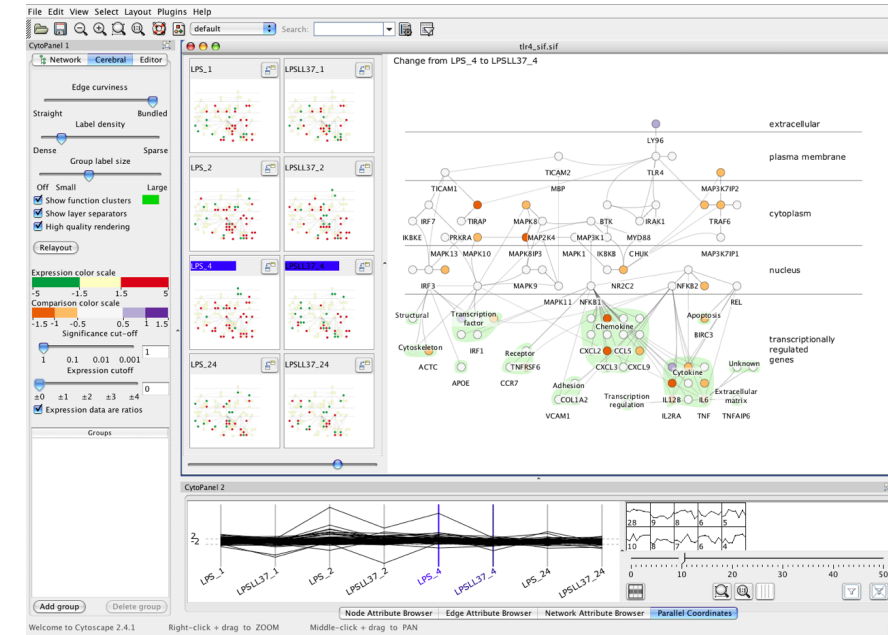
Aaron Barsky



Jenn Gardy (Microbio)



Robert Kincaid (Agilent)



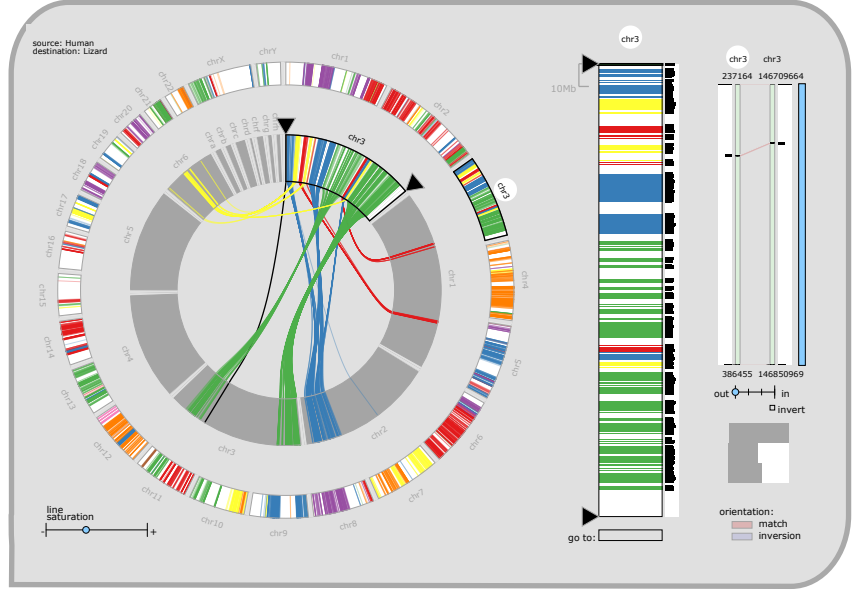
Cerebral

<https://youtu.be/76HhG1FQngl>

Miriah Meyer

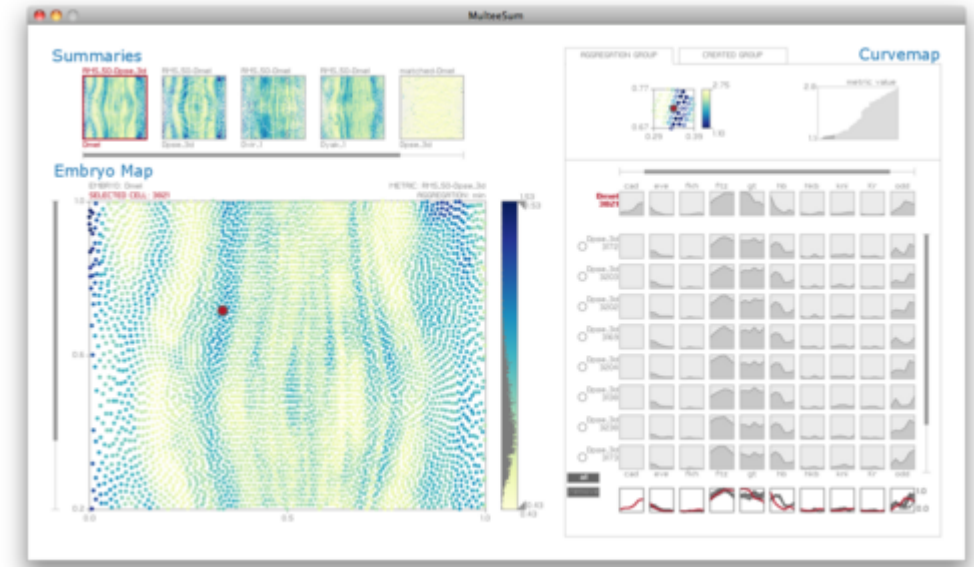


Hanspeter Pfister (Harvard)



MizBee

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



MulteeSum, Pathline

Problem-driven: Genomics, fisheries

T F P
E

Joel Ferstay



Cydney Nielsen
(BC Cancer)



Variants

Mutation Type
Reference A.A.s
Variant A.A.s



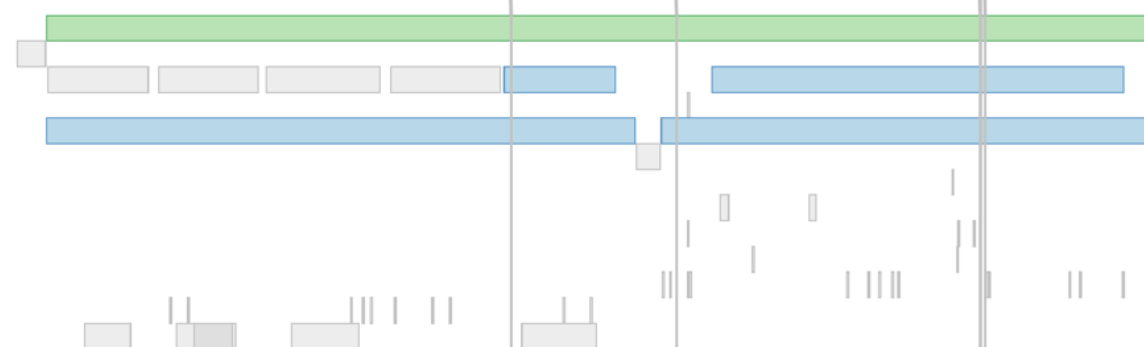
Transcript

trans-anon



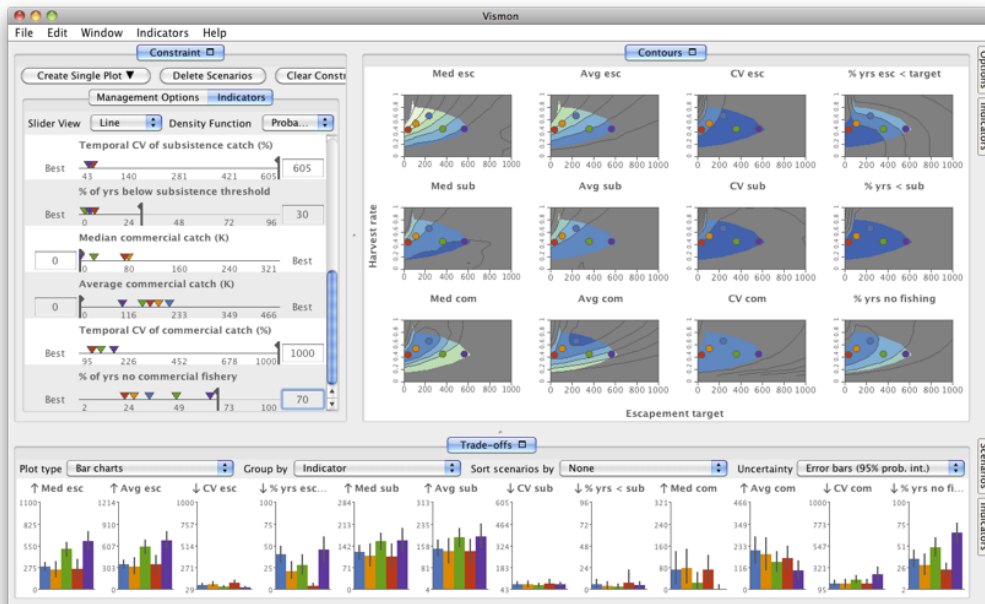
Protein

A.A. Chain
Signals
Domains
Regions
Topo. Domains
Transmem.
Active Sites
NP Binding
Metal Bind.
Bindings
Mod. Residue
Carbohydr.
Disuf.



Variant View

https://youtu.be/AHDnv_qMXxQ



Vismon <https://youtu.be/h0kHoS4VYmk>

Maryam Booshehrian



Torsten Moeller
(SFU)



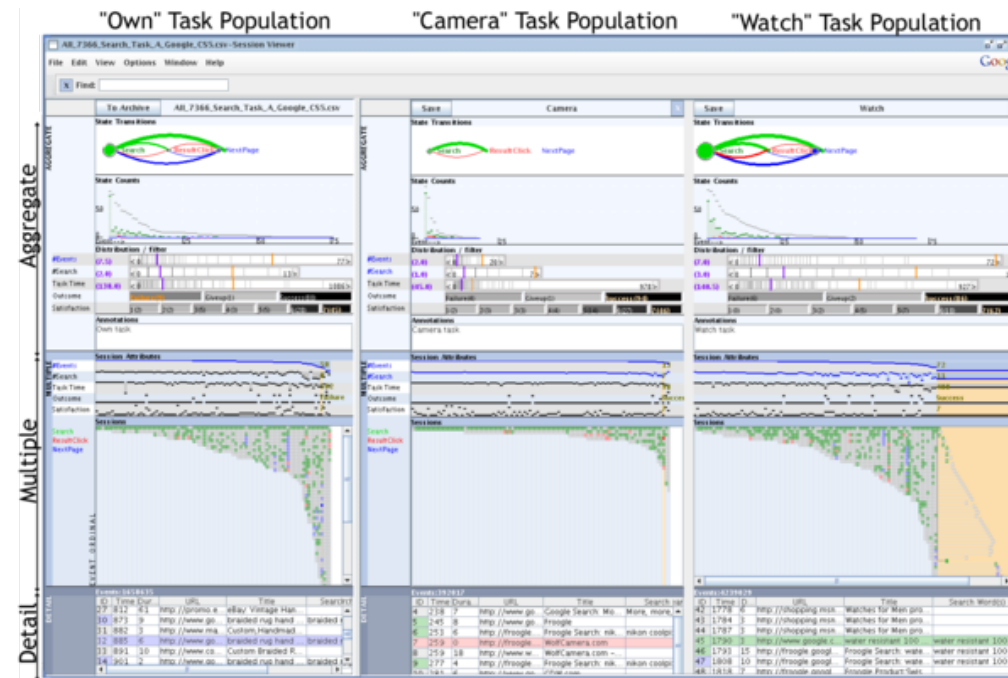
Problem-driven: Tech industry

T F E P

Heidi Lam



Diane Tang (Google)



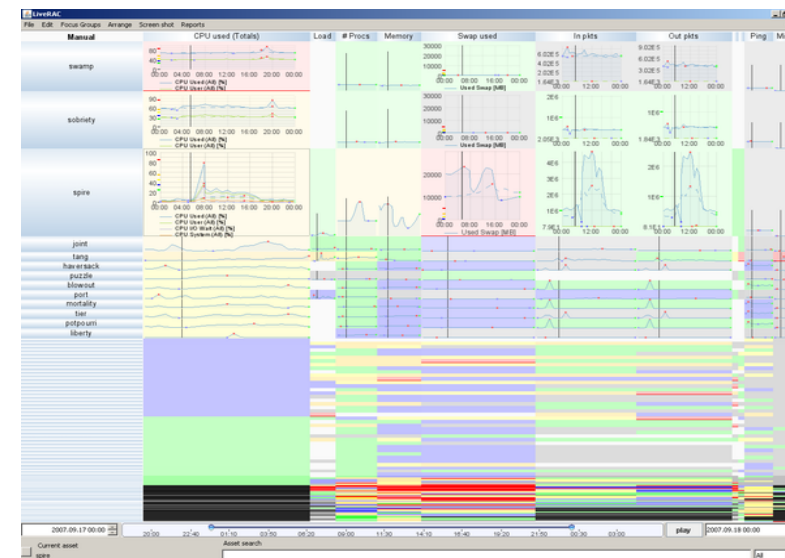
SessionViewer: web log analysis

<https://youtu.be/T4MaTZd56G4>

Peter McLachlan



Stephen North (AT&T Research)



LiveRAC: systems time-series

<https://youtu.be/ld0c3H0VSkw>

methods reflection:
staged model of access
to target users

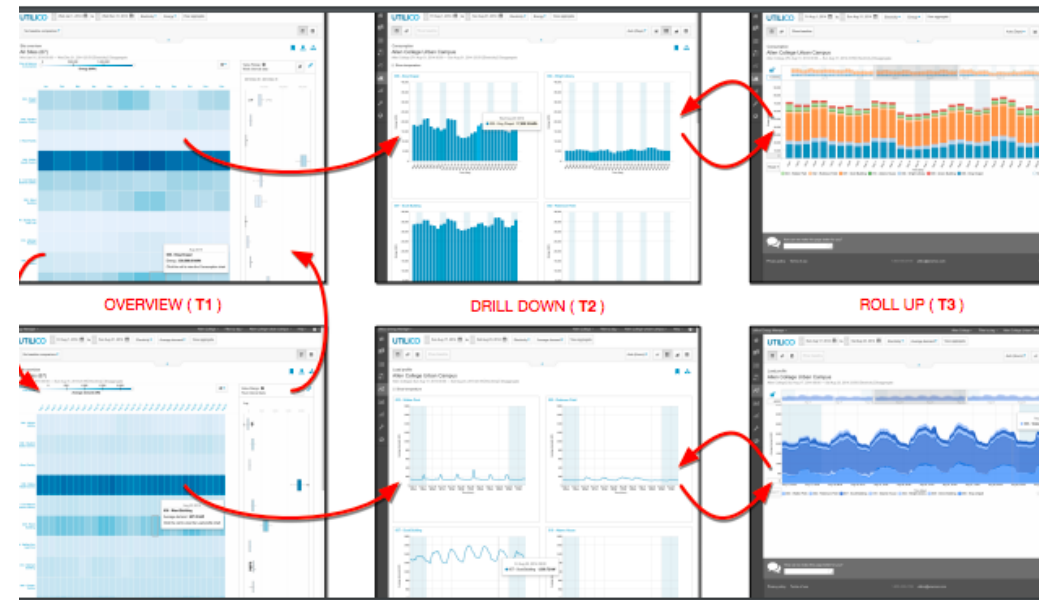
Problem-driven: Building energy mgmt, journalism

T F E P

Matt Brehmer



Kevin Tate
(Pulse/EnerNOC)



