Code-based, open-source software for teaching interactive data visualisation

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November 16, 2017

Problem

Tukey (1965, p. 25)

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- How does interactivity benefit data analysis?
- Which interactive techniques are 'worth learning'?
- Which code-based, open-source software to use?

Method

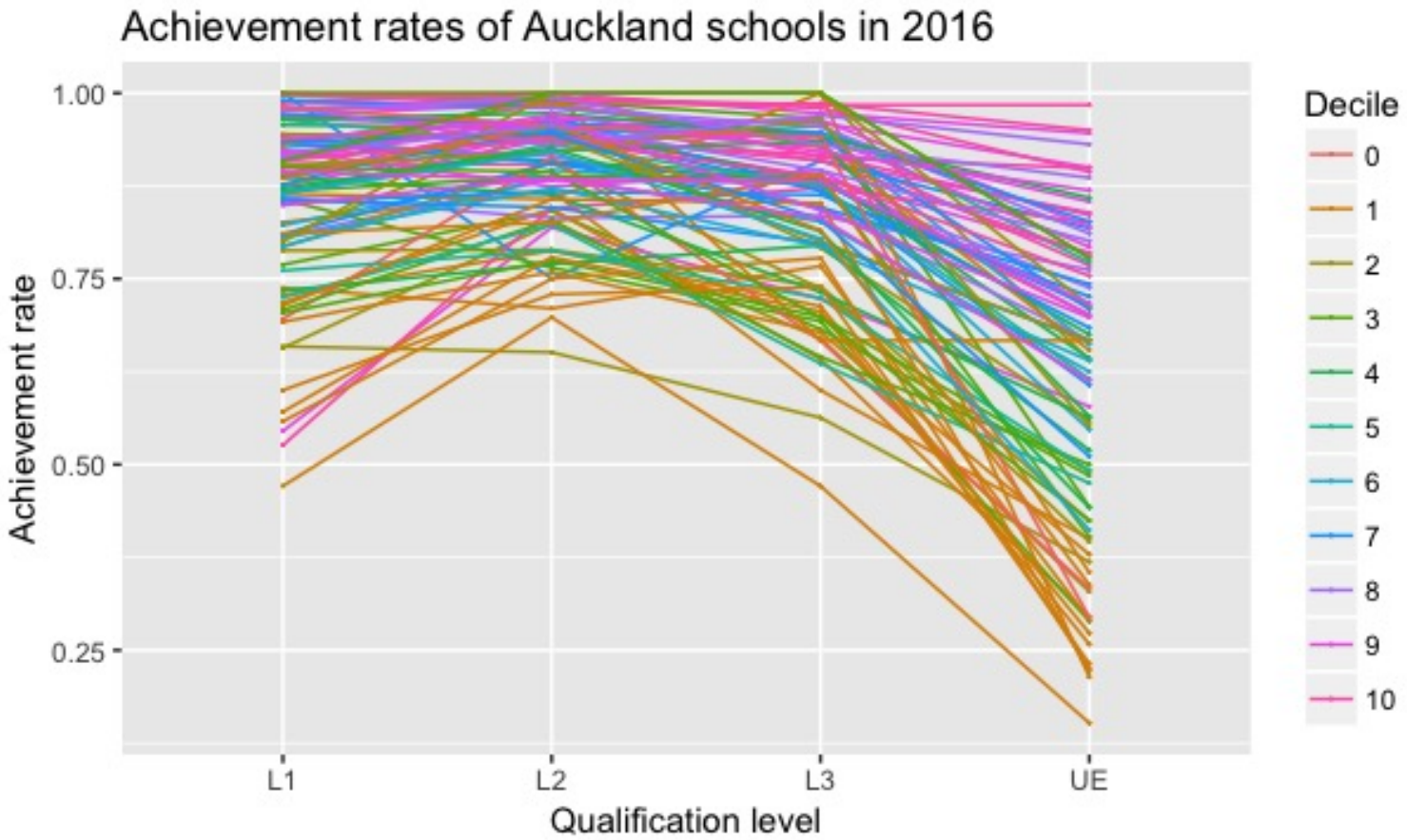
- Literature review of interactive techniques.
  - Interactive data visualisation using **GGobi** graphical user interface (Cook and Swayne, 2007)
- Survey of current code-based, open-source software.
- Explore how interactive techniques further insight into data.
  - Application to exploratory data analysis (EDA) of the 2016 National Certificate of Educational Achievement (NCEA) results for Auckland schools.

