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

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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

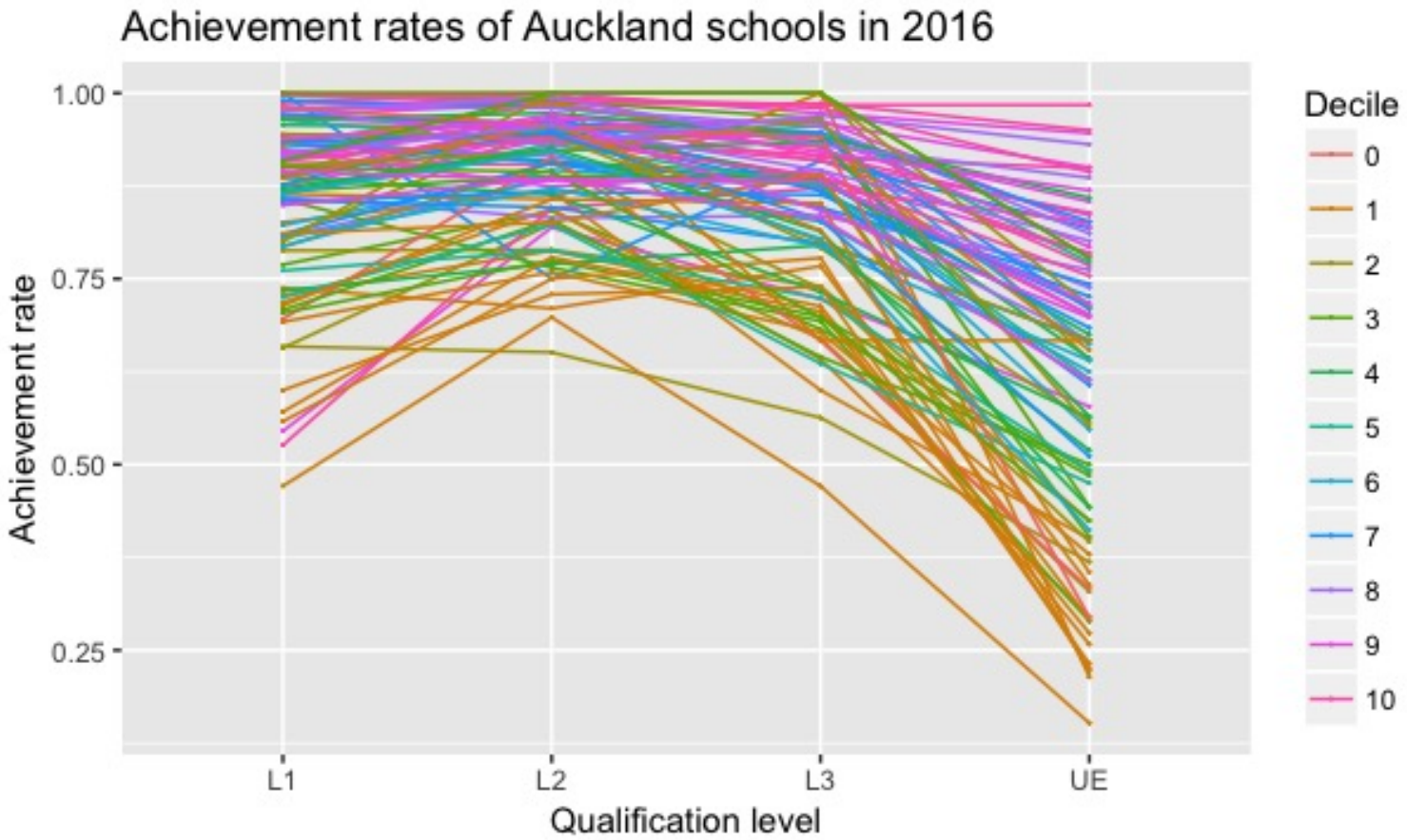
- Literature review of interactive techniques.
  - Interactive data visualisation using **GGobi** graphical user interface (Cook and Swayne, 2007)
- Survey of current code-based, open-source software.
- Application to exploratory data analysis of 2016 National Certificate Educational Achievement (NCEA)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

Findings

- Key interactive techniques that enrich data analysis:
  - Linked brushing
  - Identification
  - Scaling
  - Subset selection
  - Tours
- A focal set of **R** packages for applying interactive data visualisation: **plotly**, **crosstalk** & **shiny**.
  - Ease of installation and application
  - Coverage of interactive techniques
- Interactive data visualisation is worthwhile teaching.