Energy Manager

redesign success:
industrial swdev
resources committed

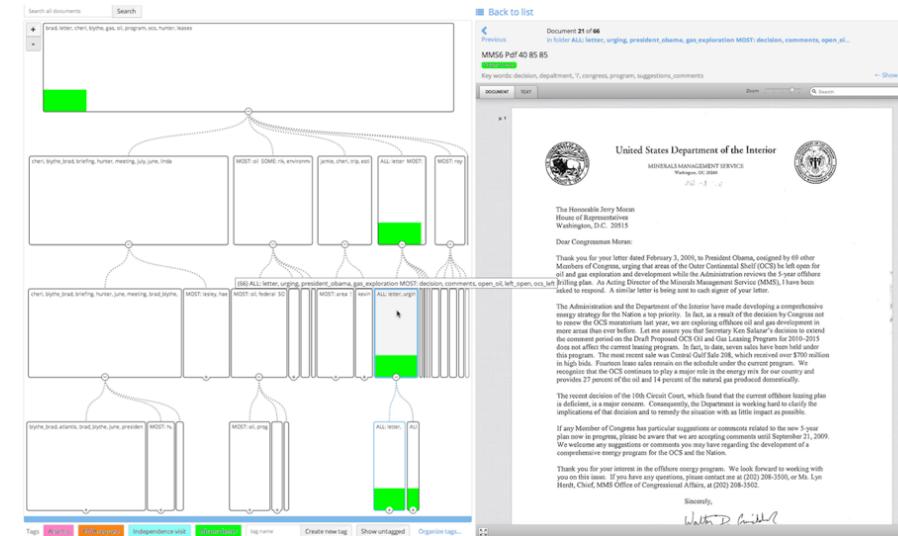
Matt Brehmer



Stephen Ingram



Jonathan Stray
(Assoc Press)



Overview

<https://vimeo.com/71483614>



Matthew Brehmer
@mattbrehmer



Stephen Ingram
@FroweFace



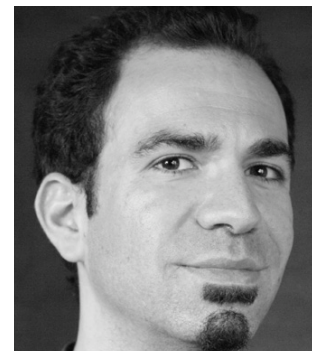
Overview

The Design, Adoption, and Analysis of a Visual Document Mining Tool For Investigative Journalists

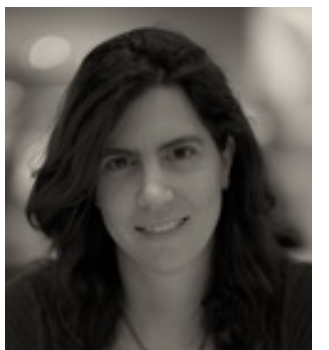
<http://www.cs.ubc.ca/labs/imager/tr/2014/Overview/>

<https://www.overviewdocs.com>

Jonathan Stray
@jonathanstray



Tamara Munzner
@tamaramunzner



Overview: The Design, Adoption, and Analysis of a Visual Document Mining Tool For Investigative Journalists. Brehmer, Ingram, Stray, and, Munzner. *IEEE Trans. Visualization and Computer Graphics (Proc. InfoVis 2014)*, 20(12):2271-2280, 2014.

From design

Case Study

#1

Document
Collection

4,500 pages
from FOIA

Question

*What did
security
contractors
do during
Iraq war?*

From design, to deploy, ...

Case Study	#1	#2	#3	#4	#5	#6
Document Collection	4,500 pages from FOIA	5,996 emails from FOIA	8,680 pages from FOIA	1,278 survey comments	4,653 emails from FOIA	1,680 bills
Question	<i>What did security contractors do during Iraq war?</i>	<i>Were municipal police funds mismanaged?</i>	<i>Were Paul Ryan's campaign statements hypocritical?</i>	<i>What is the gun ownership debate about?</i>	<i>Was gov't response to emergency incident effective?</i>	<i>Did gov't fail to pass bills addressing police misconduct?</i>

... to redesign, to reflect on task abstractions...

Case Study	#1	#2	#3	#4	#5	#6
Document Collection	4,500 pages from FOIA	5,996 emails from FOIA	8,680 pages from FOIA	1,278 survey comments	4,653 emails from FOIA	1,680 bills
Question	<i>What did security contractors do during Iraq war?</i>	<i>Were municipal police funds mismanaged?</i> find the needle in the haystack	<i>Were Paul Ryan's campaign statements hypocritical?</i>	<i>What is the gun ownership debate about?</i>	<i>Was gov't response to emergency incident effective?</i>	<i>Did gov't fail to pass bills addressing police misconduct?</i> prove haystack contains no needles!

*Overview:
The Design, Adoption, and Analysis of a
Visual Document Mining Tool
For Investigative Journalists
IEEE InfoVis '14*

THOUSANDS OF DOCUMENTS

M. Brehmer¹, S. Ingram¹,
J. Stray², & T. Munzner¹

¹University of British Columbia:
{brehmer,sfingram,tmm}@cs.ubc.ca

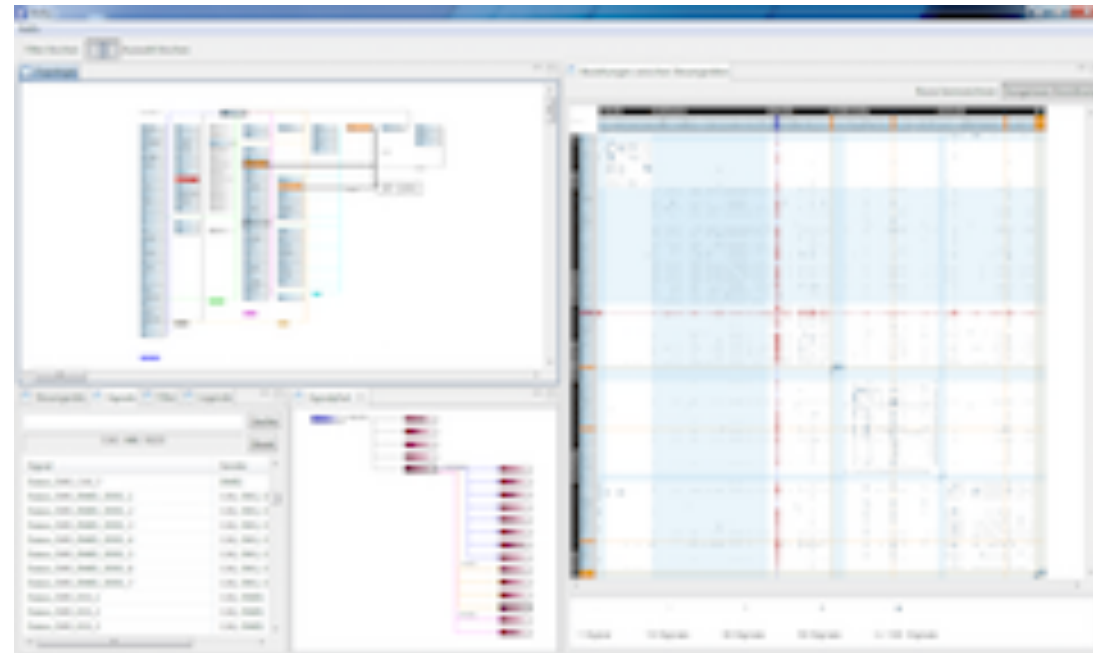
²Columbia Journalism School &
Associated Press:
jonathanstray@gmail.com

images: wikimedia commons

Problem-driven: In-car networks, e-commerce

T
F
E
P

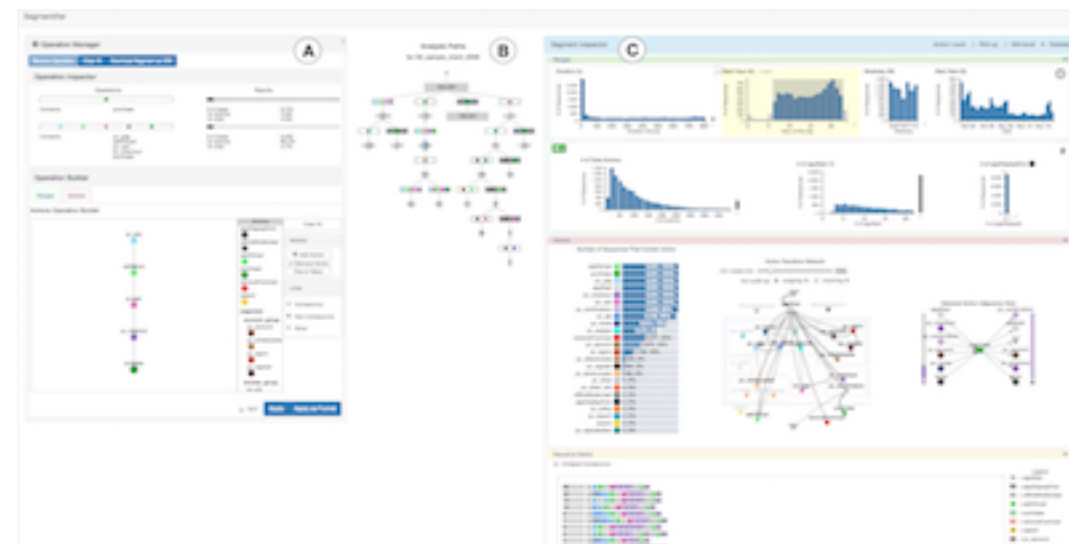
Michael Sedlmair



RelEx (BMW)

<https://youtu.be/89lsQXc6Ao4>

Kim Dextras-Romagnino



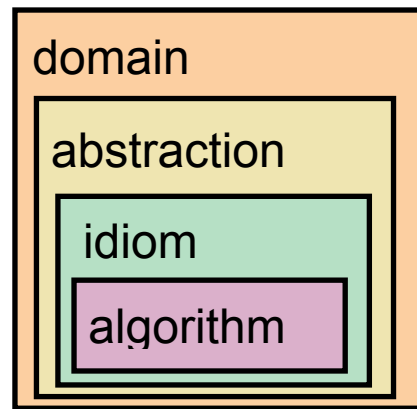
latest work: Segmentifier
(Mobify): e-commerce clickstreams

sneak preview video

Segmentifier: Interactively Refining Clickstream Data into Actionable Segments

Theoretical foundations: Methodology

T F E P

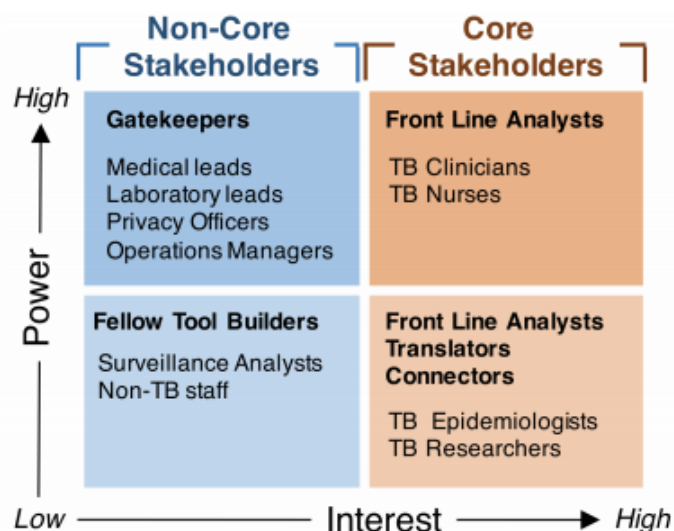


Nested Model

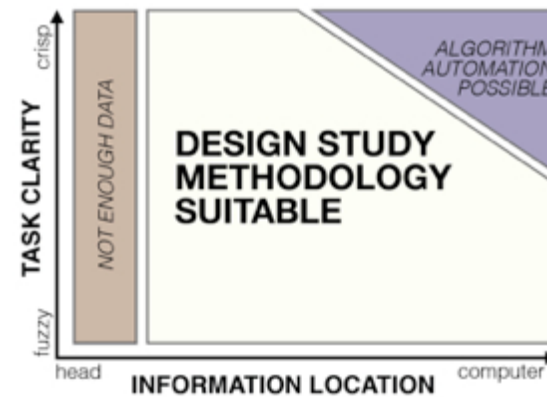
- Visual Encoding Pitfalls
 - Unjustified Visual Encoding
 - Hammer In Search Of Nail
 - 2D Good, 3D Better
 - Color Cacophony
 - Rainbows Just Like In The Sky
- Strategy Pitfalls
 - What I Did Over My Summer
 - Least Publishable Unit
 - Dense As Plutonium
 - Bad Slice and Dice

Papers Process & Pitfalls

Anamaria Crisan



Regulatory & Organizational Constraints



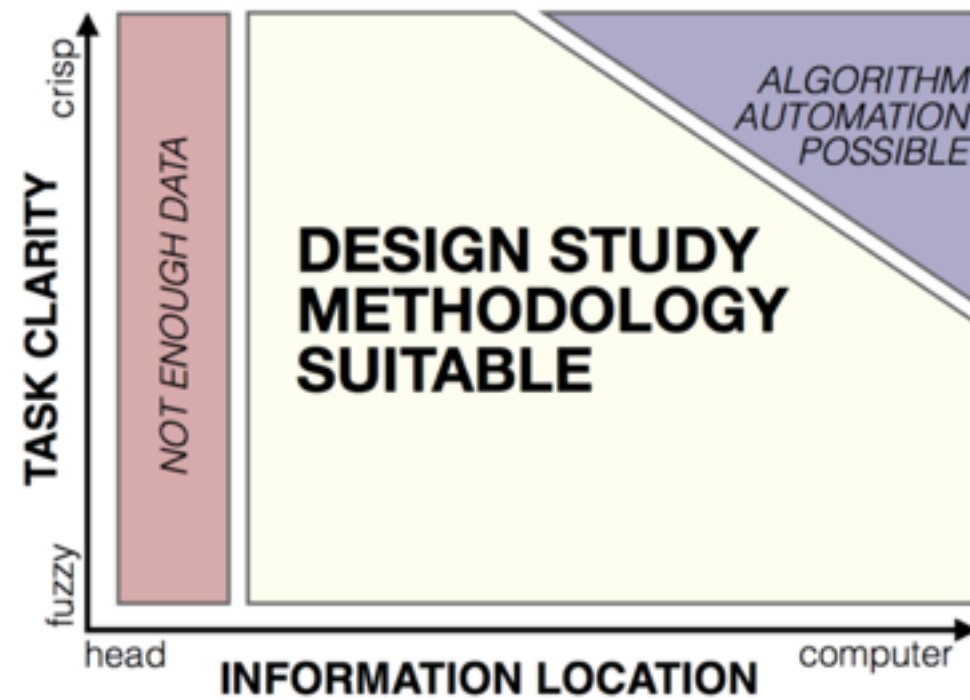
Design Study Methodology

Michael Sedlmair



Miriah Meyer





Design Study Methodology

Reflections from the Trenches and from the Stacks

<http://www.cs.ubc.ca/labs/imager/tr/2012/dsm/>

Michael Sedlmair



Miriah Meyer

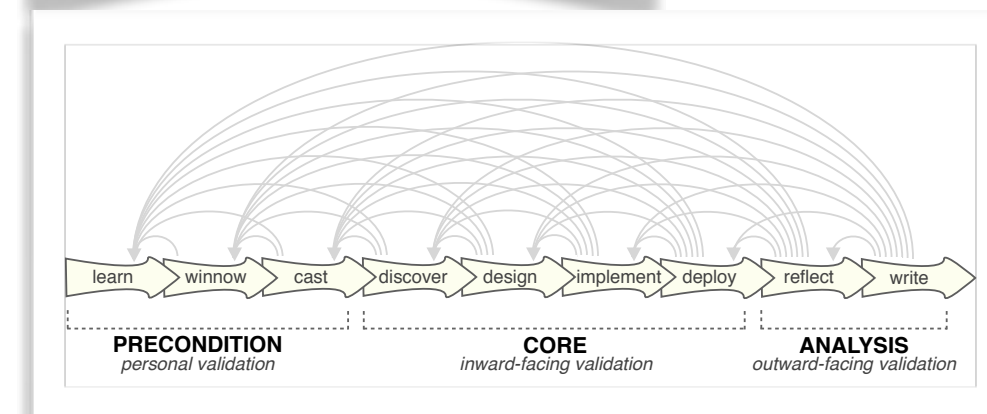
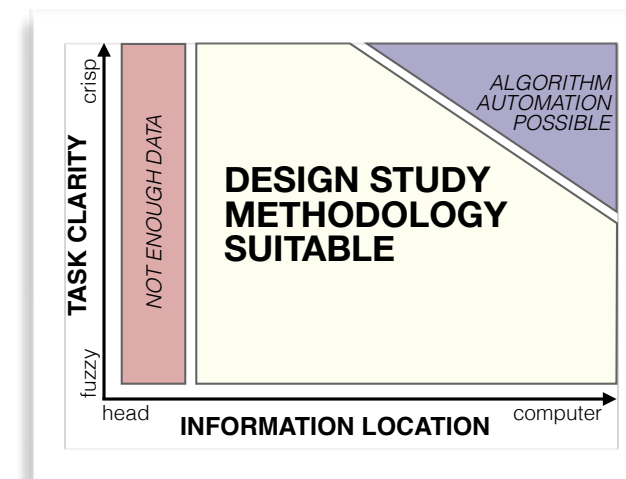


