Interpreting sequential profiling data via animated box-and-whisker plots

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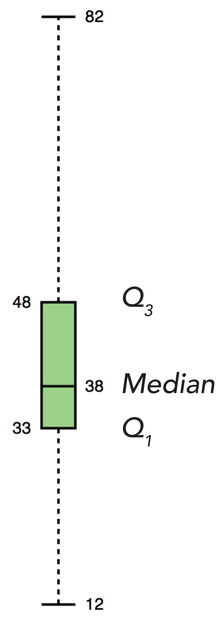
Objective

This work explores approaches to visualizations of temporal data through the use of web-based animation of boxplots. Interactive animations of temporal data help to tell the story of the product experience.

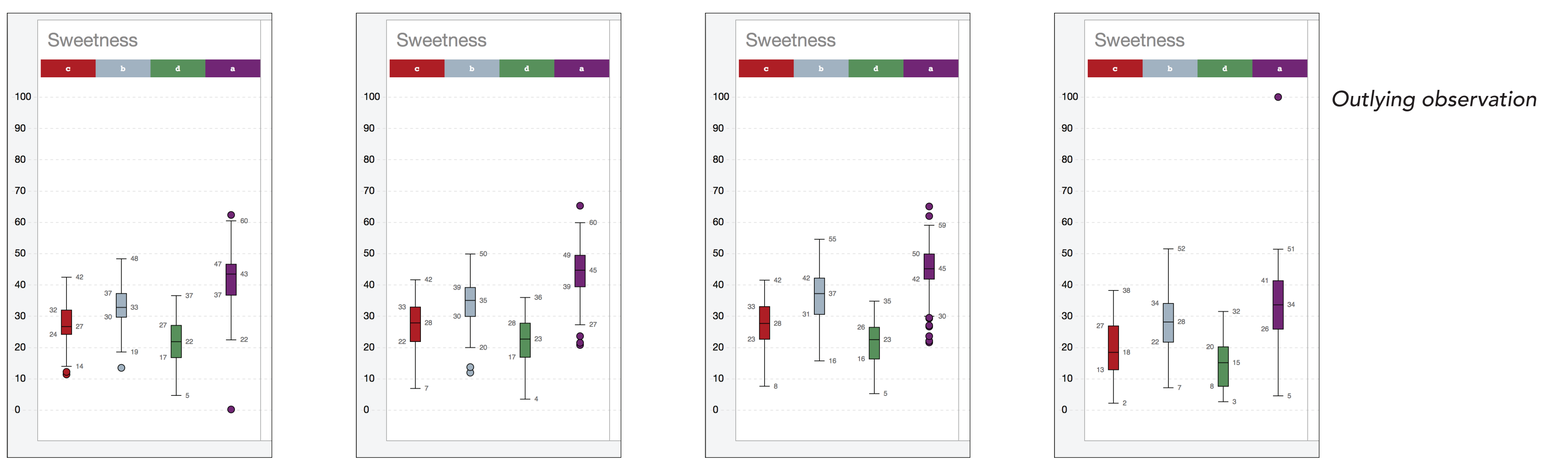
Box-and-whisker plot

- Univariate data
- Box is the height of the Interquartile range (IQR), with a crossbar at the median
- IQR is a robust measure containing the middle 50% of the data and calculated by $Q_3 - Q_1$
- Upper fence calculated by Q_3 + 1.5 IQR, lower fence calculated by Q_1 − 1.5 IQR
- Whisker length is determined by the most extreme value inside the fence
- Outlying observations fall outside the fence: mild and extreme outliers occur more (less) than 1.5 IQR above (below) Q_3 (Q_1)



Visualization in Practice

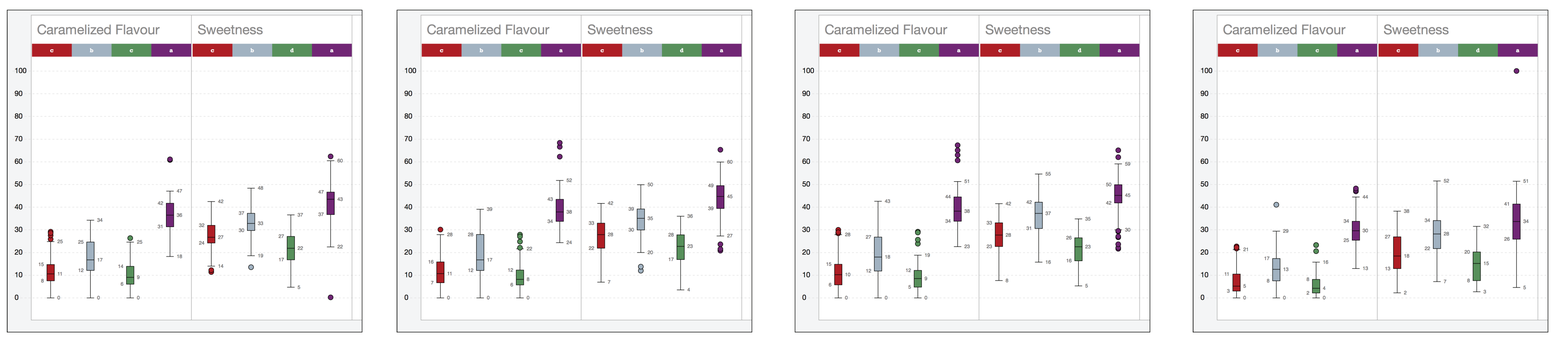
- Trained sensory panel evaluates four snack bars in triplicate using sequential profiling.
- Outlying observation for one panellist on the Sweetness attribute easily identified at time point 4.



Time Point 1 *Time Point 2* *Time Point 3* *Time Point 4*

Outlying observation

- One product stands out with intense Caramelized Flavour and Sweetness attributes.



Time Point 1 *Time Point 2* *Time Point 3* *Time Point 4*

- Post-hoc letters above each sample box-and-whisker plot indicate differences between samples at each time point.
- Animated box-and-whisker plots provide a snapshot view at each timepoint that incorporate univariate comparisons across samples, as well as a sense of intensity changes at adjacent time points.

Web-based Animation

- JavaScript framework "D3" (Data Driven Documents) used to create and animate the visualizations
- Uses HTML, CSS and SVG (Scalable Vector Graphics)
- The viewer is able to control the playback of the animation of the data, and can jump to specific time points

Data

- The visualizations lend themselves well to scale or ordered categorical data which are collected either at discrete timepoints (e.g. sequential profiling) or continuously (e.g. time intensity)

Benefits

- A flexible and portable means of creating engaging, visually appealing data visualizations for explaning complex sensory occurrences
- Using an easy-to-understand animated data-driven visualization, get a sense of how product properties change over time, differences between products, and correlation among attributes and timepoints.

References

Bostock, M., Ogievetsky, V. & Heer, J. (2011.) D3: Data-Driven Documents. IEEE Transactions on Visualization and Computer Graphics, IEEE Press.

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