VisuExplore
visualizing medical information

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Visually Exploring Multivariate Trends in Patient Cohorts using Animated Scatter Plots

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http://ieg.ifs.tuwien.ac.at/projects/timerider/

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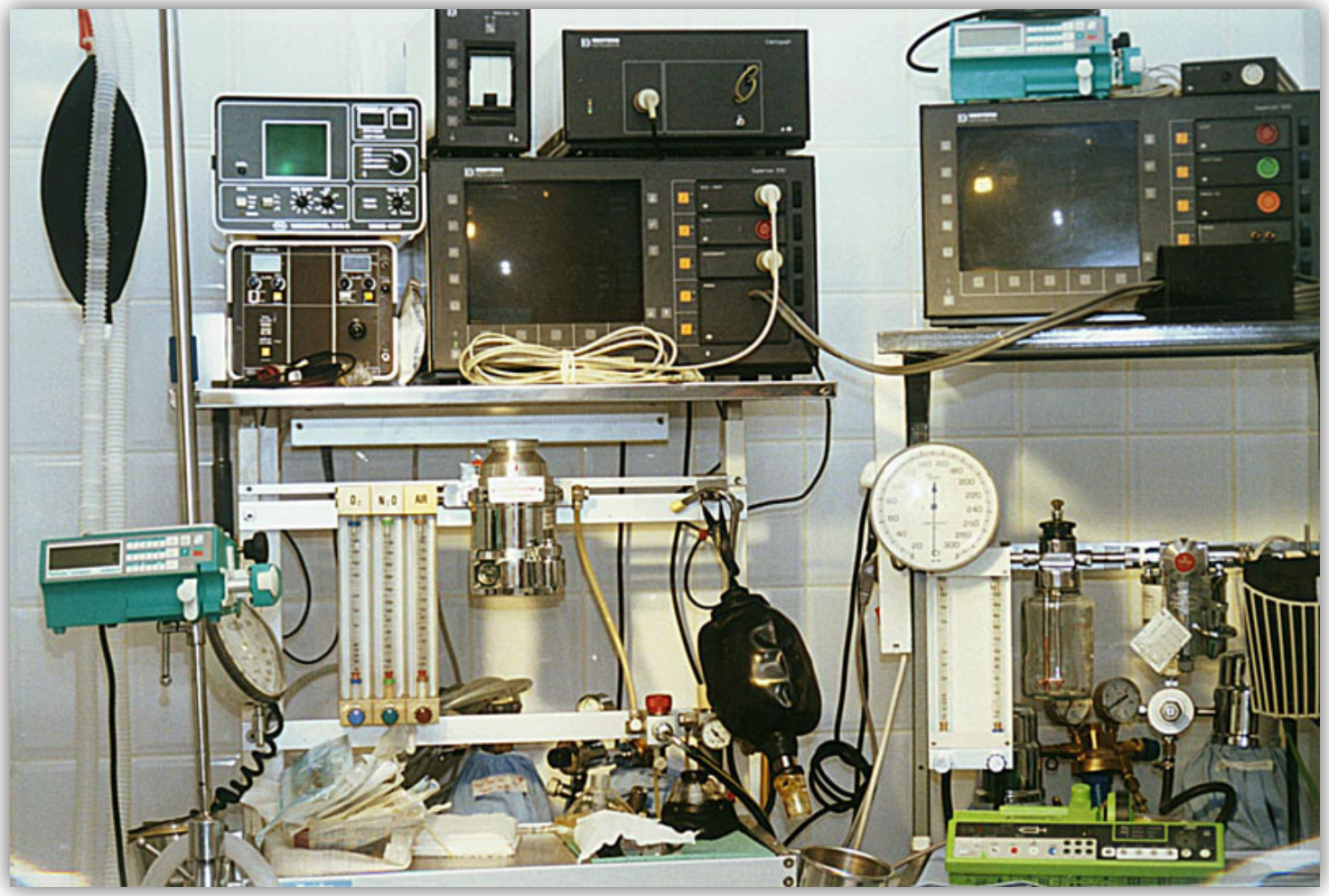
Patient data sets are large and have many variables