Tamara Munzner
@tamaramunzner



Methodology for problem-driven work

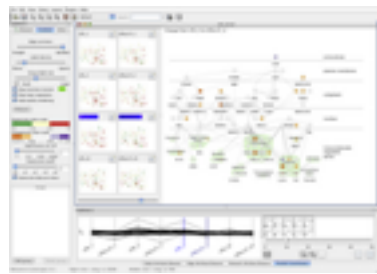
- definitions
- 9-stage framework
- 32 pitfalls & how to avoid them
- comparison to related methodologies



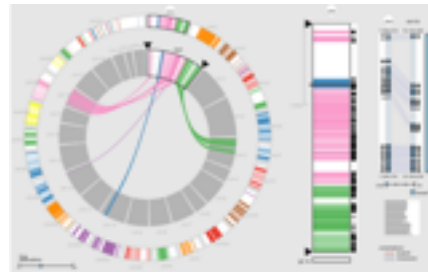
PF-1	premature advance: jumping forward over stages	general
PF-2	premature start: insufficient knowledge of vis literature	learn
PF-3	premature commitment: collaboration with wrong people	winnow
PF-4	no real data available (yet)	winnow
PF-5	insufficient time available from potential collaborators	winnow
PF-6	no need for visualization: problem can be automated	winnow
PF-7	researcher expertise does not match domain problem	winnow
PF-8	no need for research: engineering vs. research project	winnow
PF-9	no need for change: existing tools are good enough	winnow



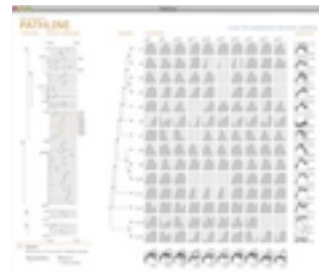
Lessons learned from the trenches: 21 between us



