Why is validation difficult?

- Different ways to get it wrong at each level

- Domain situation
  - You misunderstood the problem
  - The way you show it doesn't work
  - Algorithm
  - Your code is too slow

- Data/task abstraction
  - Designed to help people carry out tasks more effectively.

- Design studies: Lessons learned after 21 of them

- Action research
  - Evaluate new designs
  - Discover new methods
  - Winnow designs

- Analysis framework: Four levels, three questions

- Domain situation
  - Who are the target users?
  - Abstraction
  - Extent to which the work involves abstraction (e.g., visual versus functional)

- Data
  - What is shown? Data abstraction

- Process
  - How is it shown?
  - How visual encoding ideas how to draw

- Algorithm
  - Interaction ideas how to manipulate

- Effectiveness
  - User effectiveness

- Efficiency
  - Algorithm efficiency

- Visibility
  - Perceived visibility
How to encode: Arrange space, map channels

- manipulate facet reduce
- change
- select
- navigate
- juxtapose
- partition
- aggregate
- superimpose
- filter
- aggregate
- align
- map
- separate
- arrange
- express
- order
- decrease
- reduce

Definitions: Marks and channels

- marks: geometric primitives
  - dots
  - lines
  - bars
- channels: control appearance of marks

Encoding visually with marks and channels

1. vertical position
2. horizontal position
3. horizontal position
   color
4. horizontal position
   color
   size

Channels: Expressiveness types and effectiveness rankings

- magnitude channels: ordered attributes
  - identity channels: categorical attributes

Spatial region:
- color luminance
- color saturation
- curvature
- volume (3D size)
- depth (3D position)
- area (2D size)
- tilt/angle

How to handle complexity: 3 more strategies

1. previous
   - change over time
   - most obvious & flexible of the 4 strategies
   - + 1 previous

Idiom: Linked highlighting

System: EDV
- see how regions contiguous in one view are distributed within another
- powerful and pervasive interaction idiom
- encoding: different
- data all shared

Idiom: Small multiples

System: Google Maps
- encoding same
- data subset shared
- navigation: shared
- bidirectional linking
- differences: same-data
- overview-detail

Idiom: bird's-eye maps

System: Cerebral
- encoding same
- data all shared
- navigation: shared
- different attributes for node colors
- same network layout
- navigation: shared

Coordinate views: Design choice interaction

- why juxtapose views?
  - benefits: eyes vs memory
  - lower cognitive load to move eyes between 2 views than remembering previous state with single changing view
  - costs: display area, 2 views side by side each have only half the area of one view

Weaknesses
- weakened understanding
- disparate frames

Strengths
- charted storyline
- localized differences between contiguous frames
- animated transitions between states

Small multiples
- use
- all subset
- none
- redundant
- no linkage
- small multiples
- overview/detail
A quick taste of my own work!

technique-driven work

problem-driven work

theoretical foundations

evaluation

Technique-driven: Graph drawing

Technique-driven: Dimensionality reduction

Problem-driven: Genomics

Problem-driven: Genomics, fisheries

Problem-driven: Many domains

Evaluation: Focus+Context

Evaluation: Graph drawing

Evaluation: Dimensionality reduction

Evaluation: TimeLineCurator

Journalism

Theoretical foundations