

# Some new tools for visualising multivariate and multiway data

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**AIM:**

Simple interpretation of individual differences in sensory profiling using 3-way methods (here Tucker-1).

**PROBLEM:**

Straightforward extrapolation of typical 2-way plotting techniques to 3-way data analysis may often result in unreadable plots.

**INTERESTED IN:**

- Common information among assessors
- Individual differences:
  - Explained variance in respective dimensions
  - Relations between consensus and individual measurements

**PROPOSED PLOTS:**

- Common scores
- Correlation loadings for each assessor and each attribute
- "Hiding plot": relating individual principal component directions to the consensus space
- "Manhattan plot": explained variance for individual attributes and assessors as compared to the consensus

**EXAMPLE:**

Sensory profiling of cheese with different degrees of rancidity. The panel consisted of 12 assessors (9 trained and 3 untrained). A total of 14 cheese samples were tested by the panel using 17 attributes.

**RESULTS:**

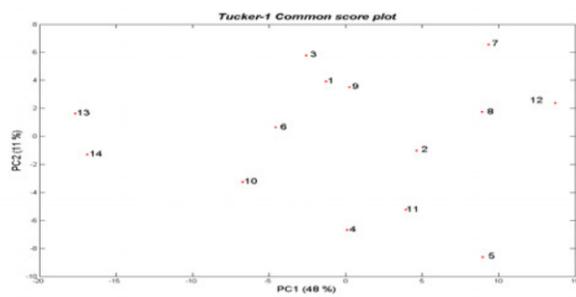


Fig. 1: Overview over the 14 tested cheese samples

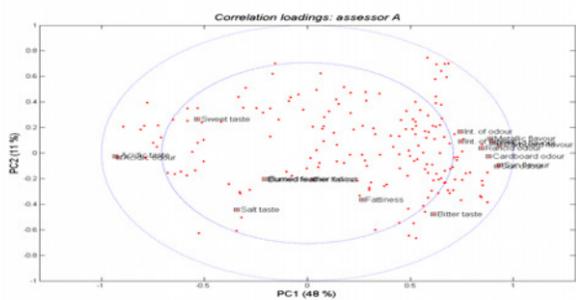


Fig. 2: All attributes of one trained assessor are highlighted. Except for sweet taste, burned feather flavour, salt taste and fattiness all attributes have a high explained variance in PC1 and PC2.

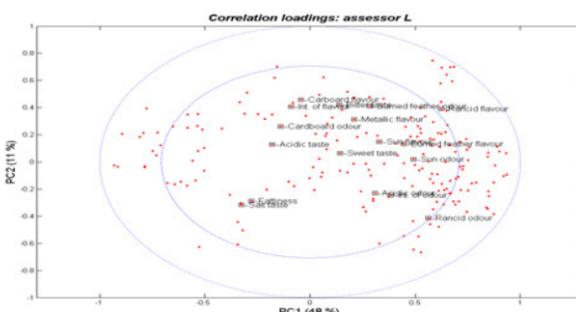


Fig. 3: All attributes for one untrained assessor are highlighted. Except for rancid taste the explained variance for all attributes is poor in PC1 and PC2.

**CONCLUSION:**

The presented plotting methods visualise sensory profile data (3-way data) in such a way that assessors performing differently from the consensus can be easily identified. They help the panel leader to reveal specific weaknesses of single assessors and allow precise feedback for further training of the panel.

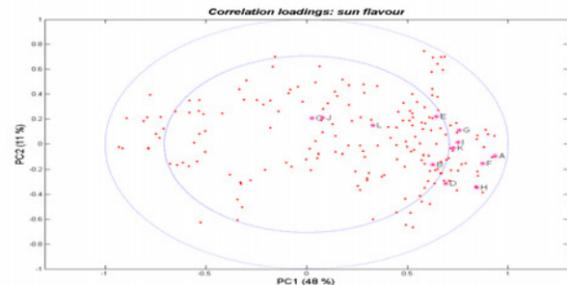


Fig. 4: Attribute 'sun flavour' is highlighted for all assessors. The assessors are grouped together except for assessors C, J and L who have low explained variance for this attribute in PC1 and PC2. The rest of the panel agrees well for this attribute.