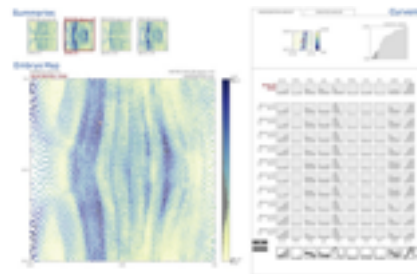
Cerebral
genomics



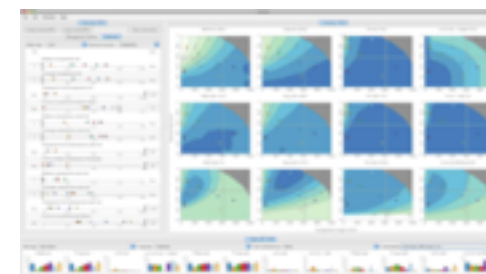
MizBee
genomics



Pathline
genomics



MulteeSum
genomics



Vismon
fisheries management



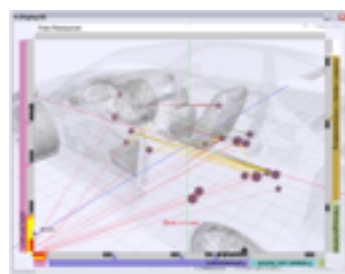
QuestVis
sustainability



WiKeVis
in-car networks



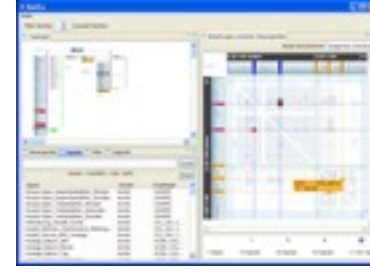
MostVis
in-car networks



Car-X-Ray
in-car networks



ProgSpy2010
in-car networks



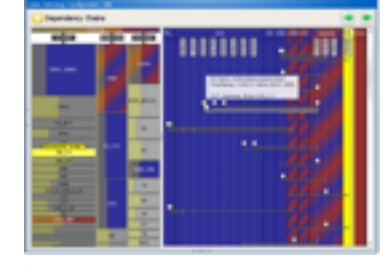
ReEx
in-car networks



Cardiogram
in-car networks



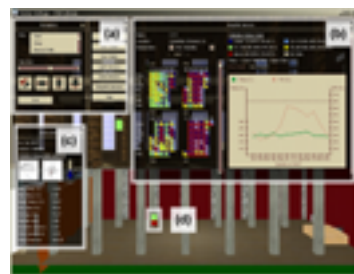
AutobahnVis
in-car networks



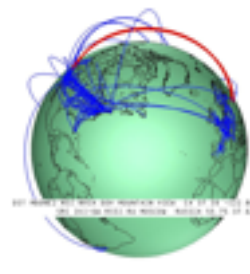
VisTra
in-car networks



Constellation
linguistics



LibVis
cultural heritage



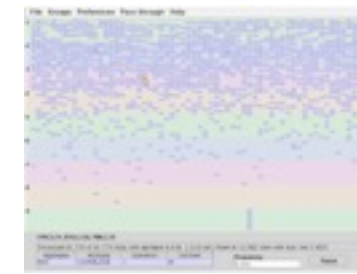
Caidants
multicast



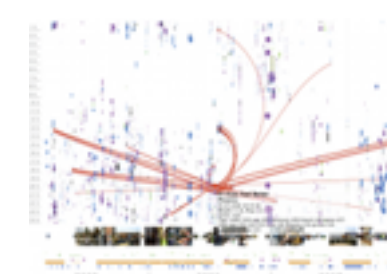
SessionViewer
web log analysis



LiveRAC
server hosting

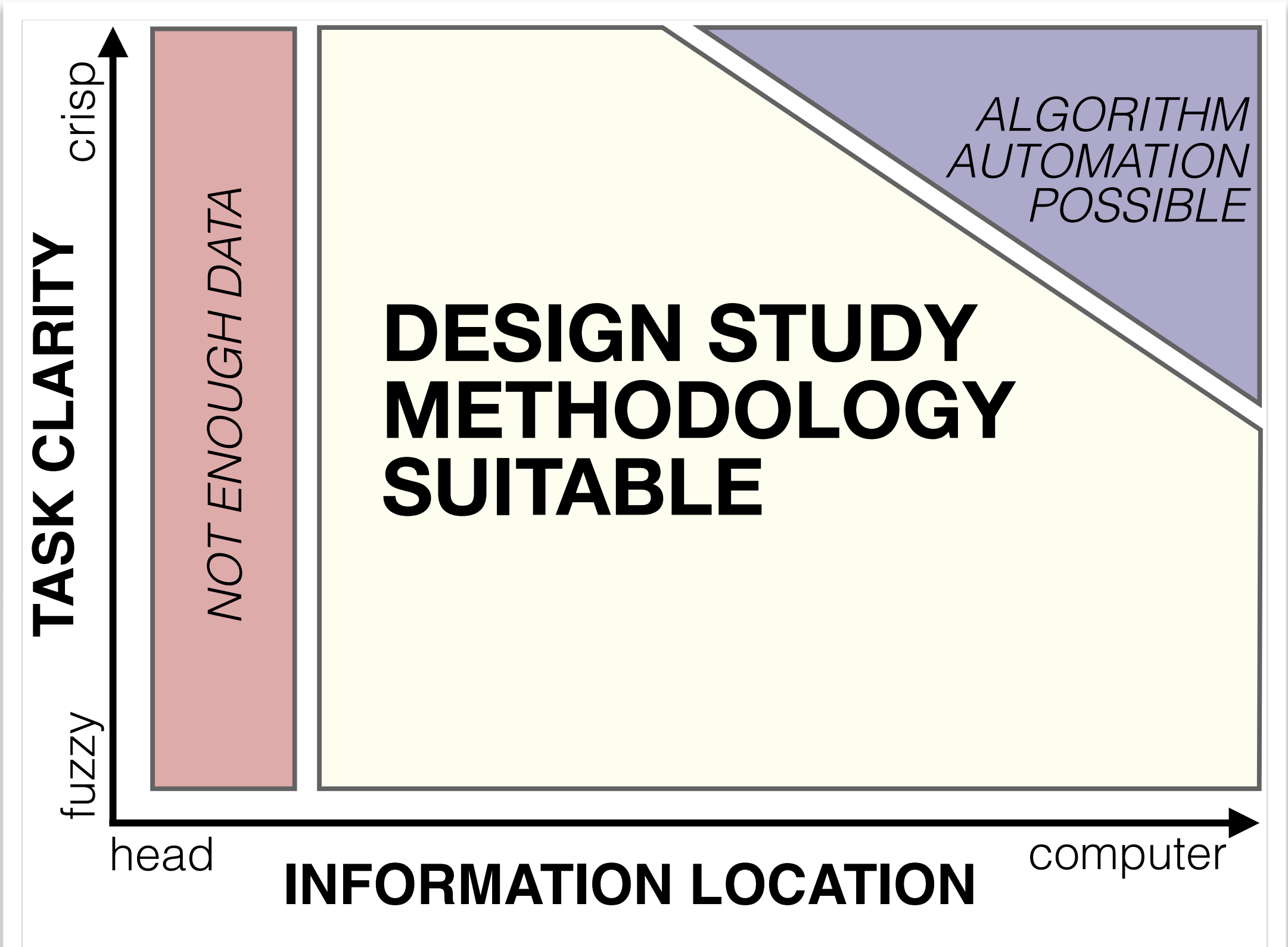


PowerSetViewer
data mining

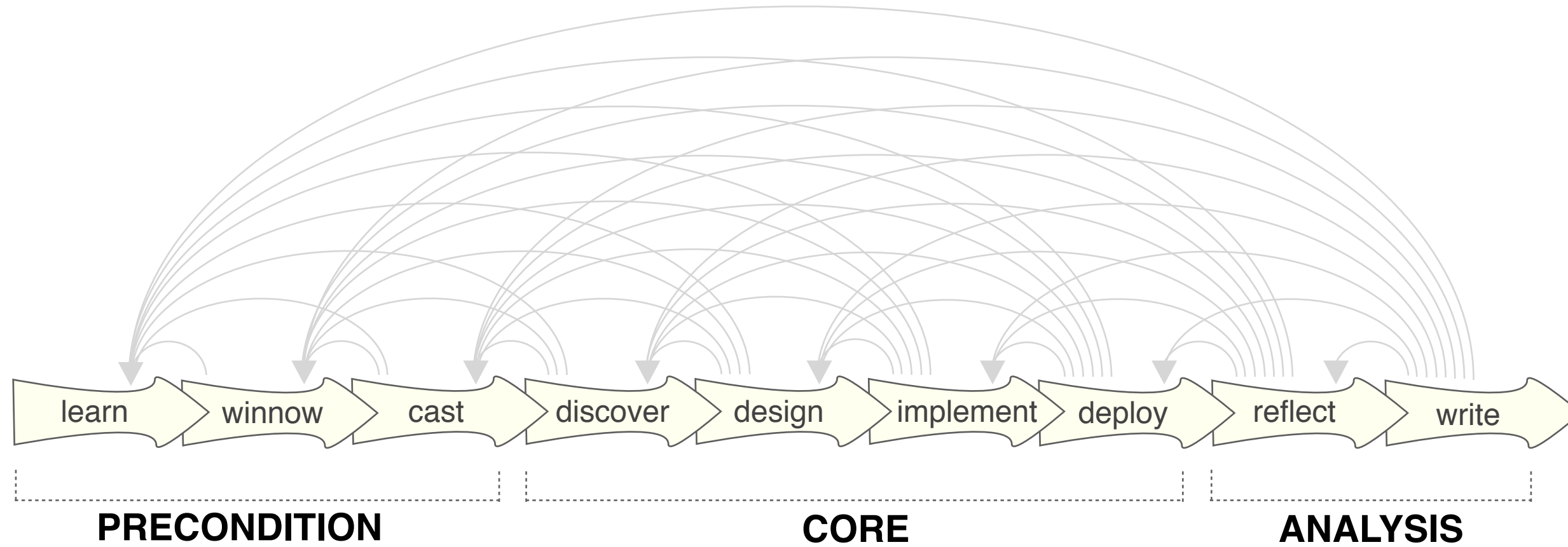


LastHistory
music listening

Design study methodology: definitions

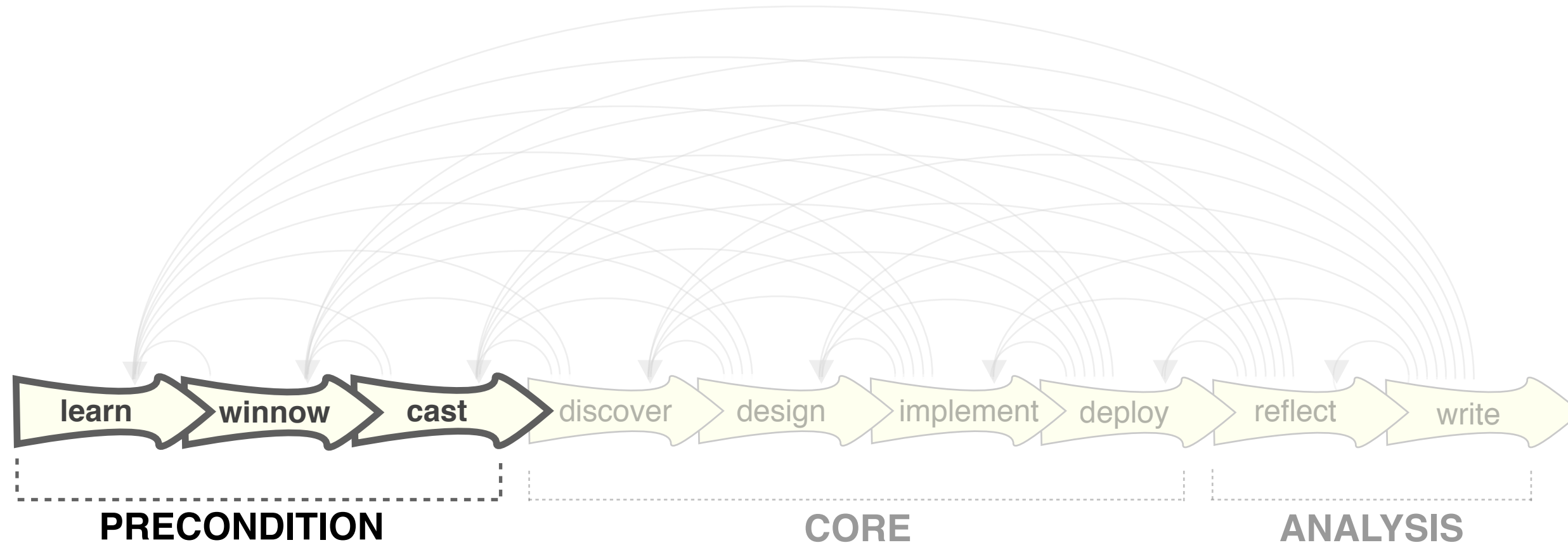


9 stage framework



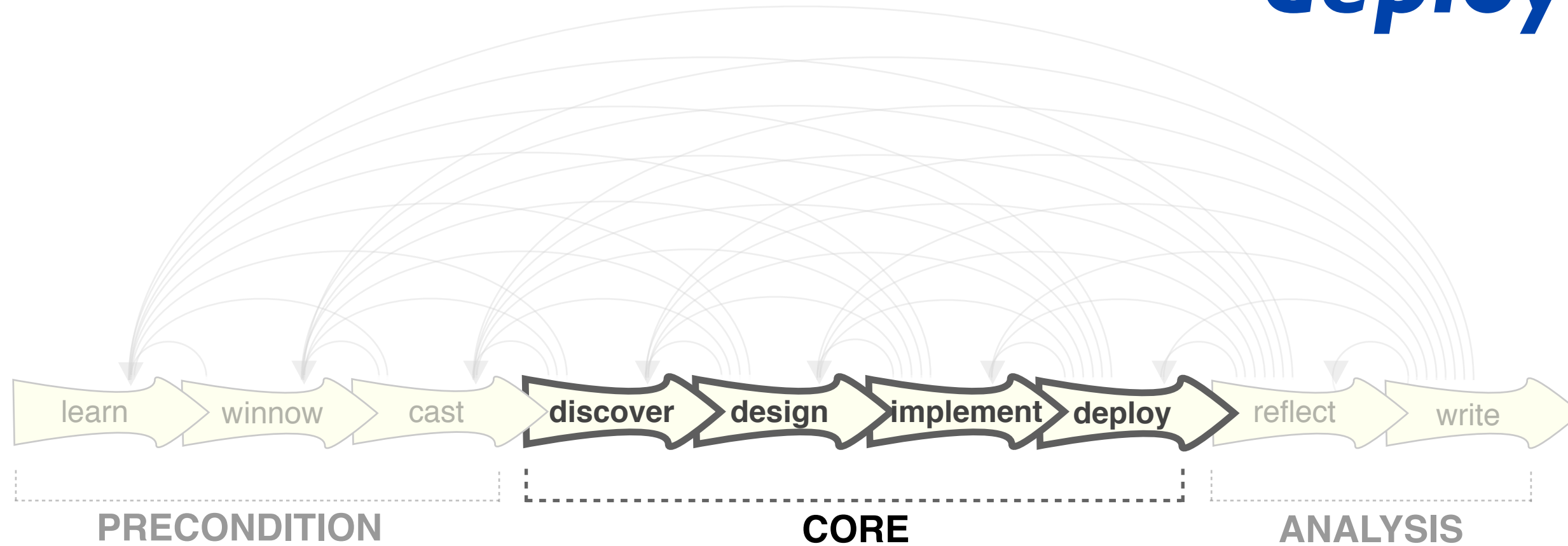
9-stage framework

learn
winnow
cast



9-stage framework

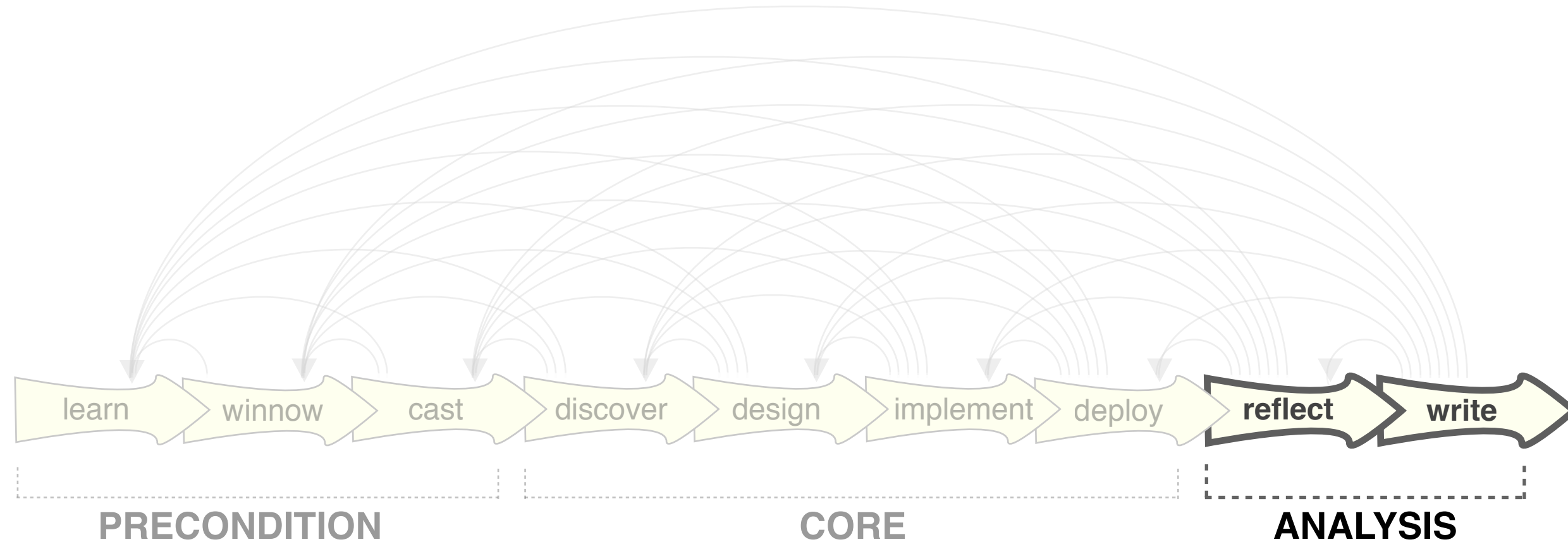
discover
design
implement
deploy



9-stage framework

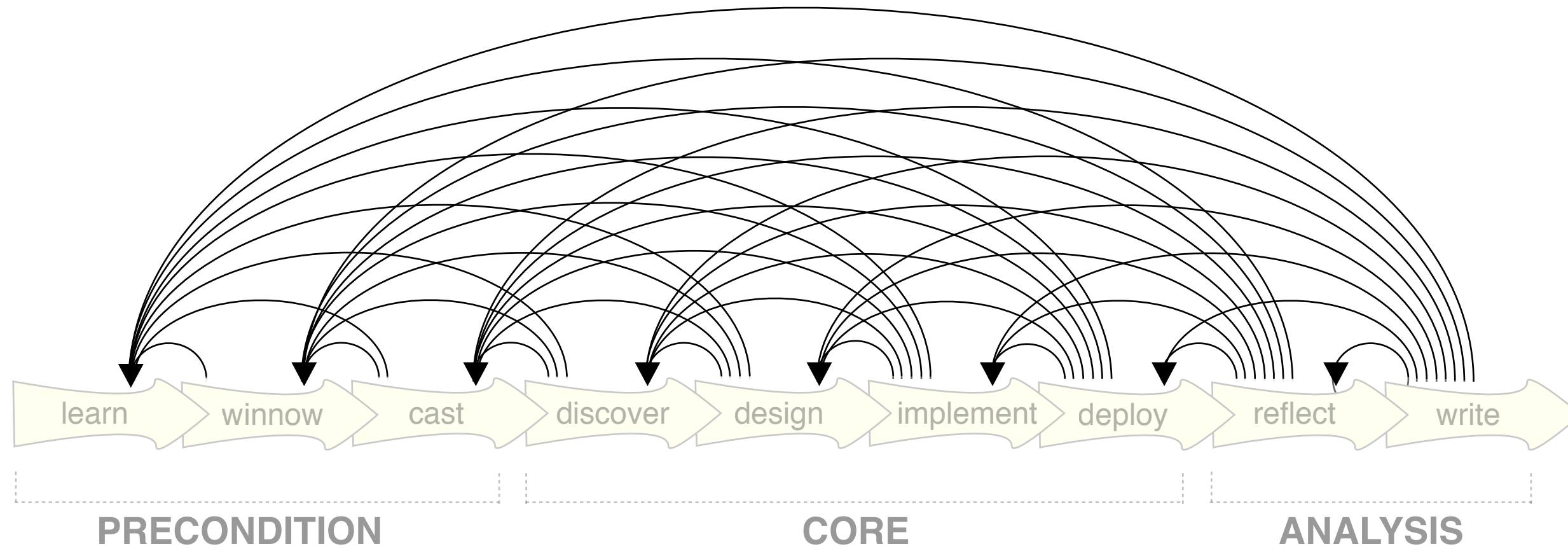
- guidelines: confirm, refine, reject, propose

reflect
write



9-stage framework

iterative



Design study methodology: 32 pitfalls

- and how to avoid them

PF-1	premature advance: jumping forward over stages	general
PF-2	premature start: insufficient knowledge of vis literature	learn
PF-3	premature commitment: collaboration with wrong people	winnow
PF-4	no real data available (yet)	winnow
PF-5	insufficient time available from potential collaborators	winnow
PF-6	no need for visualization: problem can be automated	winnow
PF-7	researcher expertise does not match domain problem	winnow
PF-8	no need for research: engineering vs. research project	winnow
PF-9	no need for change: existing tools are good enough	winnow

I'm a domain expert!
Wanna collaborate?



COLLABORATOR

Of course!!!



MR. VIS

considerations



Have **data**?
Have **time**?
Have **need**?
...



Design study methodology: 32 pitfalls

PF-21	mistaking technique-driven for problem-driven work	design
PF-22	nonrapid prototyping	implement
PF-23	usability: too little / too much	implement
PF-24	premature end: insufficient deploy time built into schedule	deploy
PF-25	usage study not case study: non-real task/data/user	deploy
PF-26	<i>liking</i> necessary but not sufficient for validation	deploy
PF-27	failing to improve guidelines: confirm, refine, reject, propose	reflect
PF-28	insufficient writing time built into schedule	write
PF-29	no technique contribution \neq good design study	write
PF-30	too much domain background in paper	write
PF-31	story told chronologically vs. focus on final results	write
PF-32	premature end: win race vs. practice music for debut	write

METAPHOR

Horse Race vs. Music Debut

Must be first!



technique-driven

Am I ready?

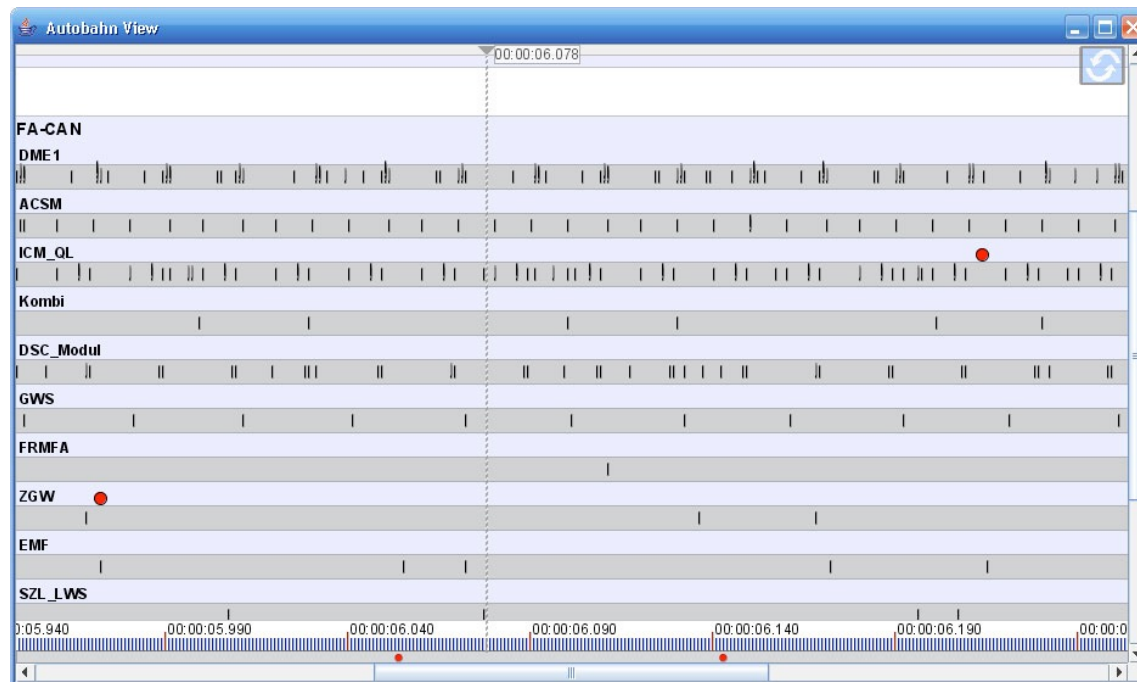


problem-driven

EXAMPLE FROM THE TRENCHES

Don't step on your own toes!

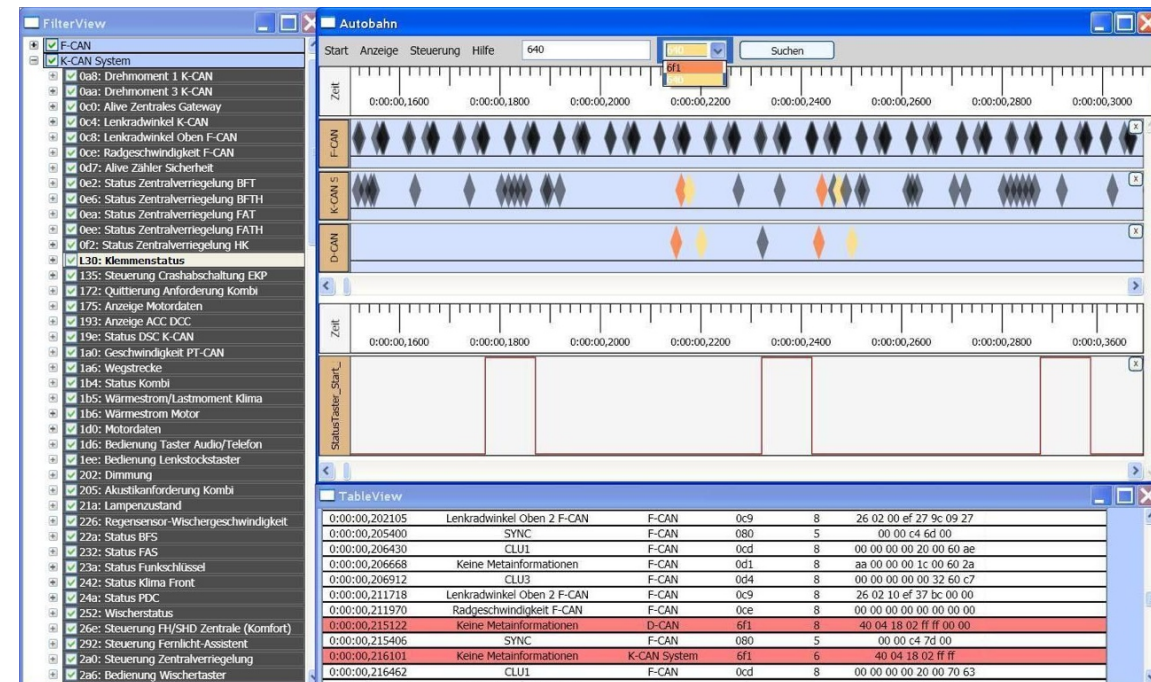
First design round published



AutobahnVis 1.0

[Sedlmair et al., Smart Graphics, 2009]