Leveraging static plots

Parallel coordinates plot (PCP)



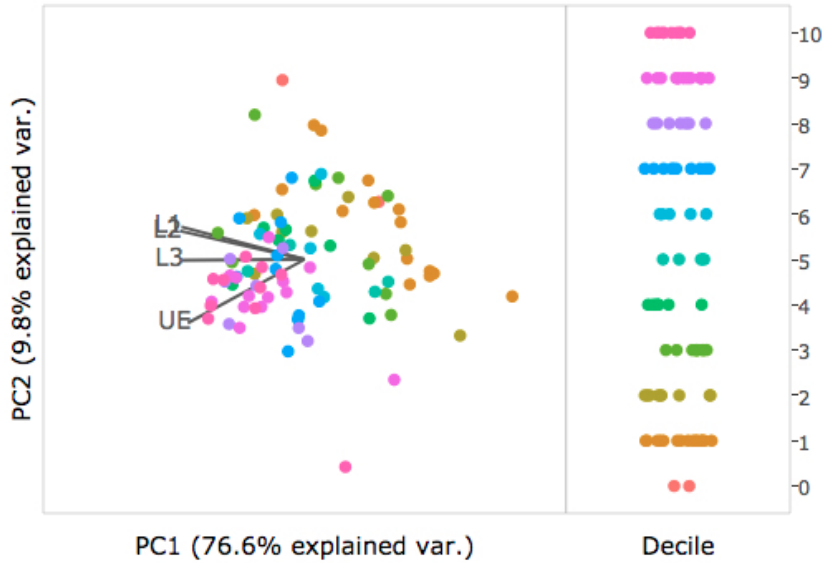
Leveraging static plots

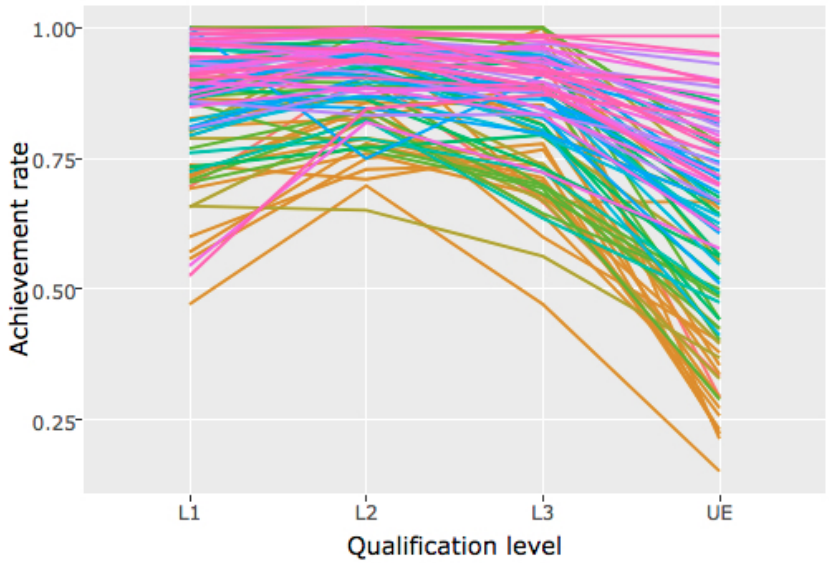
Parallel coordinates plot (PCP)

- **Linked brushing** and **identification** allow fast querying of unusual patterns, groups and/or individuals.
- Interactive **scaling** to compare and explore the different patterns revealed.
- **Subset selection** via filtering views alleviates issues with overplotting.

Relating multiple views

Principal components plot and PCP





Relating multiple views

Principal components plot and PCP

- Insights into multivariate data structures gained from individual static plots are extended by **linked brushing**.
- Applying interactive data visualisation encourages further exploration of the data.
  - Questions are quickly addressed and more questions arise from probing the data with interactive techniques.
- Awareness of the strengths and weaknesses of different software allows for efficient application of interactive techniques.

A focal set of software

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

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

Conclusion

- Interactive techniques benefit data analysis.
  - Insights beyond static plots.
  - Relate multiple views.
  - Further exploration of structures.

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Conclusion

- Interactive techniques benefit data analysis.
  - Insights beyond static plots.
  - Relate multiple views.
  - Further exploration of structures.
- 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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