Findings

- Key interactive techniques that enrich data analysis:
  - Linked brushing
  - Identification
  - Subset selection
  - Scaling
  - Tours
- A focal set of **R** packages for applying interactive data visualisation: **plotly**, **crosstalk** & **shiny**.
  - Coverage of key interactive techniques
  - Ease of installation and application
- The benefits of interactivity justify the effort of teaching interactive tools.

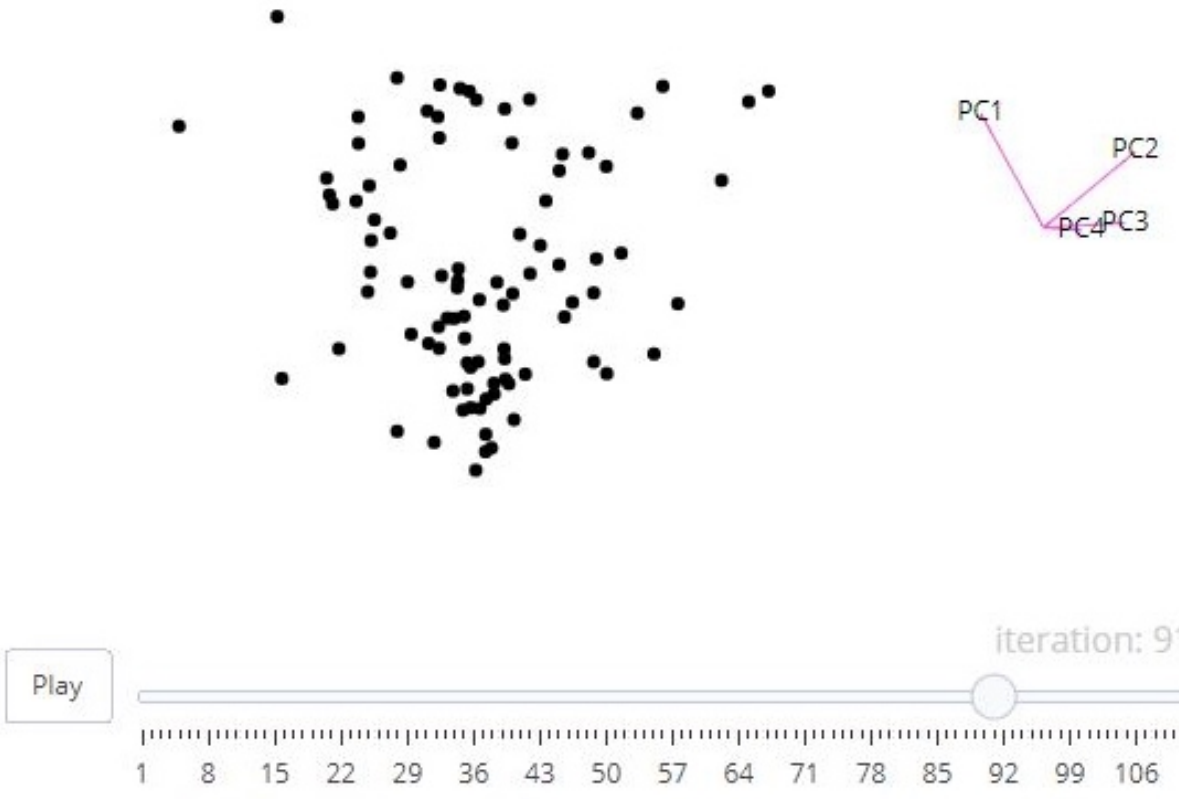
Leveraging static plots

Parallel coordinates plot (PCP) ▸ Demo

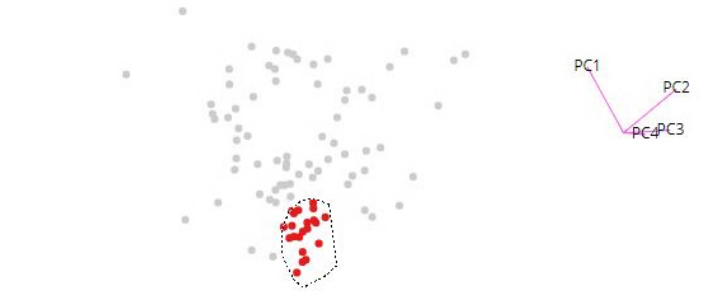


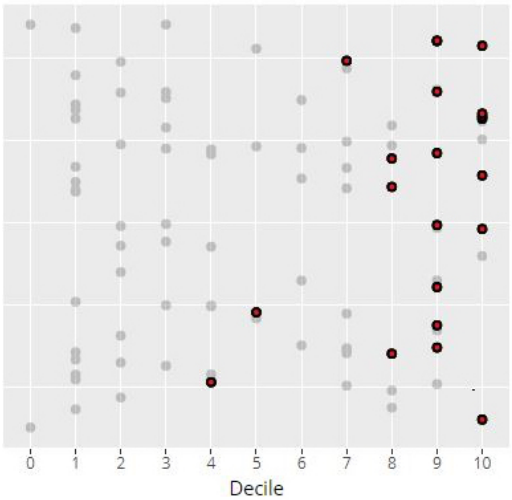
Relating multiple views

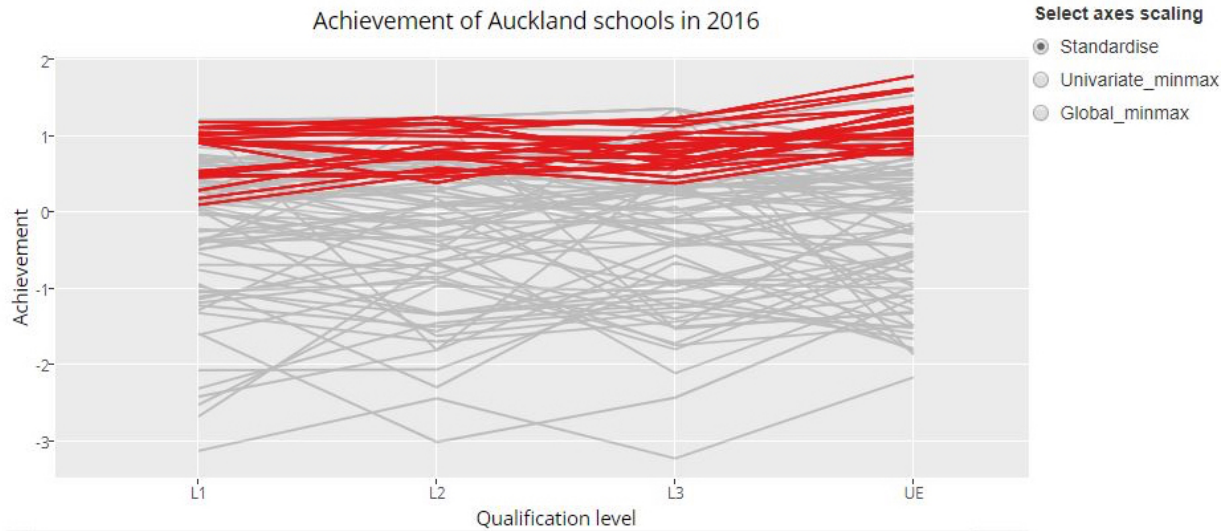
Tours



Relating multiple views







Benefits to EDA

- **Linked brushing** and **identification** allowed fast querying of unusual patterns, groups and/or individuals.
- **Subset selection** via filtering views alleviated issues with overplotting and colour schemes.
- Interactive **scaling** revealed different structures.
- **Linked brushing** related multiple views together and helped with interpretation.
- **Tours** allowed multivariate structures to be explored.
- Questions were quickly addressed and more questions arose from probing the data with interactive techniques.

A focal set of software

Coverage of interactive techniques by **shiny**, **plotly** and **crosstalk**.

Package	Linked brushing	Tooltip Identification	Subset selection	Scaling	Animation (for tours)	Active R session
Crosstalk	Easiest for 1-to-1		Filtering views only		Yes	
Plotly		Yes	Filtering views only	Zoom in or out	Yes	
Shiny	Aggregate brush possible		Analysis & filtering views		Yes	Yes

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  - Utilises and relates multiple views
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Conclusion

- Interactive techniques benefit data analysis.
  - Insights beyond static plots
  - Utilises and relates multiple views
  - Further exploration of the data
- The **R** packages **shiny**, **plotly** and **crosstalk** enable interactive data visualisation with code-based, open-source software.
- The benefits of applying interactive techniques to data analysis warrant teaching interactive data visualisation to future statisticians.

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