Subsequent work not stand-alone paper



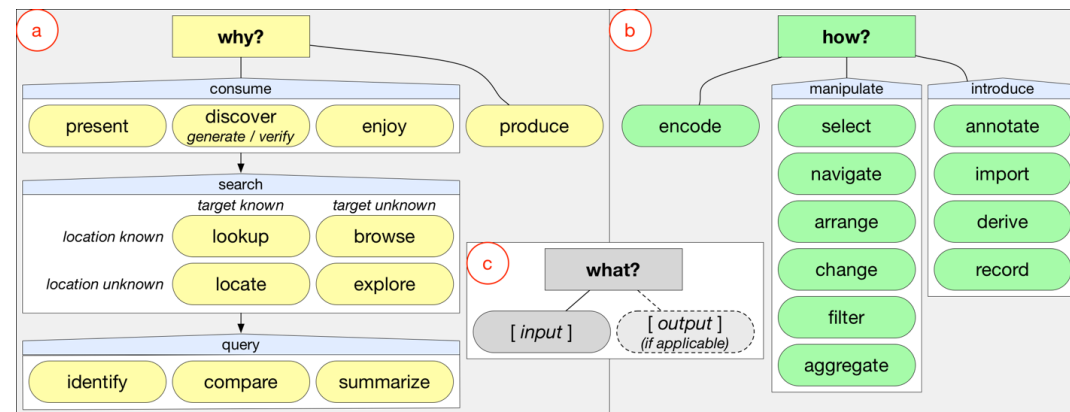
AutobahnVis 2.0

[Sedlmair et al., Information Visualization 10(3), 2011]

Theoretical foundations: Typologies

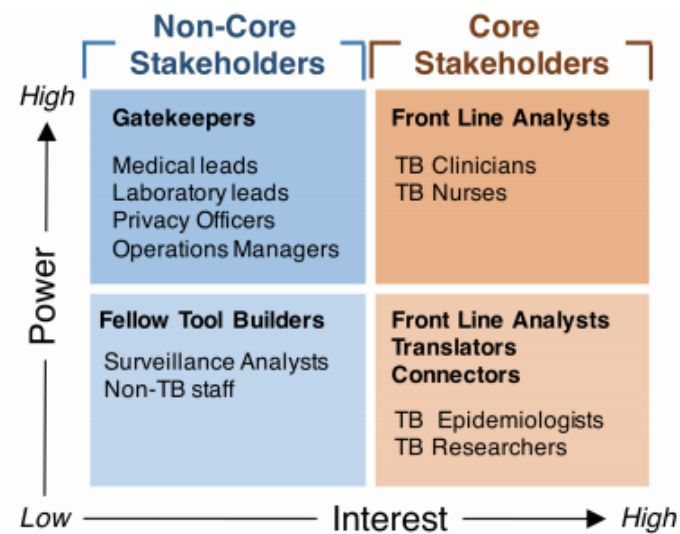
T F E P

Matt Brehmer

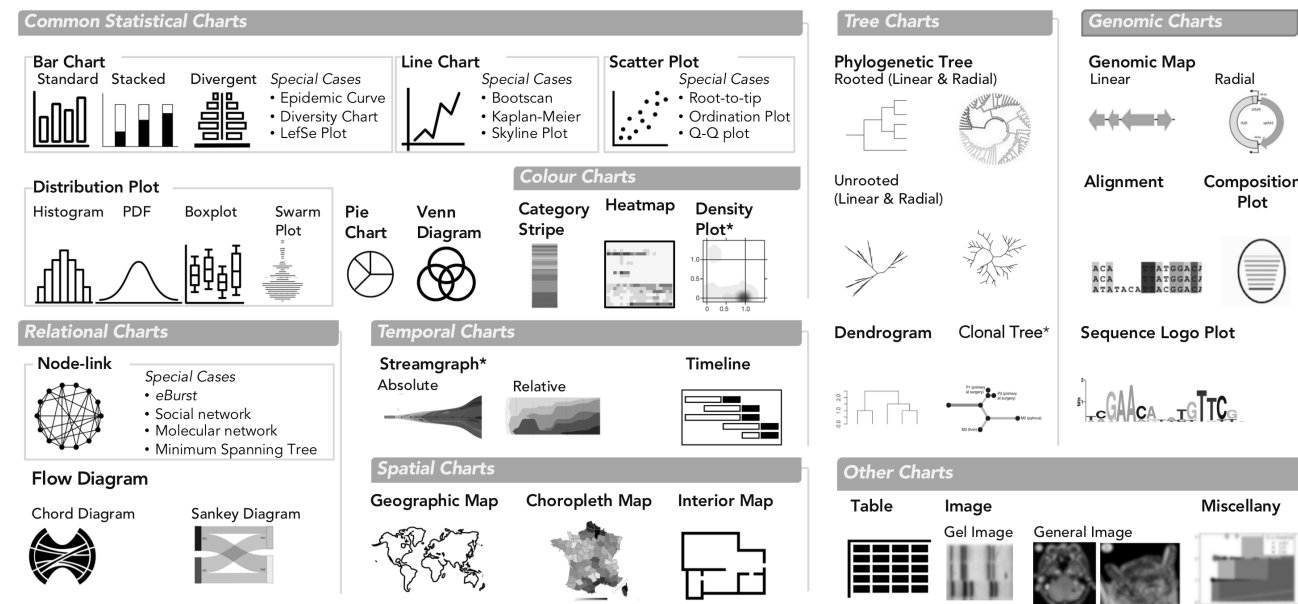


Abstract Tasks

Anamaria Crisan

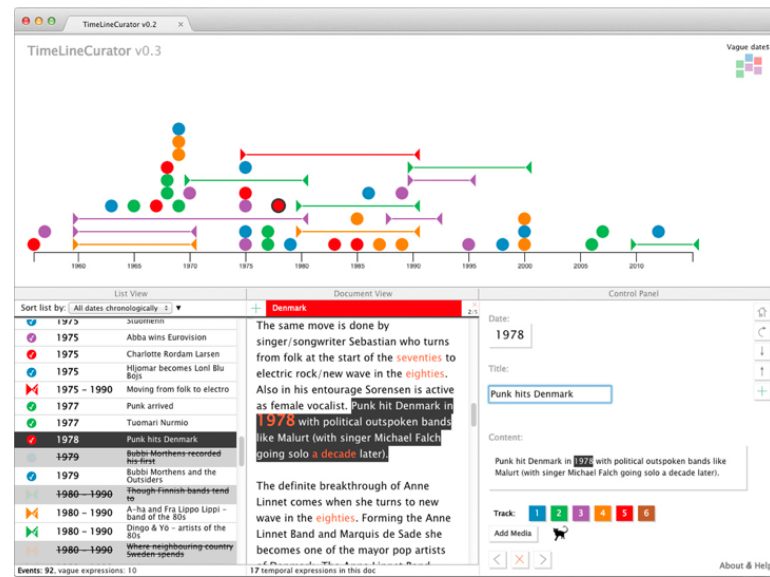
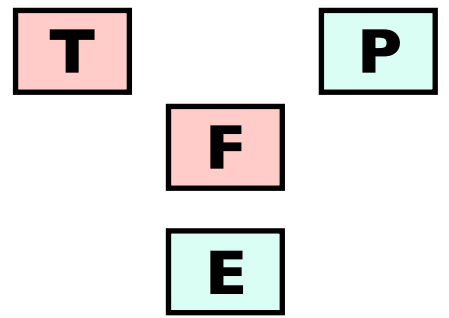


Regulatory & Organizational Constraints



GEViT: Genomic Epidemiology Visualization Typology

Curation & Presentation: Timelines



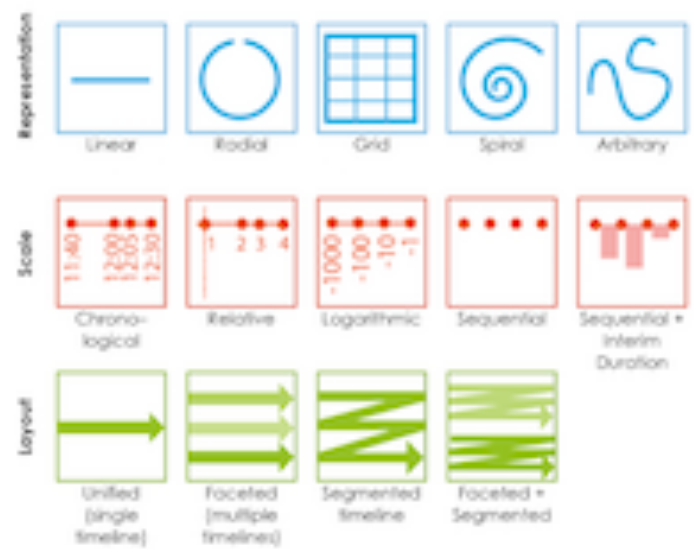
TimeLineCurator

<https://vimeo.com/123246662>

Matt Brehmer



**Johanna Fulda
(Sud. Zeitung)**



Timelines Revisited

timelinesrevisited.github.io/

Matt Brehmer



**Bongshin Lee
(Microsoft)**

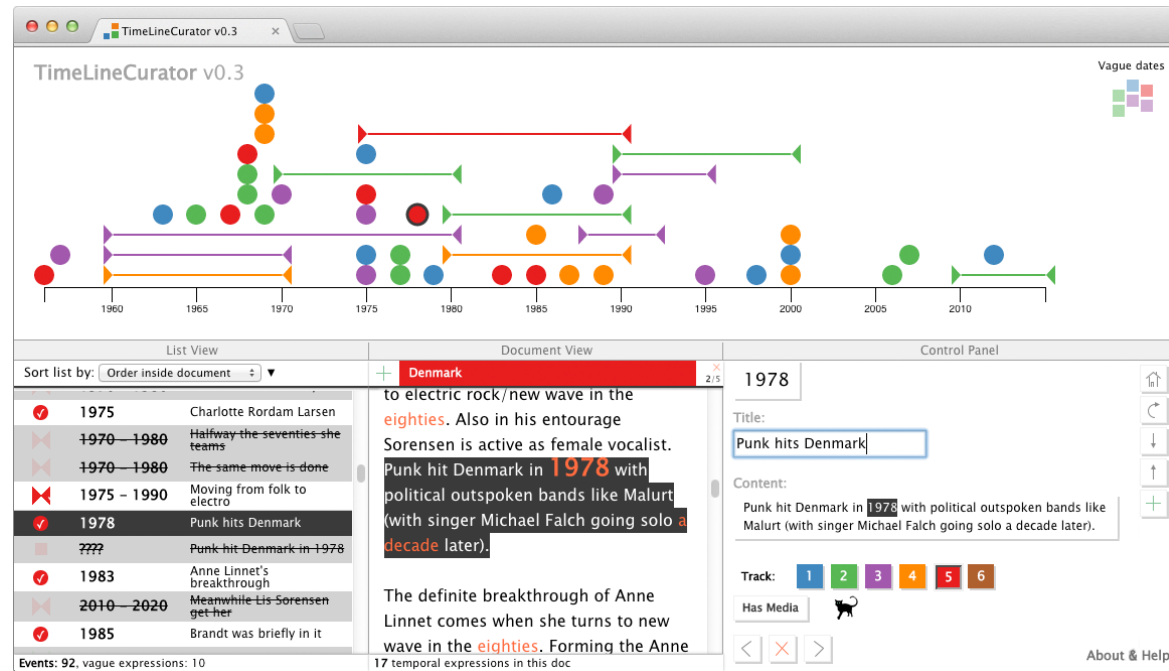


**Benjamin Bach
(Microsoft)**



Nathalie Henry-Riche





Johanna Fulda
@jofu_



Matthew Brehmer
@mattbrehmer



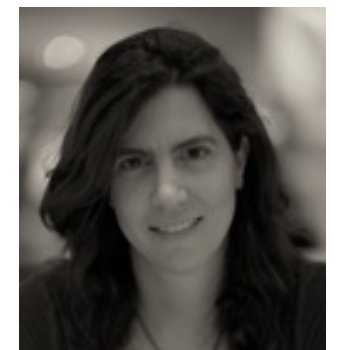
TimeLineCurator

Interactive Authoring of Visual Timelines from Unstructured Text

<http://about.timelinecurator.org>

<http://timelinecurator.org>

Tamara Munzner
@tamaramunzner



TimeLineCurator: Interactive Authoring of Visual Timelines from Unstructured Text.
Fulda, Brehmer, Munzner. *IEEE Trans. Visualization and Computer Graphics (Proc IEEE VAST 2015)* 22(1):300-309, 2015.

TimeLineCurator

visual & browser-based

<https://vimeo.com/jofu/tlc>

Manual creation process



Timeline:

- 1868 The Typewriter: Invented by Christopher Sholes, typewriters quickly became indispensable tools for practically all writing other than personal correspondence. They were widely used by professional writers, in offices, and for business correspondence in private homes.
- 1897 The Mouse: Some additional information here.
- 1977 The Mouse: Some additional information here.
- 1986 The Mouse: Some additional information here.
- 1997 The Stylus: a small pen-shaped instrument that is used to input commands to a computer screen, mobile device or graphics tablet.
- 2007 Multi Touch: With the start of iPhones Multi-touch became a thing.
- 2012 Speech Recognition: *3D Touch has to be mentioned here, since it's the new shit*

Handwritten Notes on Paper:

- we only have 2 columns for this piece*
- Why is there such a big gap that wastes whitespace and we only have 2 columns*
- can we not have so much whitespace here?*
- was there nothing else happening in the time between Mouse and Stylus?!*
- has to be mentioned here, since it's the new shit*
- 3D Touch*
- Handwritten labels: Christopher Sholes, Douglas C. Engelbart, 1868, Type writer, Mouse, + One Button Computer, Stylus, Multi touch, Speech Recognition.

Articles and Patents:

- Mighty Mouse:** In 1980, Apple Computer asked a group of guys fresh from Stanford's product design program to take a \$400 device and make it mass-producible, reliable and cheap. Their work transformed personal computing.
- Early mouse patents:** From left to right: Opposing track wheels by Engelbart, Nov. 1970, U.S. Patent 3,541,541; Ball and wheel by Rider, Sept. 1974, U.S. Patent 3,835,464; Ball and two rollers with spring by Opocensky, Oct. 1976.
- Inventor Douglas Engelbart's computer mouse:** showing the wheels that make contact with the working surface.

Structured creation process

Browse

Extract

Format

Show

Update

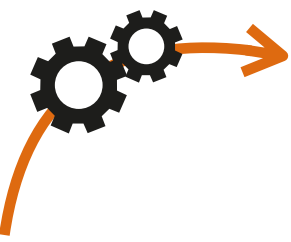
THE NEW YORKER
Annals of National Security | MAY 10, 2004 ISSUE
Torture at Abu Ghraib
American soldiers brutalized Iraqis. How far up does the responsibility go?
BY SEYMOUR M. HERSH

AMNESTY INTERNATIONAL
REPORT MAY 12, 2014
Torture in 2014: 30 Years of Broken Promises
Introduction By Sall Shetye
Torture is abhorrent. It is barbaric and inhumane. It can never be justified. It is wrong, self-defeating, and poisons the rule of law, replacing it with terror. No one is safe when governments abuse its use.

