What Is Lacking in InfoVis Theory?

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Questions to think about

- Is InfoVis a science or an art?
- Why people use statistics for data analysis but do not (widely) use visualisation?
- What is the difference between the statistics and InfoVis?

Observation

- Statistics textbooks (for users)
  - Interpreting Basic Statistics
  - Introduction to the Practice of Statistics
  - Statistics: Informed Decisions Using Data
  - Statistics for Business and Economics
  - Statistics for the Behavioral Sciences
  - Statistics in Social Research
  - Statistics for Dummies
  - Statistics for the Utterly Confused
  - …
- Visualization (text)books
  - for users
    - Creative Visualization
    - Practical Guide to Creative Visualization: Manifest Your Desires
  - for designers or scientists
    - Information Dashboard Design: The Effective Visual Communication of Data
    - Information Visualization: Perception for Design
    - Readings in Information Visualization: Using Vision to Think
    - Visualization Handbook
    - …
  - presentation and communication
  - exploration and analysis

Question

- Can the InfoVis community write such textbooks as (for users)
  - Interpreting Analytical Visualizations
  - Practical Guide to Analytical Visualization: Understand Your Data
  - Visualization: Informed Decisions Using Data
  - Visualization for Business and Economics
  - Visualization for the Behavioral Sciences
  - Visualization in Social Research
  - Visualization for Dummies
  - Visualization for the Utterly Confused
  - …?

Does InfoVis have everything for this?

Opinion

(concerning the emergence of the term "Visual Analytics")

> … visualization keeps re-inventing itself, under the pressure of retaining (or gaining) scientific credibility. Focusing more on the integration of computational methods, and on the distribution of tasks between humans and machines is certainly a promising turn. But as long as the goal is not explicitly to produce ***testable theories with predictive power***, not much useful and respectable will result. As long as new visualization *tools* and approaches keep being proposed, along with claims what they achieve, but the corresponding incremental theoretical advances remain obscure, we will need yet another name for the field in a few years.

(a reviewer of the paper "Geovisual Analytics for Spatial Decision Support: Setting the Research Agenda")

Can we object to this?

InfoVis Theory

- Does it exist?
- If so, is it a *testable theory with predictive power*?
  - If so, how to prove this to the opponents?
    - What and how does it predict?
    - What and how can be tested?
  - If not, can it be developed into such a theory? How?
    - What can/needs to be predicted?
    - What can/needs to be tested?

Existing InfoVis theory

- Descriptions and analyses of good and bad examples
- Descriptions of existing techniques and tools
- Taxonomies of techniques

⇒Descriptive rather than predictive

- Characteristics of human perception and cognition; user's perceptual and cognitive tasks

⇒Too abstract or too basic, difficult to apply to real data and problems

- Visualization operators; design frameworks (visualization pipeline etc.)

⇒Designer-oriented

Possible approach

Suppose that we agree that the main goal of analytical visualization is to help the user to *discover patterns in data*…

⇒ theory outline:

- ✓ Definition of the concept "pattern"
- ✓ Typology of patterns
- ✓ Methods to discover each type of pattern, including
  - ➢Graphical techniques
  - ➢Interaction techniques
  - ➢Data transformations
  - ➢Visually controlled computational techniques

Predictive power

The theory should tell how

- given an arbitrary dataset

to predict

- what types of patterns can be discovered
- and what method(s) can effectively help in this

(not specific tools or systems but generic techniques)

Testability

- Apply the theory to example data where the patterns are already known
- Check if the types of patterns that have been predicted correspond to the known patterns
- Check if the known patterns can be exposed by the techniques that have been chosen

(objective capability rather than user testing)

From theory to practical use

- If InfoVis research achieves this…

⇒ it will be quite possible to write:

  - Practical Guide to Analytical Visualization: Understand Your Data
  - Visualization: Informed Decisions Using Data
  - Visualization for Business and Economics
  - Visualization for the Behavioral Sciences
  - …

Some ideas concerning the construction of the theory are presented in our poster: