
Effectiveness of Animation in Trend Visualization, 2008, IEEE Visualization

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Trend visualization

What is a trend?

- observed general tendency

Standard visualization:

- line or bar chart in a time series

Trend patterns:

- up, down, reverse, cyclical, noise
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Multivariate Trend visualization

- Trends estimation is statistical technique (not this paper)

Multivariate Exploratory Visualization:

- Plotting multiple timeseries, line/bar charts

Gapminder Trend analyzer (Hans Rosling):

- bubble plot with animation (4 variables)
 - x,y,size of bubble are three variables
 - time is used for animation
 - popular / copied by others e.g. Microstrategy
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Gapminder trend analyzer

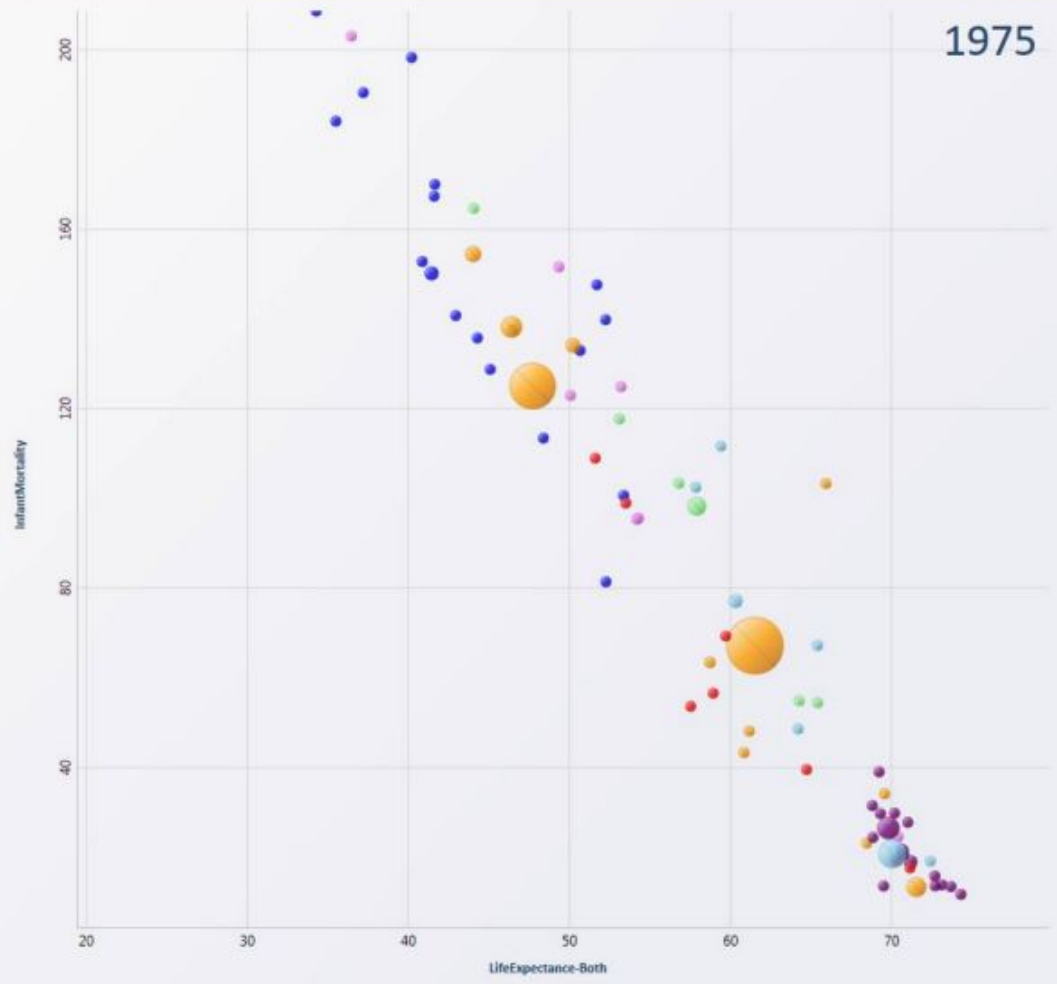
Use of gapminder trend analyzer

- less useful for analysis and exploration (because animation)
- Used for presentations (e.g. Hans Rossling)
- Presenter knows in front the patterns animation

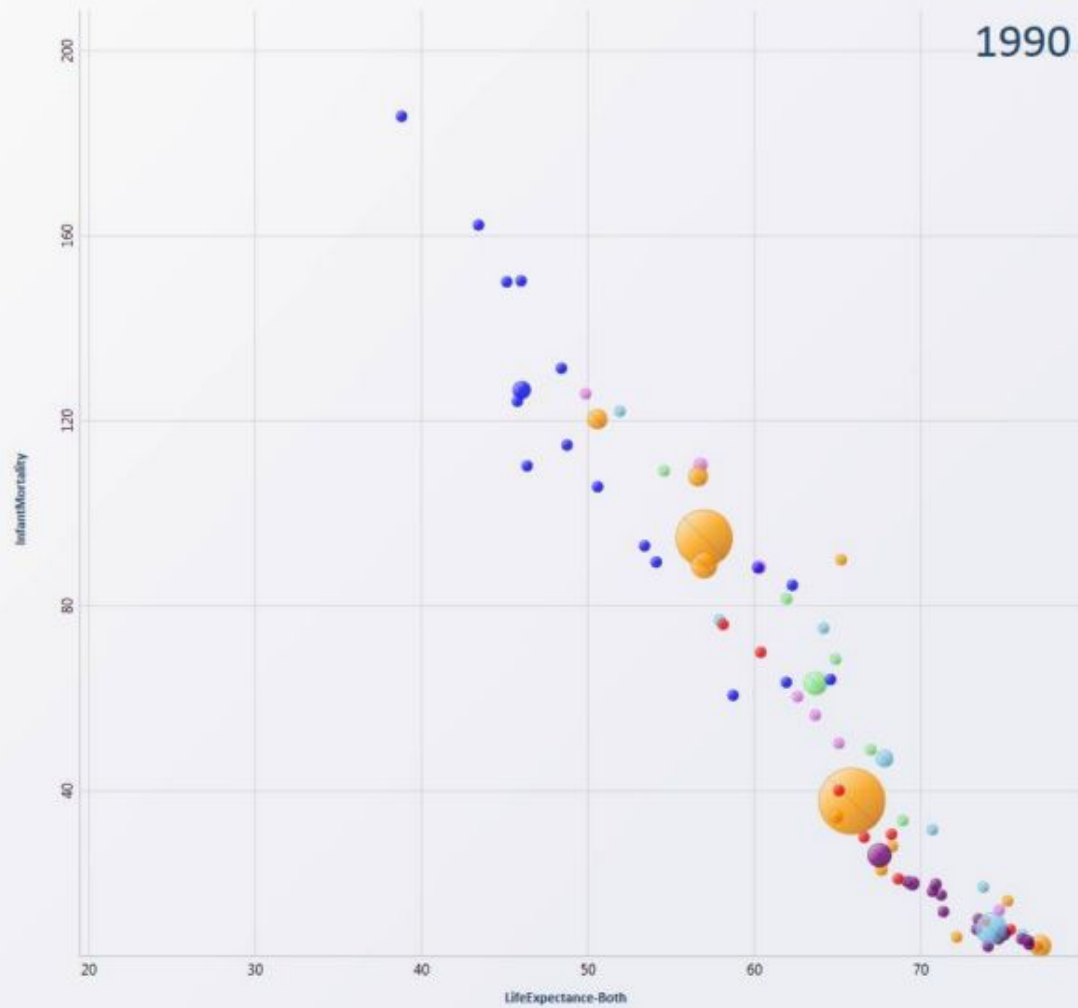
Paper:

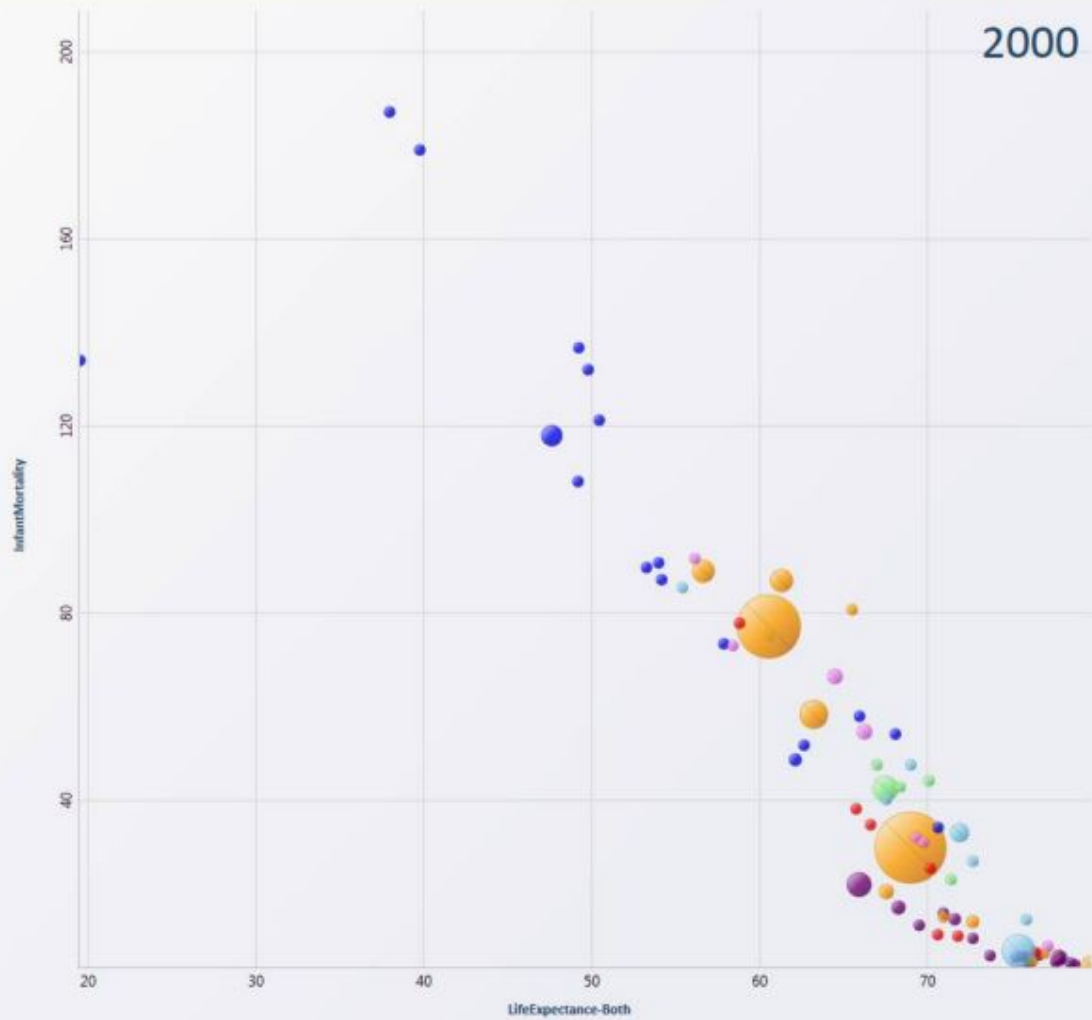
- Two alternative visualization techniques
 - How effective for viewers and analysis?
-