October 2001-2004: US Creates Multilayered Secret Overseas Prison System Holding 10,000 Prisoners
The United States government created a multi-layered detention center for combatants, a hidden array of a network of prisons in Guantanamo, Cuba and other intelligence secret US government questioning...
lawyer; no chaotic humane treatment civilians in US j. official tells the indefinitely, for example, rendition interrogation ce the House and S operations, do n it is estimated t the world. They Libya, Malaysia, Turkey, Ukraine, 2/1/2004
Entry Tags: Central Timeline Tags: Com Category Tags: High 9/11, Key Events

October 4, 2001: NAT Rendition Flights
2/10/2004
1/1/2008
2/4/2004
3/1/2004

Start Date	End Date	Headline	Text	Media	Media Credit
10/28/2003		Facemash	Zuckerberg wrote a program called Facemash on October 28, 2003 while attending Harvard as a sophomore	http://dubindigital.ie/wp-content/uploads/2011/02/facemash-700x299.jpg	Dublin Digital
1/1/2004	1/31/2004	new website	The following semester, Zuckerberg began writing code for a new website in January 2004		
2/4/2004		thefacebook.com	On February 4, 2004, Zuckerberg launched "thefacebook", originally located at thefacebook.com Six days after the site launched, three Harvard seniors (Cameron Winklevoss, Tyler Winklevoss, and Divya Narendra) accused Zuckerberg of intentionally misleading them into believing he would help them build a social network called HarvardConnection.com They later filed a lawsuit against Zuckerberg, subsequently settling in 2008[17] for 1.2 million shares (worth \$300 million at Facebook's IPO)	http://www.capitalberg.com/wp-content/uploads/2015/05/Harvard-wider.jpg http://4.bp.blogspot.com/-KM6s4_O3yvs/VV5335_YFsI/AAAAAAAAATB/b15x0cQ3TA/s1600/5.jpeg	Capital Berg
2/10/2004		Harvard Connection settles	Membership was initially restricted to students of Harvard College; within the first month, more than half the undergraduates at Harvard were registered on the service In March 2004, Facebook expanded to the universities of Columbia, Stanford, and Yale.[20] In mid-2004, entrepreneur Sean Parker (an informal advisor to		Easymese
1/1/2008	12/31/2008	Harvard Connection settles			
2/4/2004	3/4/2004	thefacebook at Harvard only			
3/1/2004	3/31/2004	thefacebook expands to other universities			



March 20, 2003

U.S. Invades Iraq

← MARCH 14, 2003 OLC Memo → APRIL 16, 2003 Memo: Rumsfeld

The U.S. Invades Afghanistan | U.S. Invades Iraq | President elect

Bush's treatment | CIA Intern | Maj Dur inte | Depa mem tech | OL | O D | President Bush states America's commitment to global end of torture | Jar E c li | Memo: Alberto Mora

First Major News Story on Torture | Gul Rahman is found dead a CIA black t Afghanistan (the " | Detainee Abdul Wali dies in his cell at Asadabad base | Contractor David Passa indicted, arrested for as detainee Abdul Wali, As















2002 2003 2004 200

GS

TimelineJS
timeline.knightlab.com/

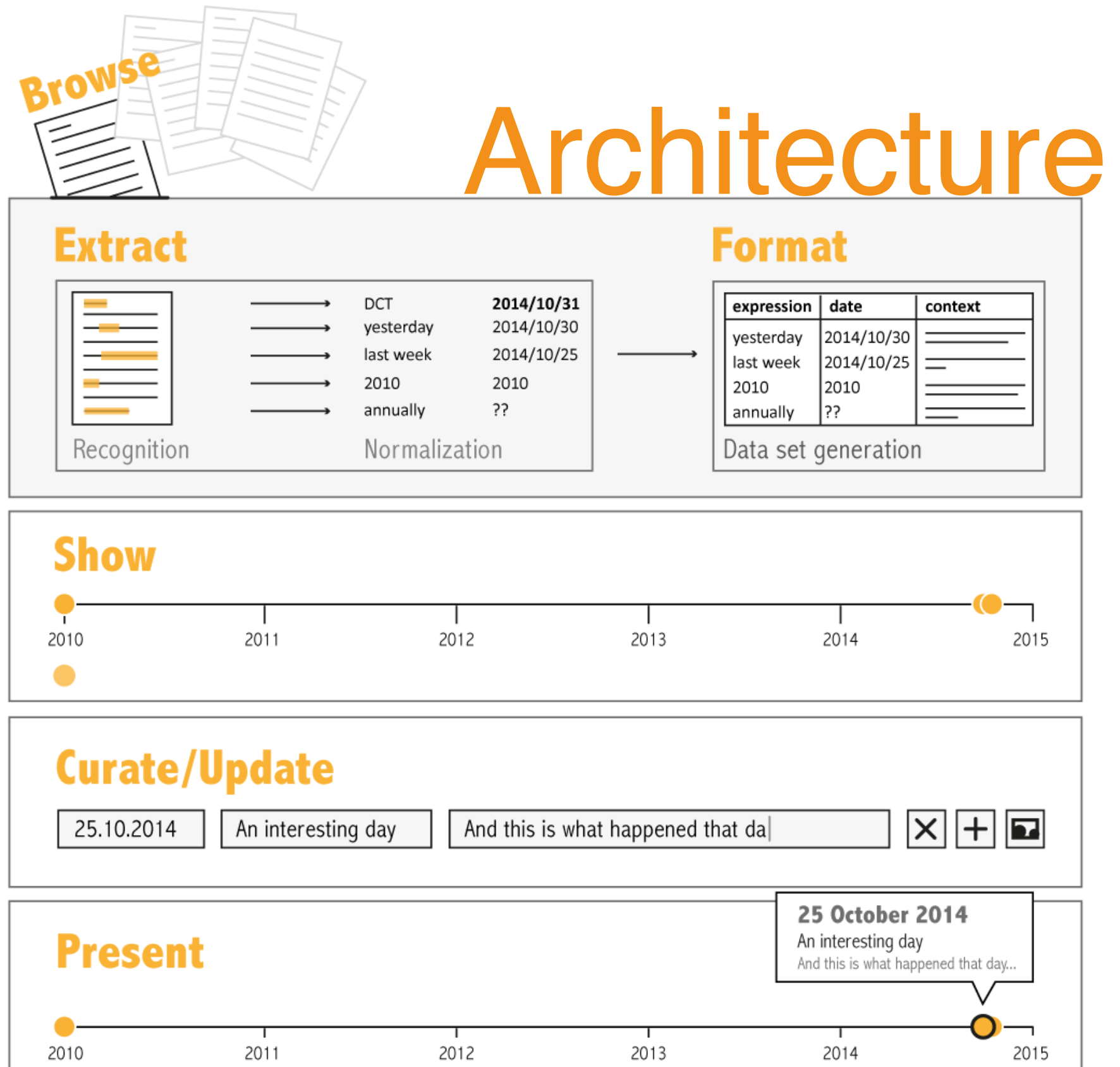
Timeline authoring model

- time required for each task

	Browse	Extract	Format	Show	Update
Manual Drawing	 slow	 slow		 slow	 slow
Structured Creation	 slow	 slow	 slow	 automated	 fast
TimeLine Curator	 fast	 automated	 automated	 fast	 fast

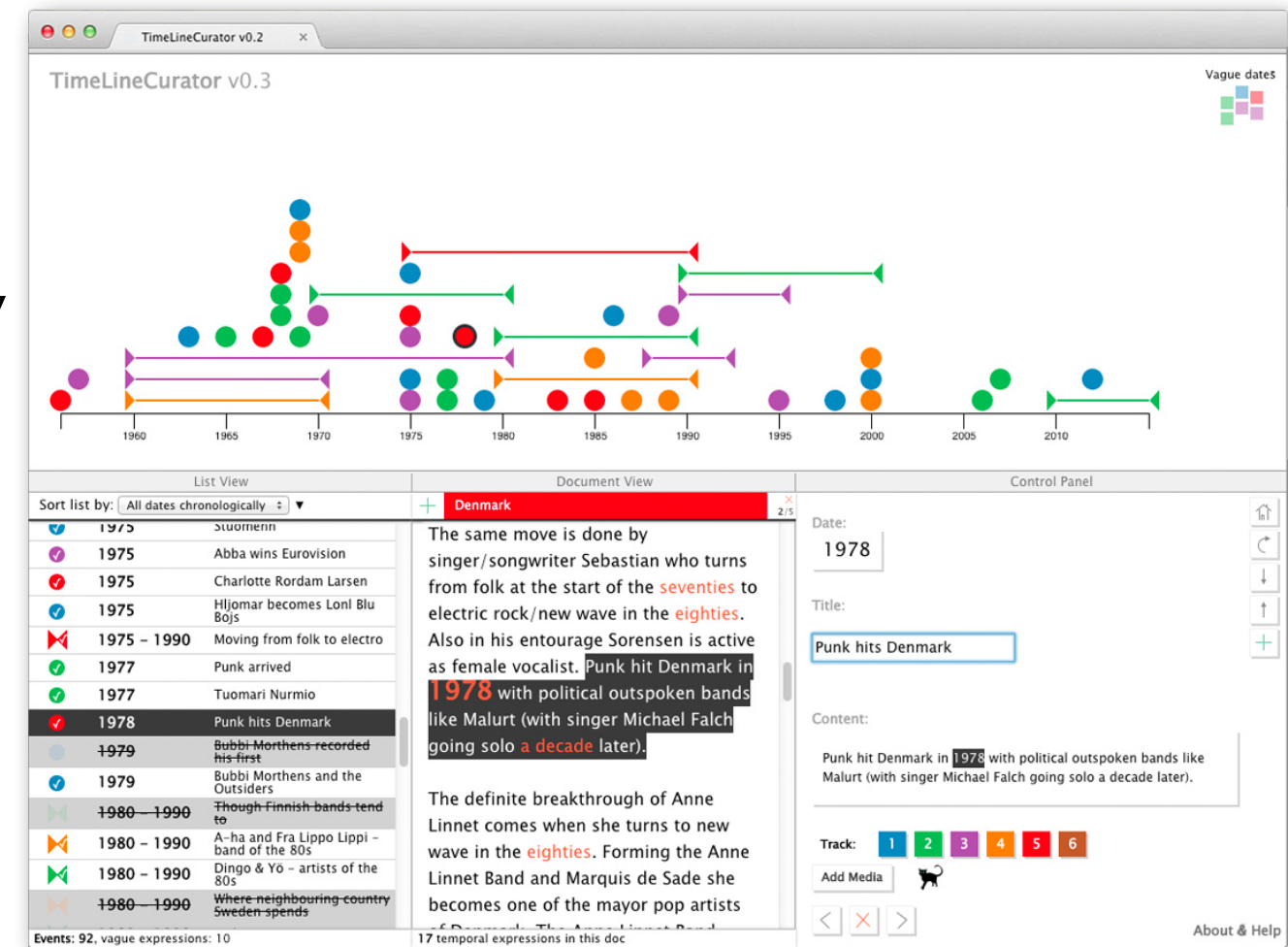
The general case for curation

- build for human in the loop as continuing need
 - automatic processing to accelerate not replace
 - assume computational results good but not perfect
 - for the indefinite future!
 - visual feedback to accelerate



The importance of being brisk

- sexy use case: eureka moment
 - success: enable what was impossible before
 - vis tools for new insights & discoveries
- workhorse use case: workflow speedup
 - success: vis tools accelerate your prior workflow
 - sometimes enables the previously infeasible
- TLC use cases
 - started with speedup use case, for presentation
 - make this doc into a timeline now!
 - two other use cases nudge towards exploration
 - comparison between multiple timelines
 - speculative browsing

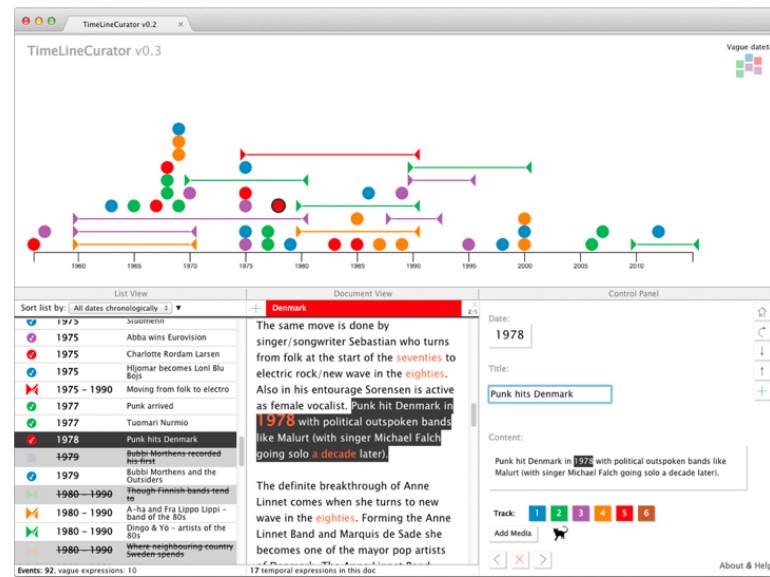
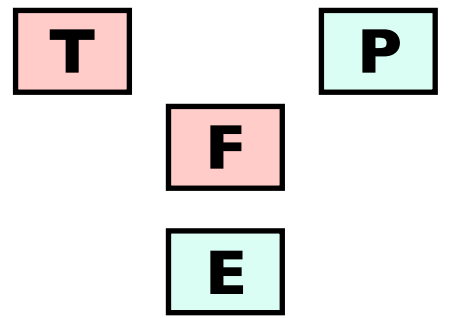


TimeLineCurator: Speculative Browsing

s p e c u l a t i v e b r o w s i n g

<https://vimeo.com/jofu/tlc>

Curation & Presentation: Timelines



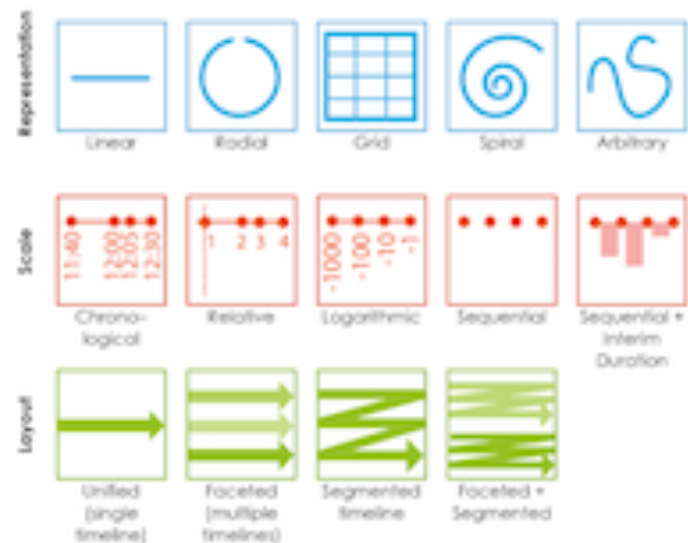
TimeLineCurator

<https://vimeo.com/123246662>

Matt Brehmer



Johanna Fulda



Timelines Revisited

timelinesrevisited.github.io/

Matt Brehmer



Bongshin Lee (Microsoft)