For long-term diabetes care we need to explore multivariate trends in cohorts

diabetes out-patient clinic

check up examinations

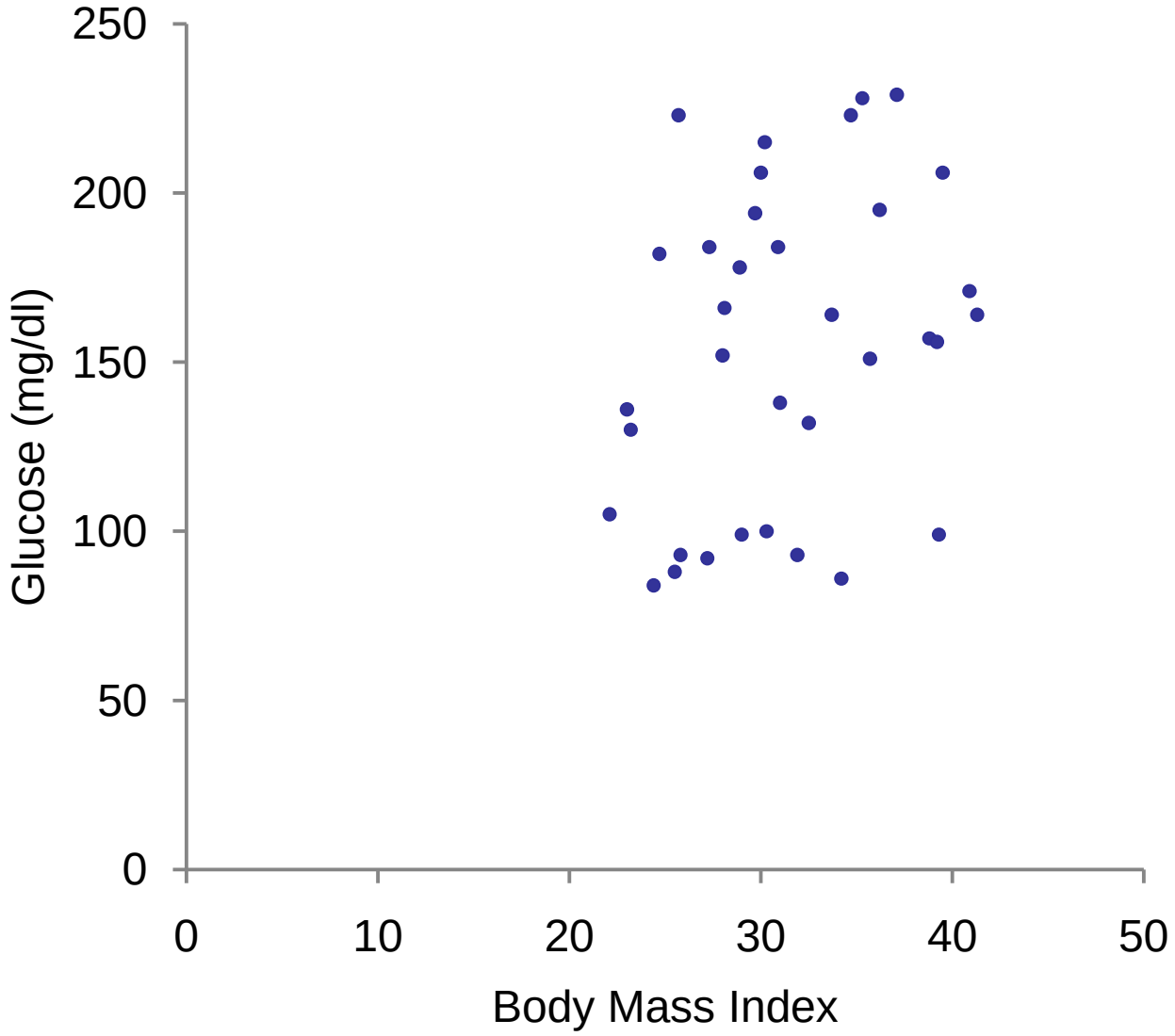
- 10 quantitative variables
- + more data on therapy

development over many years

- esp. co-development of variables

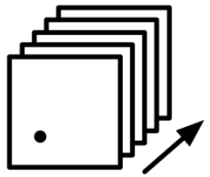
~ 35 patients in the cohort

Scatter plot is a popular method to explore relationships between 2 variables



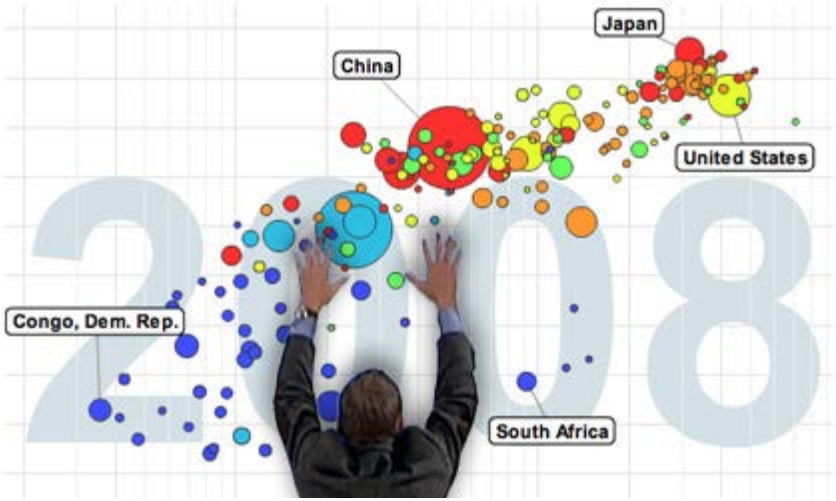
But how can we explore development over time?

mapping



time to space vs. time to time

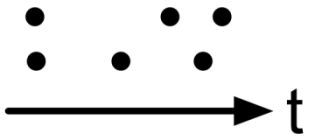
TimeRider based on Animated Scatter Plot