1975

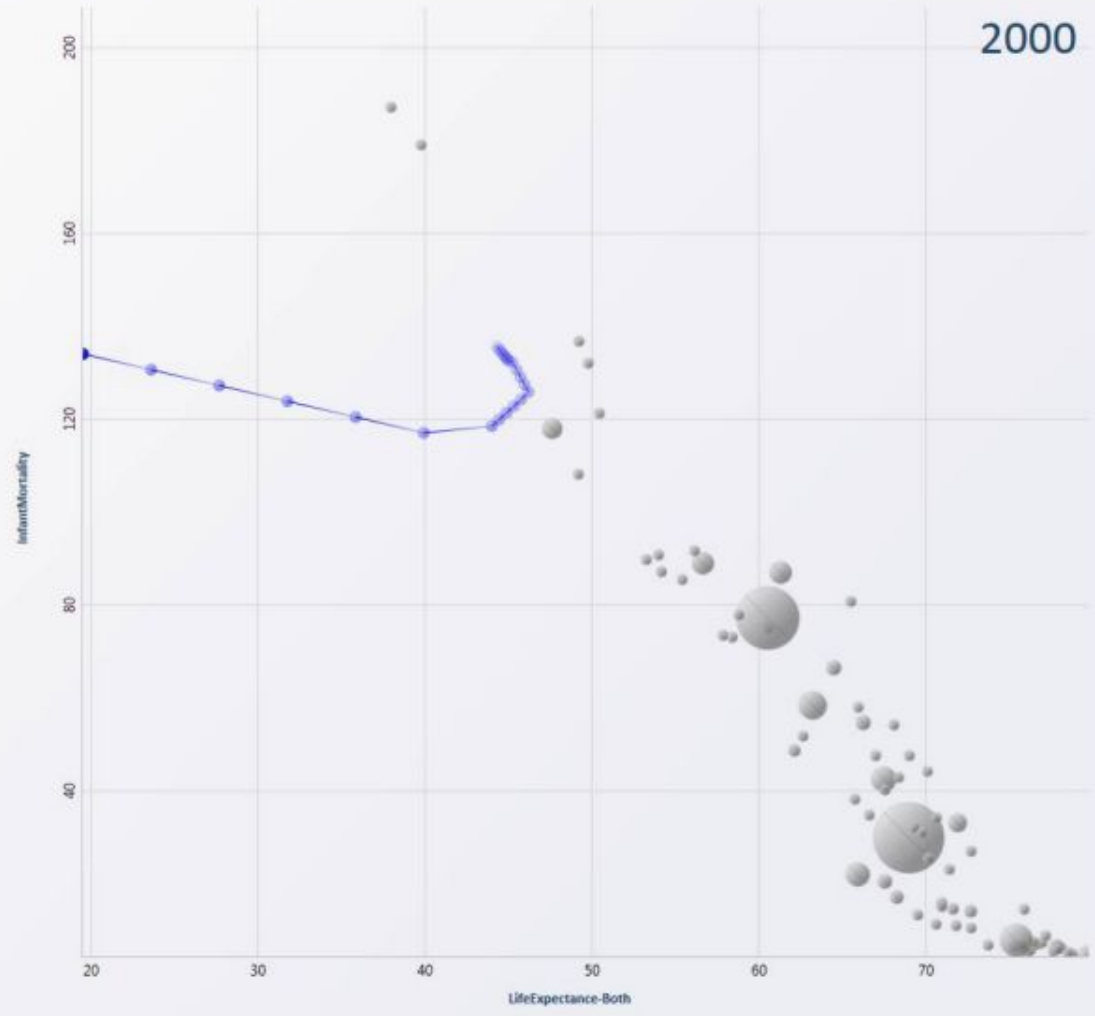


1990





2000



Tasks

Presentation, narrator plays essential role:

- explains what's happening, highlights data points (e.g. country)

Analysis:

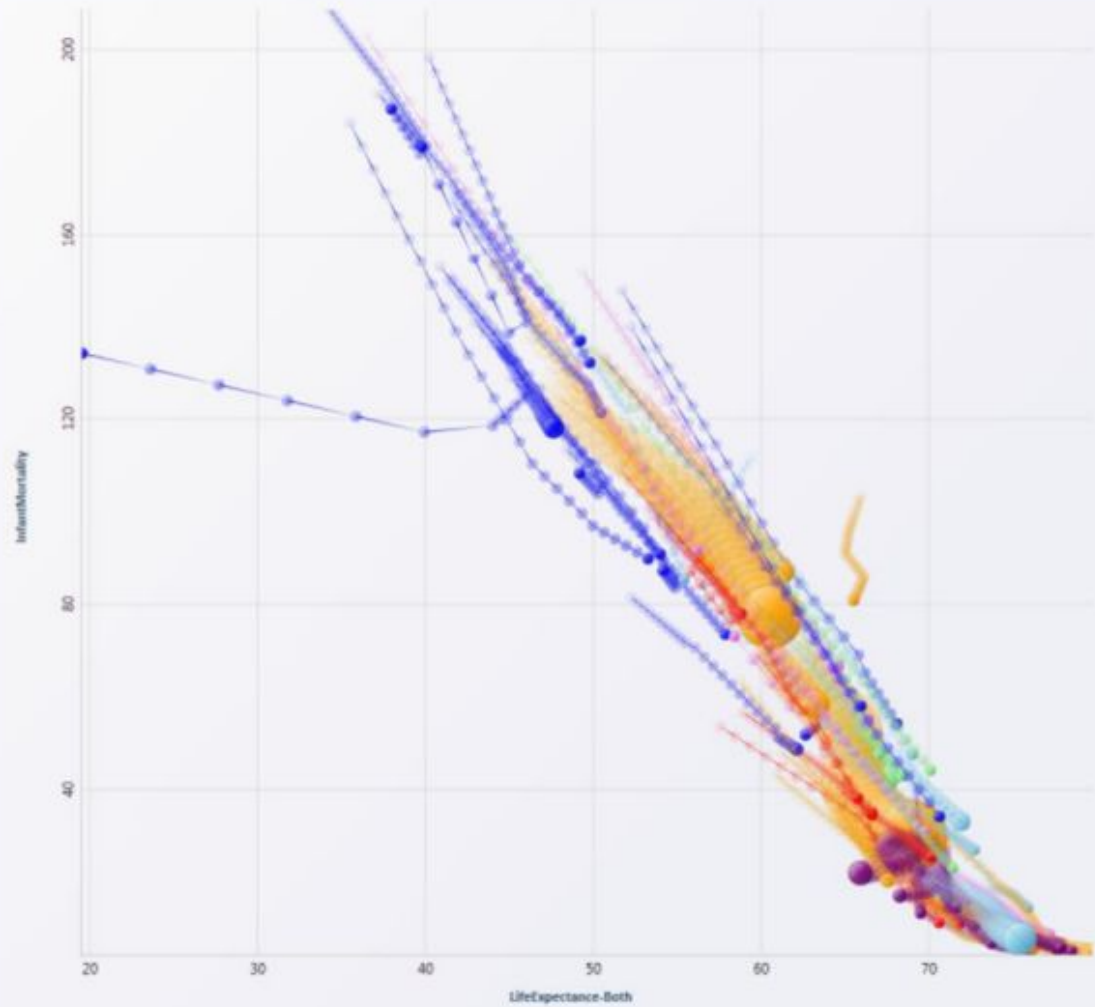
- replaying animation over and over to detect patterns
 - problem: noise, many data points, difficult to focus
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Alternative 1: traces

- Plot the trace of each point (next slide)

Advantage;

- anomalies pop up
 - clear trends are straight lines
 - Challenges direction of trend: using size of bubbles (big one first)
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Alternative 1, problems

Complicated trends are not visible:

- reverse, cyclical etc.

Multiple countries / points

- cause occlusion, visual clutter
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Alternative 2: small multiples

- split the display in small multiples

Pro:

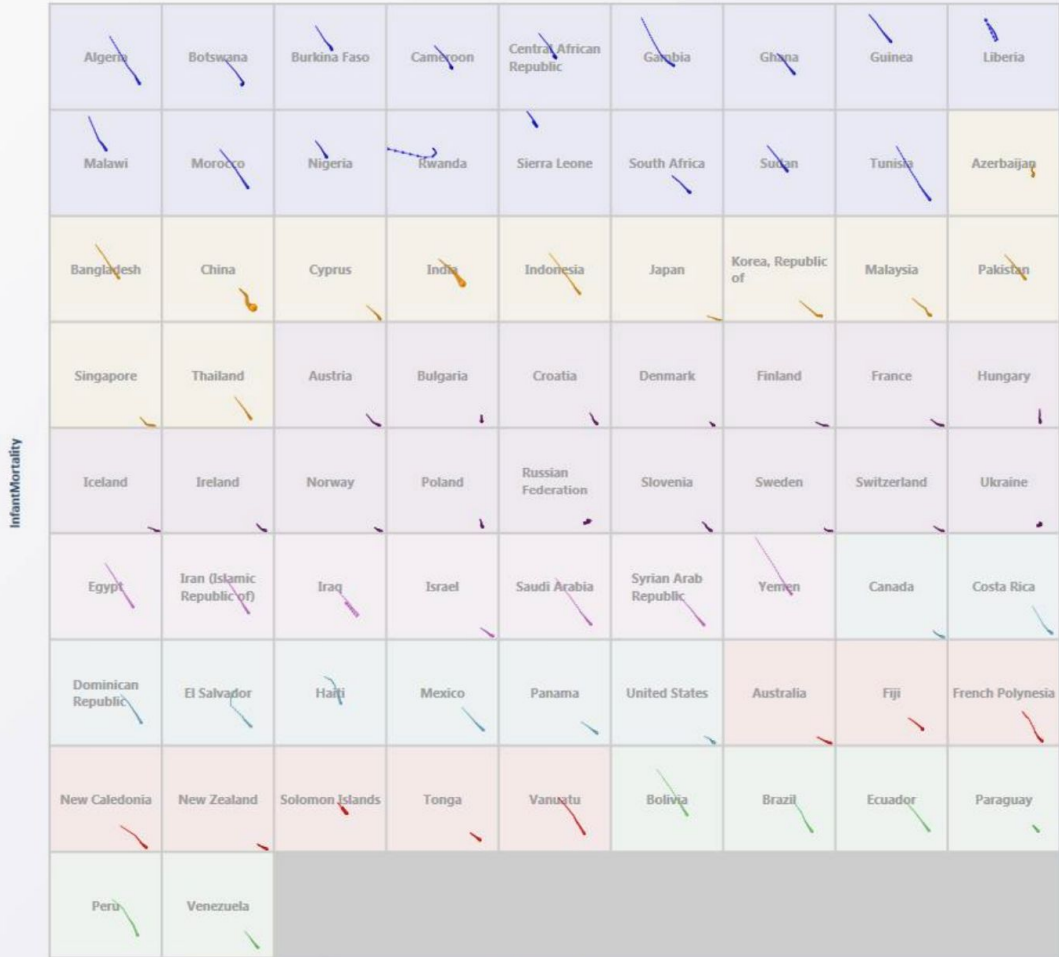
- individual development is clearly visible (no clutter)

Challenge:

- direction: bubble size is smaller, more difficult
 - difficult to scan the whole array of countries
 - number of groups/countries
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Split view per country





LifeExpectance-Both

Animation effectiveness

Prior work in animation:

- use to show state change
- transition one view to another
- show mechanisms in data
- show trends (this paper)

Animation seems to help to explain/introduce a complex data problem

Also some critical papers (a.o. Tversky)

other paper (Griffin) also small multiples, but on time slices

Trend animation

- conveys “meaning”
- speed is a parameter

This paper;

- 10 sec for 25 years
 - participants not too fast or too slow
 - participants can control/stop/start animation
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Experiment

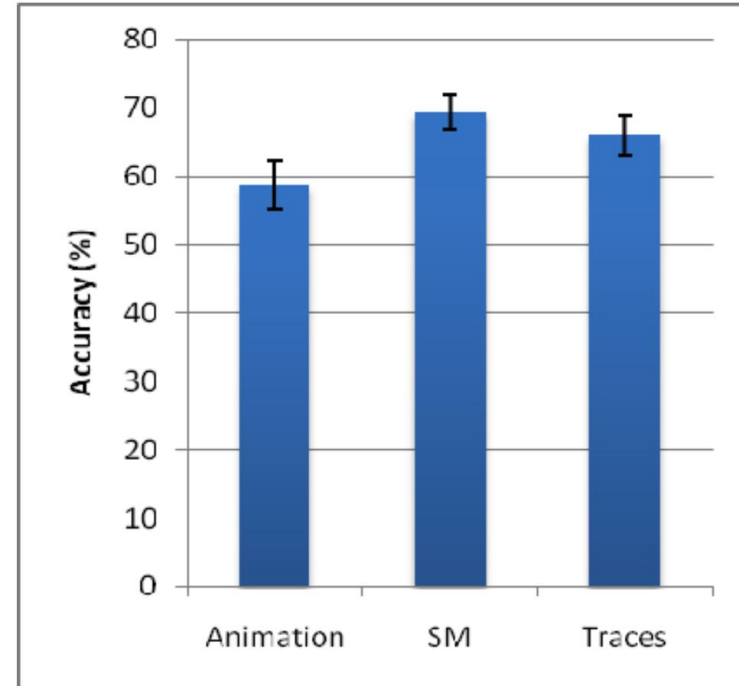
- 3 different visualizations
 - 2 datasets (small / large)
 - 18 participants
 - M/F = 10/8
 - age: 38-52 (40 average)
 - 24 Tasks
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Tasks (example)

