**Visualization Analysis & Design**

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**Why represent all the data?**  
Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more effectively.  

**Why have a human in the loop?**  
Computer-based visualization systems provide visual representations of data that are designed to help people carry out tasks more effectively.

**External representation:**  
- don’t need vision when fully automatic solution exists and is trusted  
- many analysis problems ill-specified  
- don’t know exactly what questions to ask in advance  
- possibilities  
- long-term use for end users (e.g., exploratory analysis of scientific data)  
- presentation of known results  
- stepping stones to better understanding of requirements before developing models  
- help developers of automatic solution redifining, determine parameters  
- help end users of automatic solutions verify build trust

**Why is validation difficult?**  
- solution: use methods from different fields at each level  

**Why use an external representation?**  
External representation: replace cognition with perception

**Action I: Analyze**  
- doesn’t just draw what you’re given!  
- doesn’t just discover vs present  
- classic split  
- aka explore vs explain  
- aka big data  
- aka causal, social  
- aka  
- aka complex design choice

**Analysis example: Derive one attribute**  
- table number  
- centrality metric for tree/networks  
- derived-quantitative attribute  
- draw top 5% of SCF for good ideas

**Types of Data and Datasets**  
- Tables  
- Networks  
- Spatial

**Tables**  
- Attributes (columns)  
- Value in cell  
- Geometry (Spatial)  

**Networks**  
- Node (item)  
- Fields (Continuous)  
- Attributes (columns)  

**TreeJuxtaposer**  
- Tree  
- Encode  
- Navigate  
- Select  
- Filter  
- Aggregate

**Action II: Search**  
- what does user know?  

**Why is representation all the data?**  
- summaries lose information, details matter  
- confirm expected and find unexpected

**Why is validation difficult?**  
- different ways to get it wrong at each level

**Why analyze?**  
- imposes a structure on huge design space  
- scaffolding to help you think systematically about choices  
- analyzing existing as stepping stone to designing new
Actions III: Query
• what does user know?
  – target, location
• how much of the data matters?
  – one, some, all
• analyze, search, query
  – independent choices for each

How to encode: Arrange space, map channels

Encoding visually
• analyze idiom structure

Channels: Matching Types
• expressiveness principle
  – match channel and data characteristics

Channels: Rankings
• expressiveness principle
  – match channel and data characteristics
• effectiveness principle
  – encode most important attributes with highest ranked channels

How to handle complexity: 3 more strategies
1 previous
• change view over time
  – facet across multiple views
  – reduce items/attributes within single view
  – derive new data to show within view

Idiom: Animated transitions
• smooth transition from one state to another
  – allows to jump cuts
  – support for item tracking when amount of change is limited
• example: multilevel matrix views
  – scope of what is shown narrows down

• nude block shrinks to fill space, additional structure appears within
  – other blocks squash down to increasingly aggregated representations
A quick taste of my own work!

Evaluation: Dimensionality reduction

Evaluation: Focus + Context
Separate vs integrated views
Distortion impact on search/memory
Heidi Lam
Ron Rensink
(UBC)
Robert Kincaid
(Agilent)
Heidi Lam
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A quick taste of my own work!

Problem-driven: Genomics
Problem-driven: Genomics, fisheries
Problem-driven: Many domains

Technique-driven: Graph drawing
Evaluation: Graph drawing

Theoretical foundations
Nested Model
Papers Process & Pitfalls
Design Study Methodology
Michael Sedlmair
Miriah Meyer
Aaron Barsky
Jenn Gardy
(Microbio)
Robert Kincaid
(Agilent)
Cerebral

Evaluation: Dimensionality reduction

Problem-driven: Genomics

Problem-driven: Many domains

Evaluation: Graph drawing

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  → http://www.crcpress.com/product/isbn/9781466508910
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  this talk

Rainbows Just Like In The Sky
Color Cacophony
Hammer In Search Of Nail
Unjustified Visual Encoding

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Illustrations: Eamonn Maguire
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