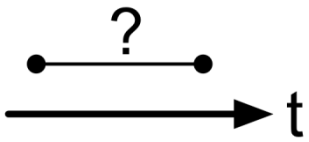
contradictory views on animation in visualization in prior research

Images: Wolfgang Aigner; http://www.gapminder.org/

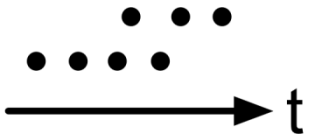
Patient cohorts pose additional challenges for animated scatter plots



Irregular sampling

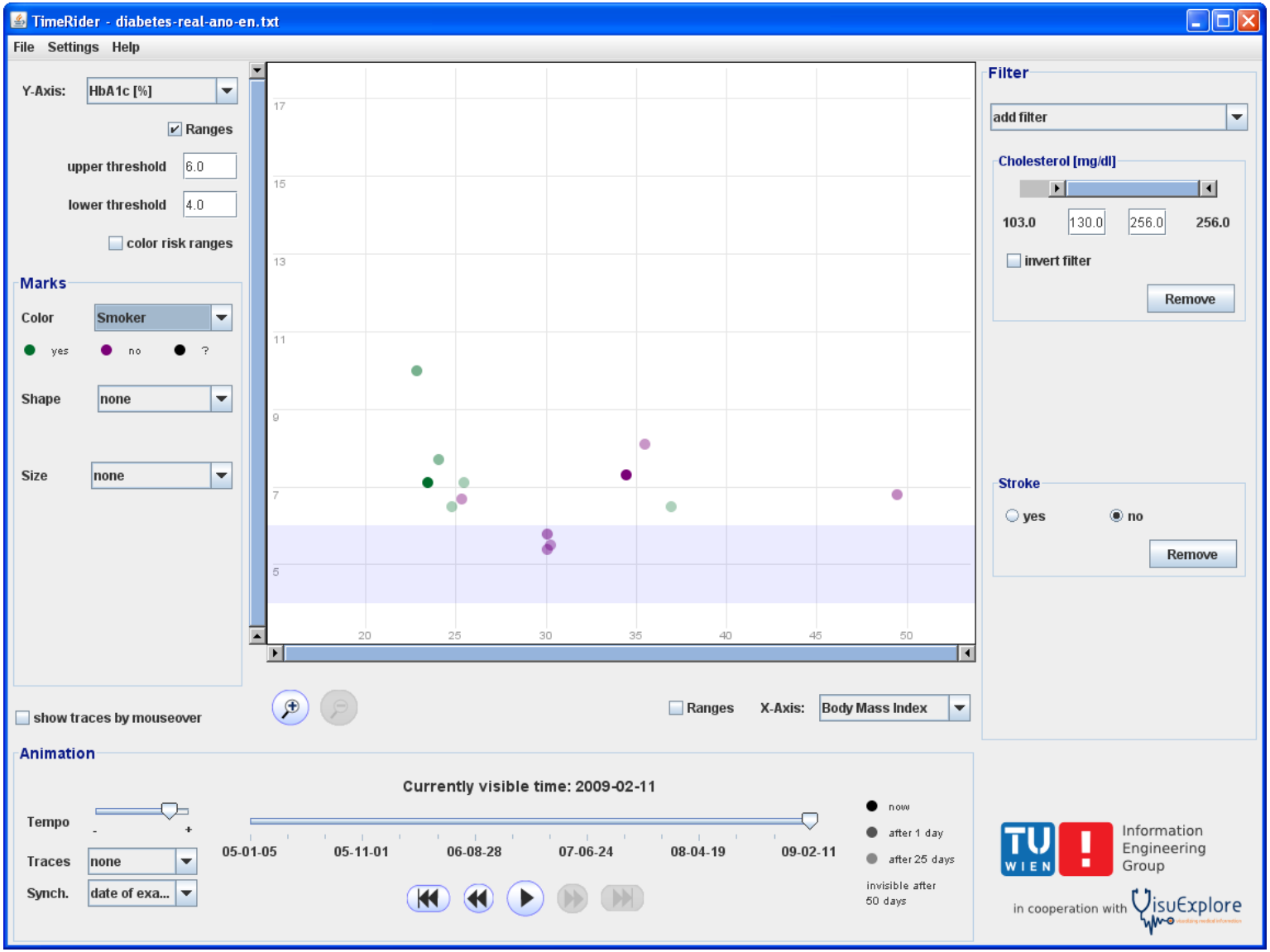


Data wear



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

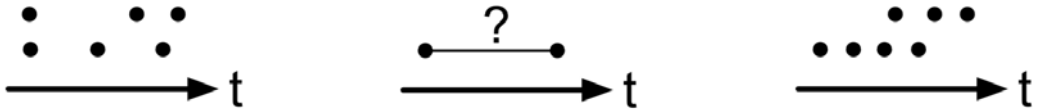
Conclusions on TimeRider

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