- Select 3 countries whose rate of energy consumption was faster than their rate of GDP per capita growth. Select 2 countries with significant decreases in energy consumption.
 - Which country had the most significant decrease in GDP per capita?
 - Which continent had the most significant increase in GDP per capita (i.e., the continent with largest percentage of countries with significant increases in GDP)?
 - Select 2 countries whose GDP per capita increased first, then decreased later.
 - Which continent had the least changes in GDP per capita?
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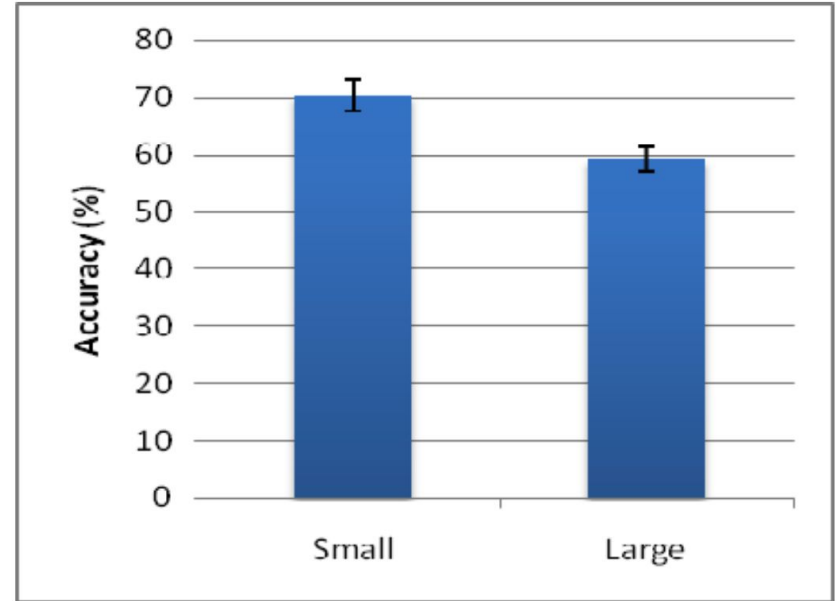
Results (1)

- Small multiples more effective than animation



Results (2)

Small data sets were
easier



However: preferences

- Participants were asked to rate how pleasant the visualization was
 - These results differ from the tasks results.
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Table 4. Average ratings for a few general questions.

	Presentation	Analysis	Overall
G1. I found the Traces view enjoyable.	3.8	2.9	3.4
G3. I found the Small Multiples view enjoyable.	4.1	3.4	3.7
G5. I found the Animation view enjoyable.	4.6	5.0	4.8
G7. The animation went too fast for me.	3.2	2.8	3.0
G8. The animation went too slow for me.	1.6	1.3	1.4
G9. I lost track of some data points as they moved.	4.9	4.6	4.8

Table 3. Average ratings for seven questions for each visualization.

* indicates significant differences ($p < .05$).

	Animation	SM	Traces
Q1. The visualization was helpful to me in answering the questions.	4.6 *Traces	4.2	4.1
Q2. For the smaller dataset, I found the tasks easy using this visualization.	4.6 *SM	4.2	4.5
Q3. For the larger dataset, I found the tasks easy using this visualization.	2.6	3.4 *Traces	2.3
Q4. I enjoyed using this visualization.	4.3 *SM *Traces	3.7	3.5
Q5. I found this visualization exciting.	4.3 *SM *Traces	3.1	3.0
Q6. For the smaller dataset, I found the screen too cluttered.	1.8	1.5	2.0
Q7. For the larger dataset, I found the screen too cluttered.	4.4	2.8 *Animation *Traces	4.7

Conclusion

- Interesting comparison of animation vs small multiples
 - Animation can be confusing
 - Small multiples and traces work better for analytical tasks
 - For presentation animation has an aesthetic and engaging advantage
 - Breaks from using results from analytical visualization
 - However the data must lend it self for animation: no noisy, over crowded data.
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