Considerations for optimization of blended wine quality based on areas of acceptability

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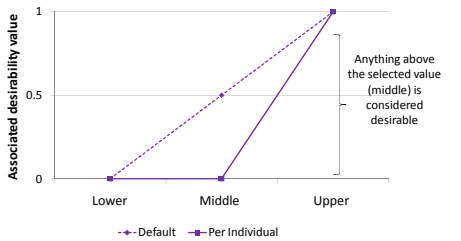
1 introduction

Understanding optimal product characteristics driven by consumer responses is critical in today's marketplace. Optimization techniques, specifically Danzart's quadratic preference mapping technique, use consumer mean overall liking (OL) scores to set the lower limit of acceptability. Therefore, any product rated greater than or equal to the mean score is considered acceptable for an individual consumer. However, this is an optimistic and lenient approach which provides large regions of acceptability (Meullenet, Xiong and Findlay, 2007) for individual consumers. An alternative is to use values which increase the acceptable minimum OL scores, narrow these areas of acceptability and are perhaps more realistic. In addition, there is a need to adapt these optimization methods to experimentally designed tests.

Contour plots may be used to identify acceptable regions in the sensory space by overlaying individual acceptable regions, where the densest area corresponds to the area of highest acceptability. Traditionally, this location provides the ideal product profile but not how to formulate the product. However, experimentally designed tests can provide ideal product formulations. This study examined the implementation of these optimization approaches to a mixture design experiment. An augmented-simplex centroid mixture design was used to develop ten wine blends from three single wines. This technique allows the identification of both the ideal product location and the component proportions (Gacula, 1993). Reducing the region of acceptability for individual consumers may also identify any segmentation in the population.

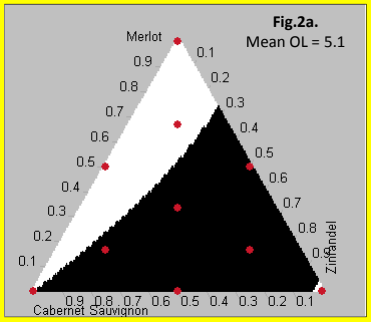
2 desirability

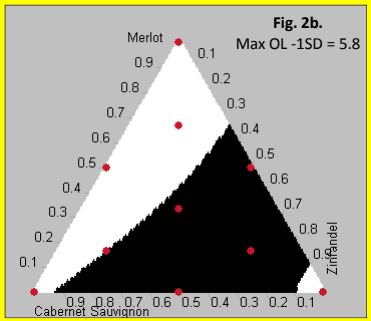


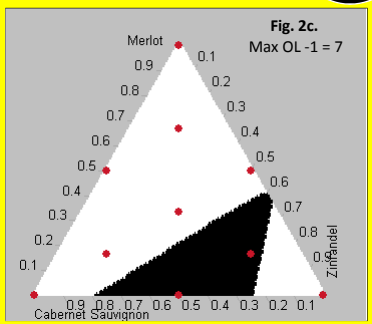
Desirability = Exp {Importance*Log(Desirability([a_1, b_1, c_1], [0.1, 0.1, 1], Y_1)}...+ Exp {Importance*Log(Desirability([a_n, b_n, c_n], [0.1, 0.1, 1], Y_n)}

For each individual:
a_1 = Lowest possible value on the scale (hedonic = 1)
b_1 = Selected value to be considered (mean, max-1, max-SD)
c_1 = Highest value selected by individual

3 influence of changing acceptability limits for consumer #9

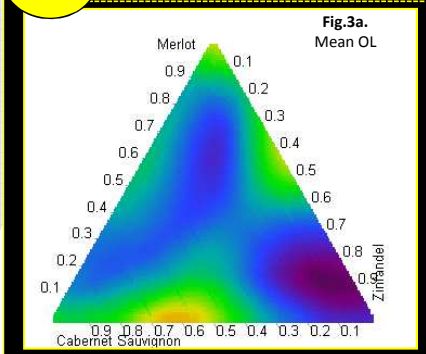


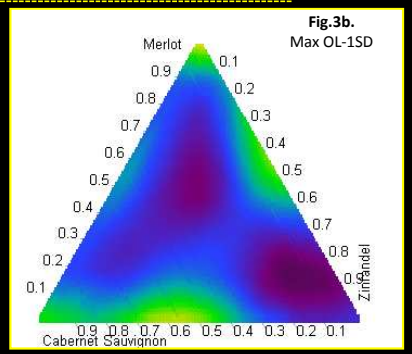


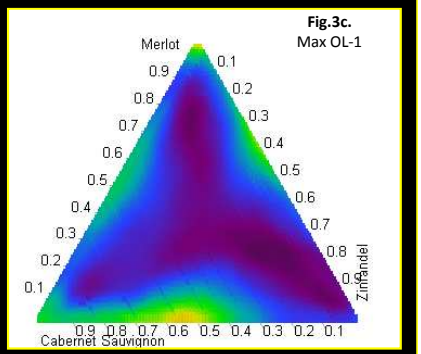


- The mean OL score (Fig.2a) indicates that consumer 9 would find a large variety of blends acceptable – any proportion of Cabernet, 30% or higher of Zinfandel and up to 70% Merlot.
- The acceptable area using Max-1SD (Fig.2b) is slightly narrower than Fig.2a, showing how a smaller region of acceptability affects plot coverage.
- Max-1 (Fig.2c)provides the tightest region of acceptability, indicating consumer #9 wants a blend of 30-80% Cabernet, 0-40% Merlot and 60-65% Zinfandel

4 influence of changing acceptability limits for all consumers







- The mean OL score shows an area of acceptability at the lower right of the contour plot (Fig. 3a).
- Fig. 3b shows segmentation occurring, with two areas of high desirability: lower right and upper middle.
- Max-1 (Fig. 3c) is the tightest area of acceptability within the population; segmentation is less obvious, but it does indicate general trends.

5 discussion

- Setting new desirability values affects areas of acceptability
- Indicates segmentation within the population
- Possible to make conclusions based on this analysis and not perform additional segmentation techniques
- Mean-1SD may be the best option among the three values used in this study, with the mean too lenient and Max-1 too severe.
- Superimposing contour plots in a mixture design environment has the ability to also provide a specific sensory profile of the ideal blend
  - Unlike traditional analysis which only provides optimal coordinates

6 conclusions

- Increasing the limit of acceptability will narrow the range of a consumer's acceptable region, thereby providing a more accurate, realistic ideal product.
- A validation study should be performed to confirm results