Design and Validity

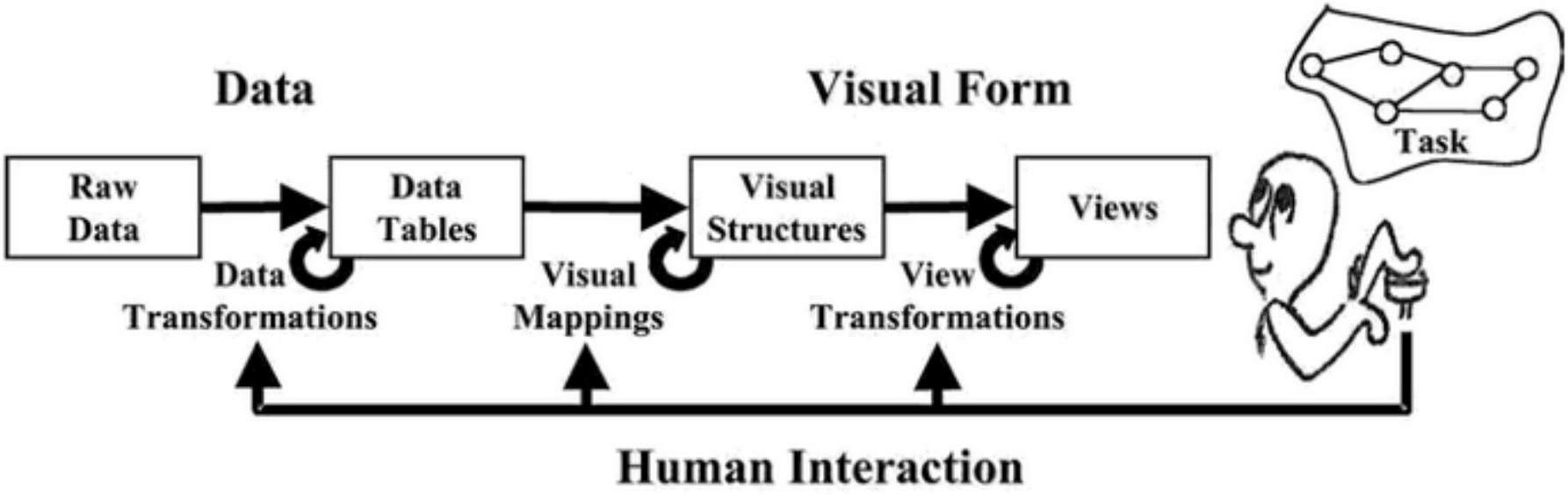


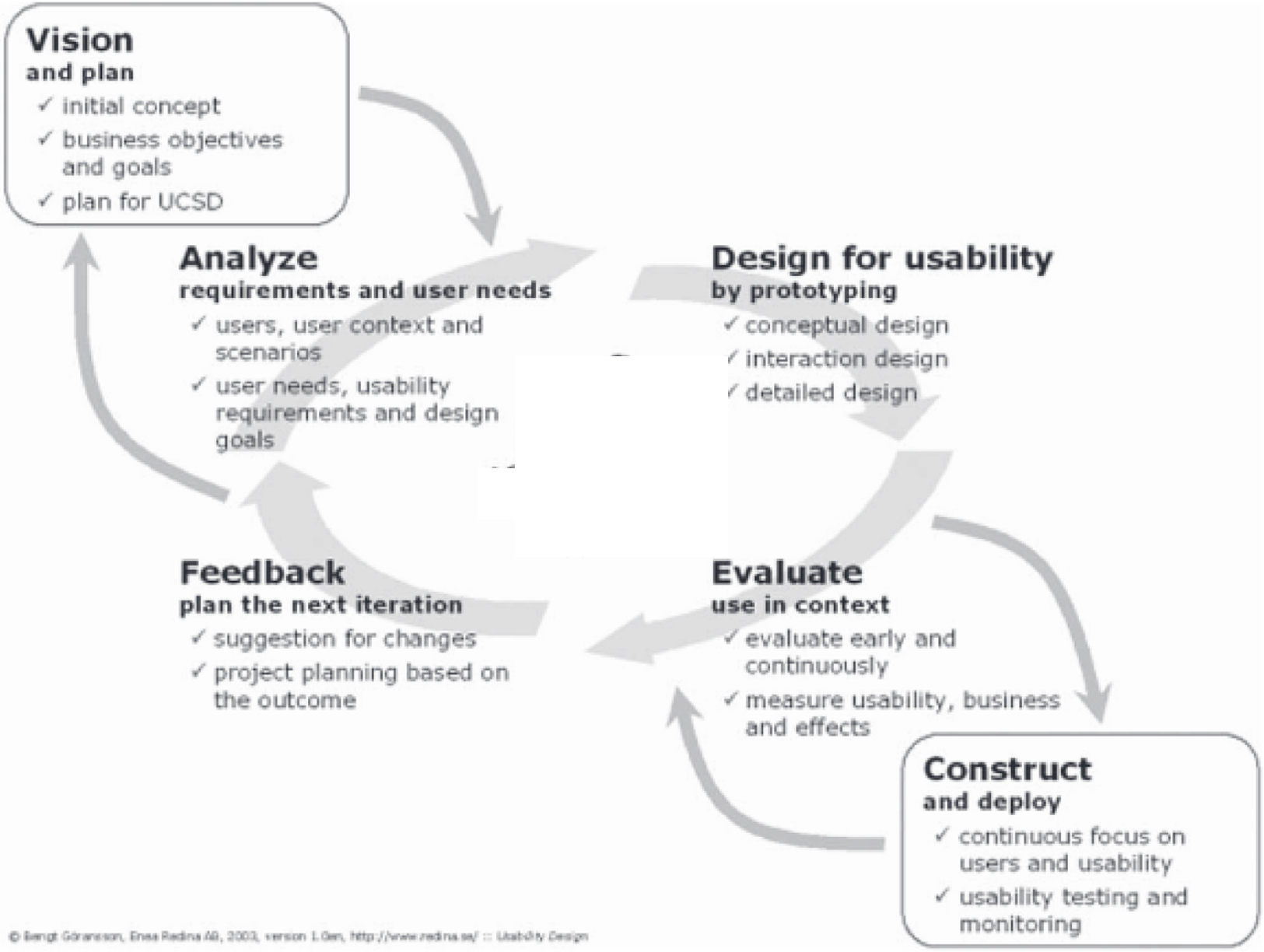
Diagram from Card, Mackinlay, & Shneiderman, 1999.
Readings in Information Visualization: Using Vision to Think