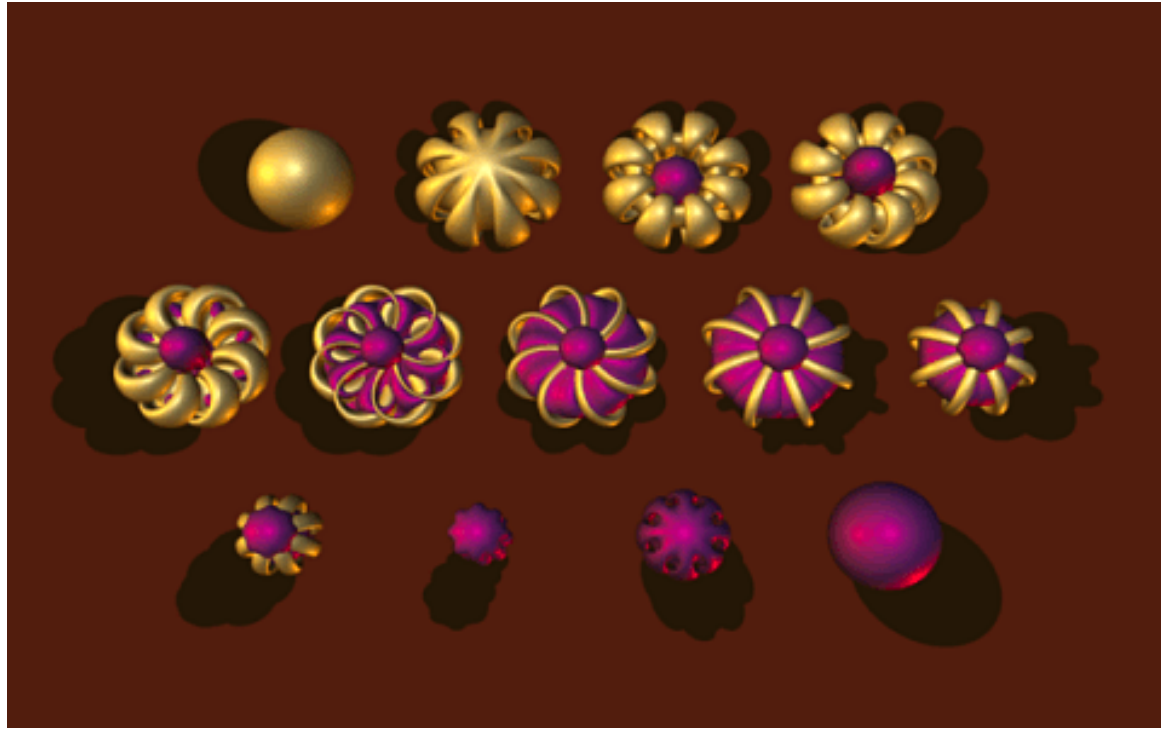
Benjamin Bach (Microsoft)



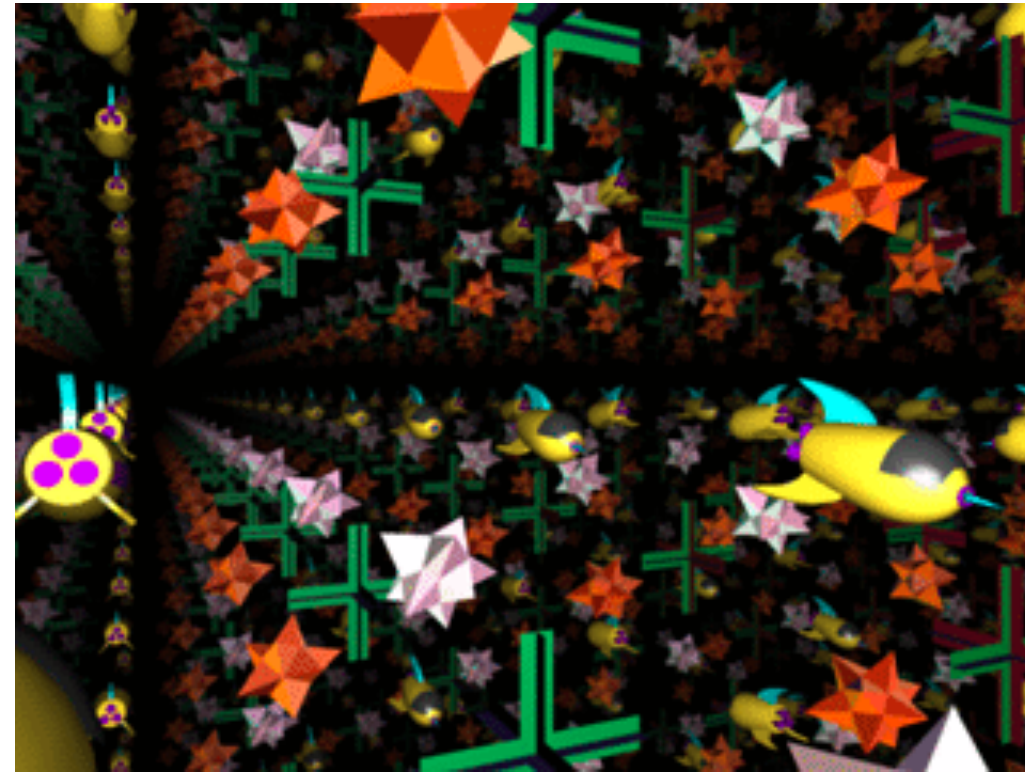
Nathalie Henry-Riche



Presentation: Geometry Center math vis videos



Outside In



The Shape of Space

Stuart Levy

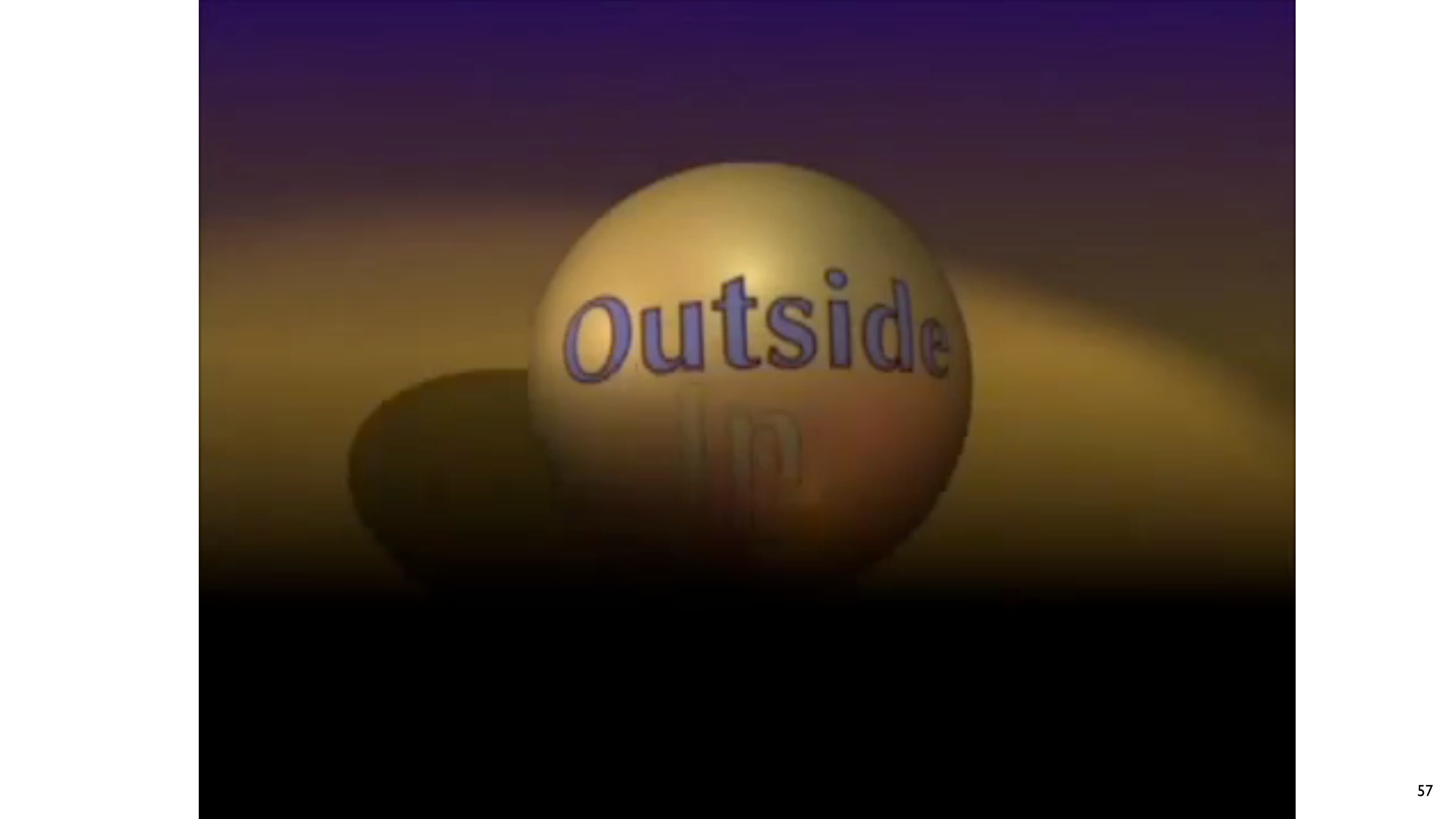


Mark Phillips



Delle Maxwell





Outside

Visualization entry points

- goals
 - exploratory data analysis
 - presentation
 - curation / authoring
- methods
 - algorithm development
 - system building & software development
 - lab studies with human subjects
 - field studies with human subjects

Teaching

Visualization Analysis and Design

[@tamaramunzner](https://twitter.com/tamaramunzner)

- book page

<http://www.cs.ubc.ca/~tmm/vadbook>

– 20% promo code for book+ebook combo:
HVN17

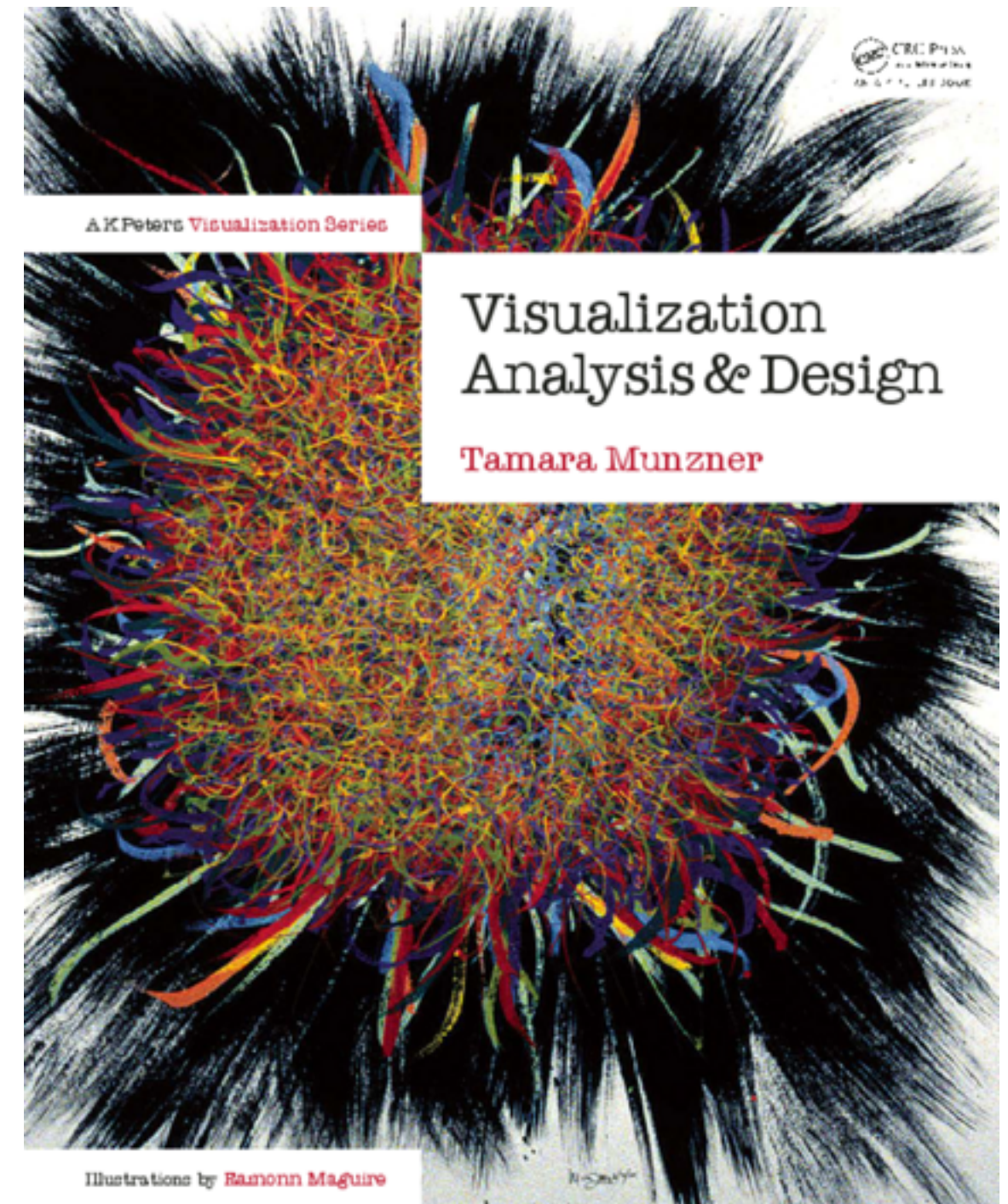
– <http://www.crcpress.com/product/isbn/9781466508910>

– free to read online within UBC

<http://resolve.library.ubc.ca/cgi-bin/catsearch?bid=7678980>

- slide decks at many talk lengths (1, 2, 3, 6, 8+ hrs),
some w/ videos

<http://www.cs.ubc.ca/~tmm/talks.html#vadallslides>



Visualization Analysis and Design.
Munzner. A K Peters Visualization Series, CRC Press, Visualization Series, 2014.

Visualization Analysis & Design

IEEE VIS 2014 Tutorial
Video Preview

Tamara Munzner

Department of Computer Science
University of British Columbia

What?

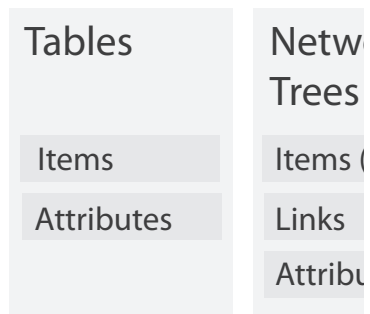
Why?

How?

→ Data Types

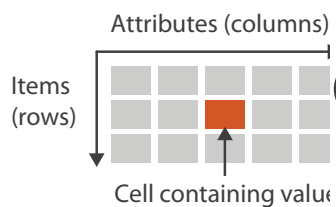
→ Items → Attributes

→ Data and Dataset Types

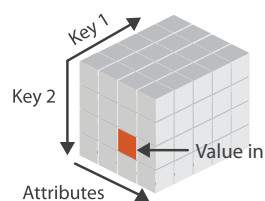


→ Dataset Types

→ Tables



→ Multidimensional Table



→ Geometry (Spatial)



→ Analyze

→ Consume

→ Discover



→ Present



→ Produce

→ Annotate



→ Record



→ Search

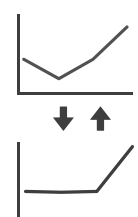
	Target known
Location known	
Location unknown	

→ Query

→ Identify



→ Compare



→ Summarize



→ Act

Encode

→ Arrange

→ Express



→ Order



→ Use



→ Separate



→ Align



→ Map

from **categorical** and **ordered** attributes

→ Color



→ Size, Angle, Curvature, ...



→ Shape



→ Motion

Direction, Rate, Frequency, ...