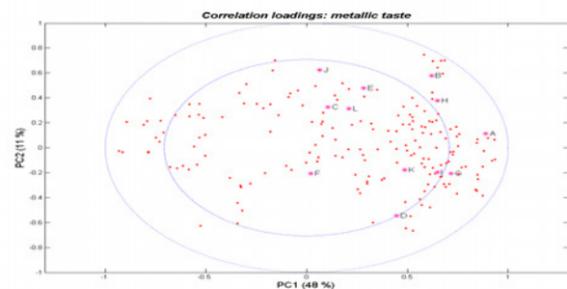


Fig. 5: Attribute 'metallic taste' is highlighted for all assessors. The assessors are spread over a large part of the correlation loadings plot. This indicates that there is little agreement among the assessors for this attribute.

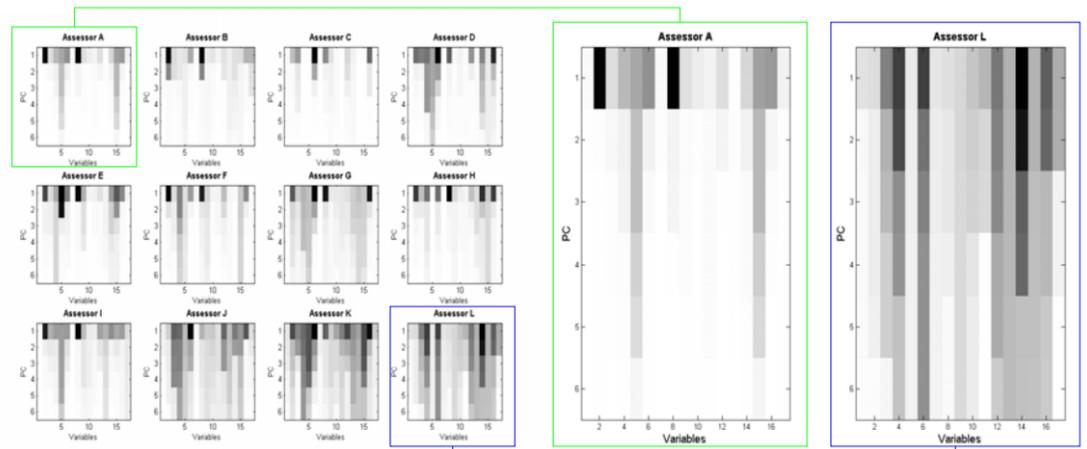


Fig. 6: Left: Manhattan plot for all assessors. Right: Manhattan plot for assessors A and L visualise efficiently how the two assessors differ in their evaluations of the tested cheese samples. For assessor A only attribute 5 (burned feather odour) and 15 (burned feather flavour) the explained variance is low through PC1 to PC5. For assessor L most of the attributes are dark or grey, indicating low explained variance.

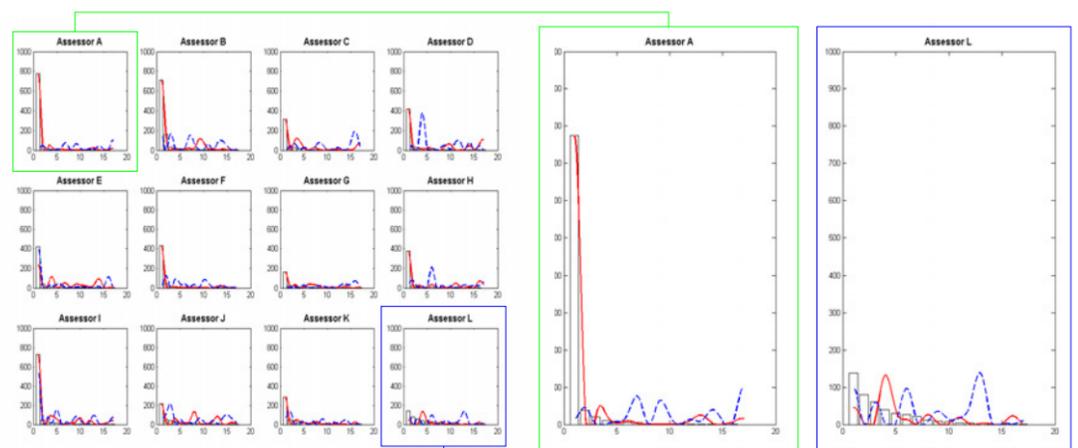


Fig. 7: Left: Hiding plot for all assessors. Right: Hiding plot for assessors A and L. Bars: Explained variance for the individual principal components of each assessor. Red bold line: Indicating coefficient for the first solution vector. Blue dashed line: Indicating coefficient for the second solution vector. Assessor A and L have very different solution vectors and explained variance for the first few PC's. This indicates that their individual data differ from each other and contribute in different ways to the consensus score matrix.