How to choose the right

data transformations, visual mappings, and view transformations for an effective visualization?

The Design Process

- Initial user needs assessment & research
- Use researched heuristics and perceptual principles as a guide
- Select efficient computational and visualization techniques/tools
- Design tool/system (prototype to higher fidelity)
- Test and collect data
- Iterate


Vision
and plan
✓ initial concept
✓ business objectives and goals
✓ plan for UCSD
Analyze
requirements and user needs
✓ users, user context and scenarios
✓ user needs, usability requirements and design goals
Design for usability
by prototyping
✓ conceptual design
✓ interaction design
✓ detailed design
Evaluate
use in context
✓ evaluate early and continuously
✓ measure usability, business and effects
Construct
and deploy
✓ continuous focus on users and usability
✓ usability testing and monitoring
Feedback
plan the next iteration
✓ suggestion for changes
✓ project planning based on the outcome
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Human-Centered Visualization Design

Places human need, skill, and creativity at the center of the design of visualization systems

Where Validity Can Break

- **Wrong domain problem:** They don't do that
- **Wrong abstraction:** Showing them the wrong thing
- **Wrong encoding/interaction:** The way you're showing doesn't work
- **Wrong algorithm:** Your code is too slow

(Muzner, 2009)

Evaluating Validity

Earlier Stages

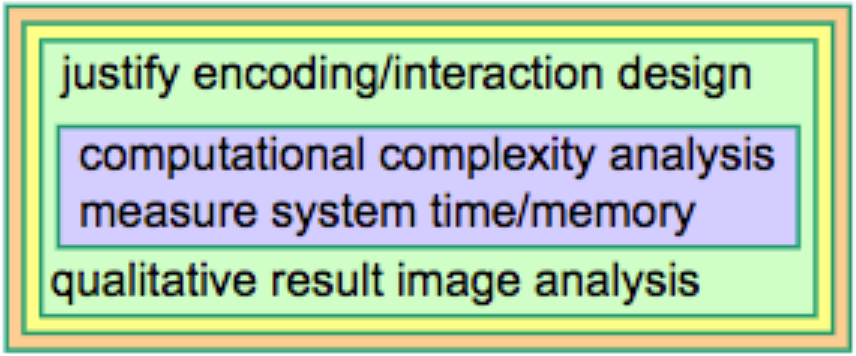
- Observe and interview target users (needs assessment)
- Design data abstraction/operation (data types, transformation, operations)
- Justify encoding/interaction design (design heuristics, perception research)
- Informal analysis/qualitative analysis of prototypes (task-based)
- Algorithm complexity analysis/evaluation

Mid- and Later Stages

- Qualitative analysis of system (task-based)
- Algorithm performance analysis
- Lab or crowdsourced user study (measure time/errors/memory/etc.)
- Field study of the deployed system

Some Variation in Methods

Visualization Tool 1:
MatrixExplorer
(Henry & Fekete, 2006)



Visualization Tool 2:
Flow map layout
(Phan et al., 2005)

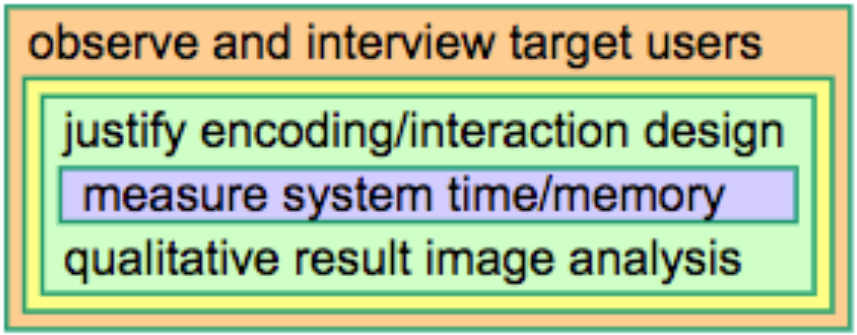


Diagram Source: Munzner, T. (2009). A nested model for visualization design and validation. *IEEE Transactions on Visualization and Computer Graphics, 15*(6).

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