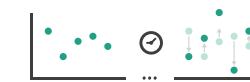


→ Spatial Data

→ Shape

Manipulate

→ Change



→ Select



→ Navigate



Facet

→ Juxtapose



→ Partition



→ Superimpose



Reduce

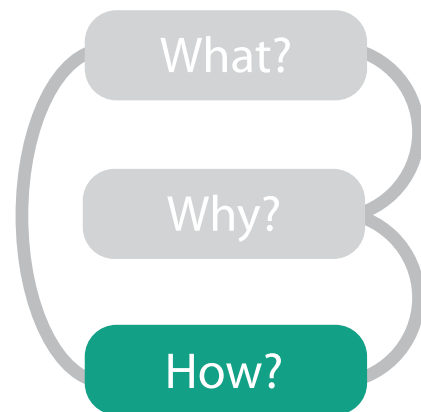
→ Filter



→ Aggregate

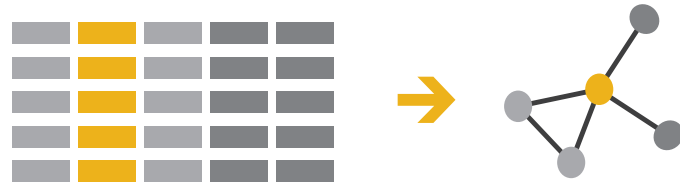


→ Embed



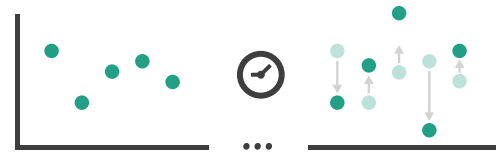
How to handle complexity: 4 families of strategies

→ *Derive*

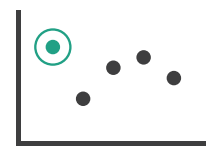


Manipulate

→ Change



→ Select

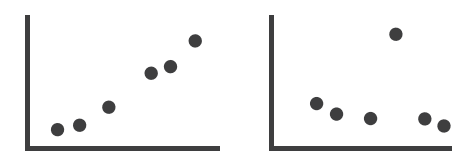


→ Navigate

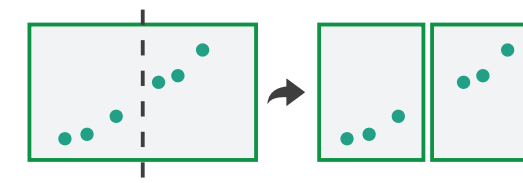


Facet

→ Juxtapose



→ Partition

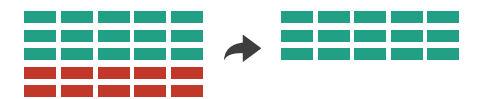


→ Superimpose



Reduce

→ Filter



→ Aggregate



→ Embed



- derive new data to show within view
- change view over time
- facet across multiple views
- reduce items/attributes within single view

Visualization Teaching at UBC: Me

- Computer Science grad
 - open to all students, no CS prereqs, non-programming project options available
 - tooling not taught (most use D3 or R)
 - Computer Science ugrad
 - coming in January 2020, 4th year CS majors
 - tooling: D3
 - Data Science
 - tooling: R
 - Journalism
 - tooling: Tableau
 - Ed Psych, Forestry, Geography, iSchool, Psychology
- <https://dfp.ubc.ca/initiatives/viz-ubc/visualization-courses>

Visualization Teaching Across UBC

- many other visualization-focused courses
 - Ed Psych
 - Forestry
 - Geography
 - iSchool
 - Psychology
- initial list compiled
<https://dfp.ubc.ca/initiatives/viz-ubc/visualization-courses>
 - please contact vizatubc-info@cs.ubc.ca with additions/corrections!
- still todo: compile list of courses with significant visualization content

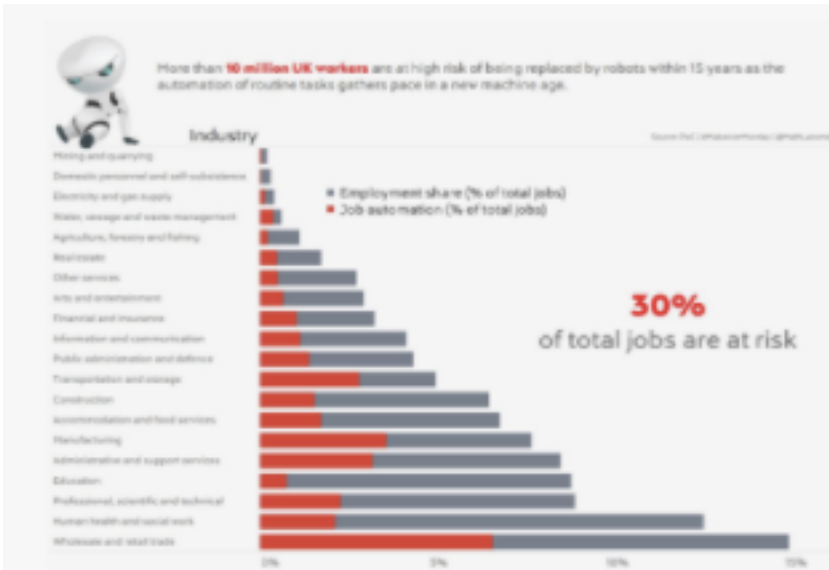
Engaging with visualization teaching

- teach/take a visualization-focused course
- teach/take domain-oriented course where visualization plays a role
 - presentation
 - exploratory data analysis
- offer your domain problem as project topic
 - research or administrative data

Engaging: Possible Next Steps

Redesign En Masse: **Makeover Mondays**

- easy entry point, Tableau focus



Week 14 – Millions of UK workers at risk of being replaced by robots

Apr 7, 2017

During week 14 we looked at job automation and the potential impact of robots and AI on the UK employment market.



Week 13 – The Secret of Success

Mar 31, 2017

Week 13 took a look at a Russian survey about the secret of success. Dot plot, bump charts, bar charts, radar charts. This week had it all! Plus seven lessons to take on board.



Week 12 – March Madness

Mar 24, 2017

We looked at March Madness data for week 12, highlighting the phenomenon that is US college basketball. Quite a few vizzes showed the passion that

Visual Design Process In Depth: **Dear Data**

- inspiring celebration of data humanism

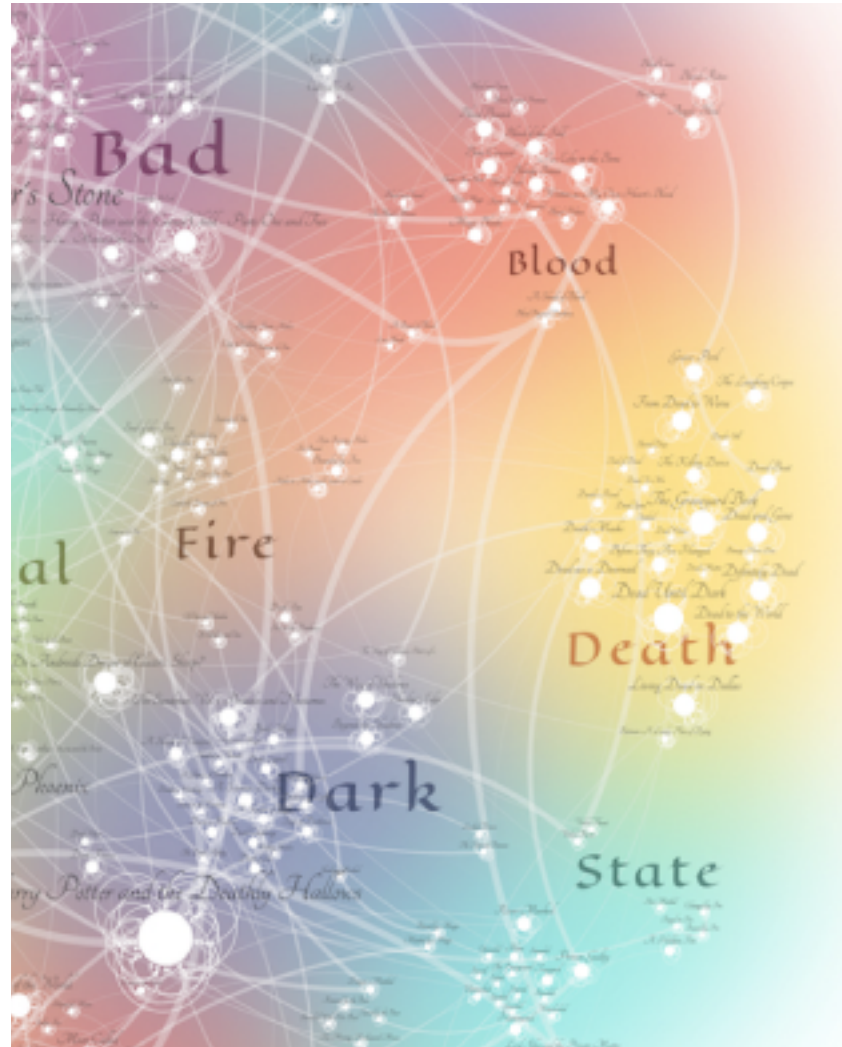


<http://www.dear-data.com/by-week/>

Giorgia Lupi and Stefanie Posavec

Visual Design Process In Depth: **Data Sketches**

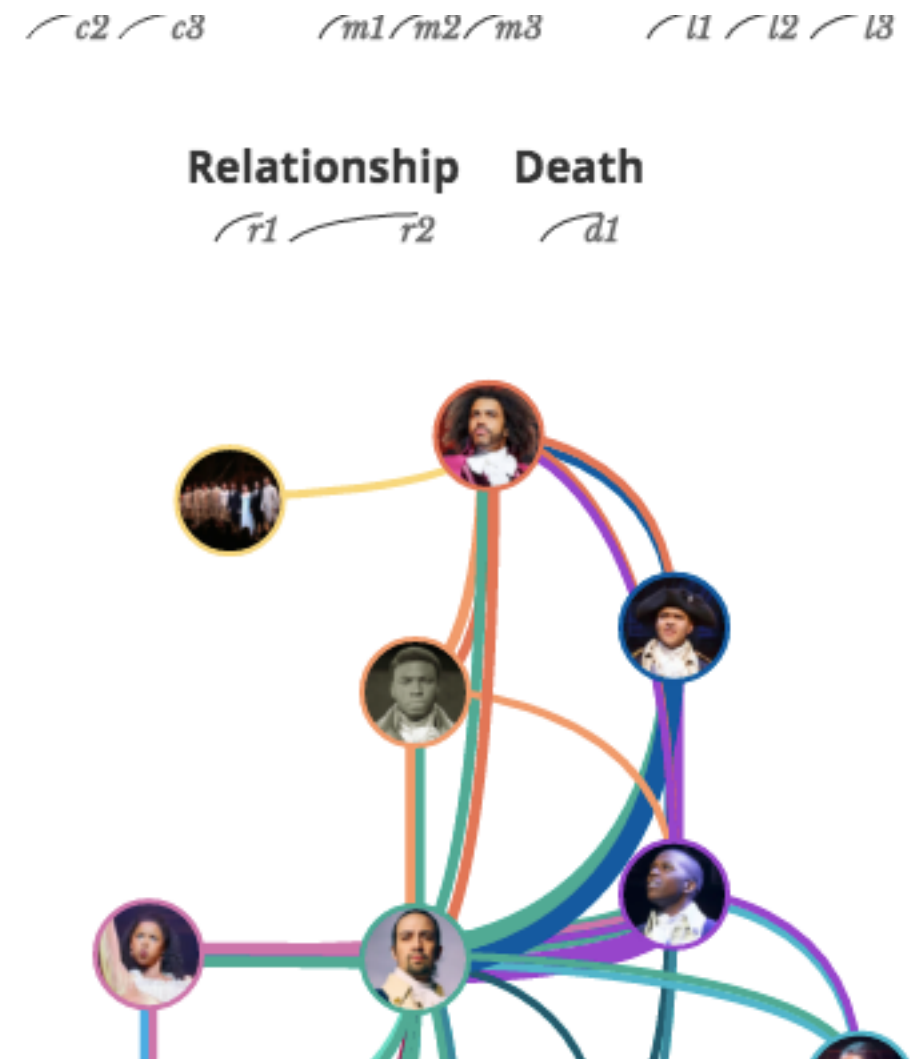
- detailed process notes, from sketching through coding



November
Books

Searching for patterns in Fantasy titles and musical lyrics

Read more...



<http://www.datasketch.es/>

Shirley Wu and Nadieh Brehmer

Pathways to participate

- join Viz@UBC
 - <https://dfp.ubc.ca/initiatives/viz-ubc>
 - get on visatubc-announce email list (send mail to vizatubc-info@cs.ubc.ca)
 - upcoming kickoff events: 2 more talks + 1 mixer
 - join as core, so you're findable in people index
 - join as organizer, help us decide what to do next
- join Data Visualization Society
 - <https://www.datavisualizationsociety.com/>
 - brand new! resources, jobs board,...

Pathways to participate

- participate in IEEE VIS 2019 in Vancouver, Oct 20-25
 - <http://ieevis.org>
 - big 3 research tracks: VA, InfoVis, SciVis
 - many associated events
 - Vis in Data Science
 - Vis In Practice
 - Large Data Analysis & Visualization
 - Application Spotlights
 - many workshops including bio, security, ...
 - job fair (asynchronous)



More Information

- this talk
<https://www.cs.ubc.ca/~tmm/talks.html#vizatubc19-entry>
- papers, videos, software, talks, courses
<http://www.cs.ubc.ca/group/infovis>
<http://www.cs.ubc.ca/~tmm>

[@tamaramunzner](https://twitter.com/tamaramunzner)

MEMBERS



Tamara Munzner



Anamaria Crisan



Zipeng Liu



Michael Oppermann



Steve Kasica



Shannah Fisher

RECENT NEWS

2/2019 [PAPER]:

Aggregated dendrograms for visual comparison between many phylogenetic trees

by Zipeng Liu, Shing Hei Zhan, and Tamara Munzner was accepted at *IEEE Transactions on Visualization and Computer Graphics*

[pre-print PDF]



10/2018 [UBC InfoVis @ IEEE VIS 2018]:

UBC InfoVis @ IEEE VIS 2018

At the BELIV Workshop, Anamaria Crisan and Madison Elliott will present the paper "How to evaluate an evaluation study? Comparing and contrasting practices in vis with those of other disciplines".

Michael Oppermann will give a talk entitled "Uncovering Spatiotemporal Dynamics from Non-Trajectory Data" at the Urban Data Visualization Workshop.

Tamara Munzner will participate in a panel at the VisGuides Workshop. We're co-hosting the (North) West Coast Party, on Thursday night.

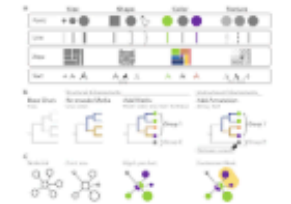


9/2018 [PAPER]:

A systematic method for surveying data visualizations and a resulting genomic epidemiology visualization typology: GEVIT

by Anamaria Crisan, Jennifer L. Gardy, and Tamara Munzner was published in *Oxford Bioinformatics*

[paper]



8/2018 [PAPER]:

Adjutant: an R-based tool to support topic discovery for systematic and literature reviews

by Anamaria Crisan, Tamara Munzner, and Jennifer L. Gardy was published in *Oxford Bioinformatics*

[paper]



8/2018 [FAREWELL]:

Visiting Professor Takayuki Itoh

Takayuki Itoh from Ochanomizu University, Japan, was visiting our group between Jul - Aug 2018. Thanks for your visit, it was great having you here!



05/2018 [PAPER]:

GarSIVis: Improving the Predicting of Self-Interruption during Reading using Gaze Data

by Jan Pilzer, Shareen Mahmud, Vanessa Putnam, and Tamara Munzner was accepted to ETVIS 2018.

[pre-print PDF]



Q&A References

- entry points for practitioners?
 - D3 resources for advanced programmers:
<https://github.com/d3/d3/wiki/Gallery>
<https://bl.ocks.org/>
 - R resources for range of programming experience:
<https://www.tidyverse.org/>
<https://ggplot2.tidyverse.org/>
 - Tableau resources, for non-programmers:
<https://www.tableau.com/>
 - Andy Kirk's continuously updated resources list
<http://www.visualisingdata.com/resources/>
 - many of these do not require programming!