Visually Exploring Multivariate Trends in Patient Cohorts using Animated Scatter Plots

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http://ieg.ifs.tuwien.ac.at/projects/timerider/
Patient data sets are large and have many variables
For long-term diabetes care we need to explore multivariate trends in cohorts

diabetes out-patient clinic
check up examinations
  10 quantitative variables
  + more data on therapy
development over many years
  esp. co-development of variables
~ 35 patients in the cohort
Scatter plot is a popular method to explore relationships between 2 variables.
But how can we explore development over time?

mapping

time to space vs. time to time

TimeRider based on Animated Scatter Plot

contradictory views on animation in visualization in prior research
Patient cohorts pose additional challenges for animated scatter plots

- Irregular sampling
- Data wear
- Data sets covering different portions of time
Demonstration of TimeRider
User study with 10 physicians

Research questions

1) Does animation, specifically in TimeRider, support physicians in getting insights from time-dependent data?
2) Is the mapping (e.g., color, traces) we developed appropriate for the task?
3) Are there any general usability/utility problems that might also occur in similar systems?

Methods

Thinking Aloud + Screen Capture
coding usability problems with Forsell & Johannssen’s heuristics for usability in Information Visualization
Tasks

4 tasks invited participants to explore the data at will and experiment with the prototype.

e.g., Task 3

Parameters: x-axis: NBZ
            y-axis: RR diast [mmHG]

Limit the data set to NBZ ≤ 100; RR diast. ≤ 80.
Choose a setting that gives a good overview over the trends of the patients.

Which patients show a favorable trend?
What is the general trend of the group?

Experiment at will.

Describe your findings.
Results

All participants required (hands-on) learning to get familiar.

Solve tasks: **All participants successful**

Predict trends: **All participants** (hesitantly) **successful**

Usability problems: 50+

- most frequent heuristic: “information coding/mapping”
- e.g., order of variables in dropdown lists
- e.g., participants did not understand how to use range sliders
- e.g., cluttering from overlapping marks/traces

→ many problems fixed in the next iteration
Conclusions on TimeRider

improved Animated Scatter Plot

http://ieg ifs tuwien ac at/research/timerider/

3 challenges posed by patient cohorts

irregular sampling

data wear

data sets covering different portions of time

User study with 10 physicians

usage – learnable

tasks – solvable

→ evidence for effectiveness of animation in visualization