The TDS-band plot : a new graphical tool for Temporal Dominance of Sensations data

C. Monterymard, M. Visalli, P. Schlich*

INRA, Centre des Sciences du Goût et de l'Alimentation, Dijon, France

* pascal.schlich@dijon.inra.fr

INTRODUCTION & OBJECTIVES

- In Temporal Dominance of Sensations (TDS ; Pineau et al., 2009), panelists are asked to describe the **sequence of sensory dominances** perceived during the time spent for testing a food or a beverage. Practically, they put the product into their mouth and successively click on **the attributes they perceive as dominant**. Computer records durations and intensities (optional) for each attribute elicitation. An attribute is considered **dominant until another attribute is selected.**
- TDS data for a given product are usually represented as **a set of curves which plots the dominance rate of each attribute against time**. The **dominance rate** of an attribute at a given time gives the **proportion of panelists** who found that attribute dominant over the others at that time.
- Visual inspection of TDS curves is quite often focusing on the attribute which dominance rate **peaks at the highest level time by time**. However, when several attributes have almost the same level of dominance rate over a period of time, **this visual inspection becomes cumbersome**.
- The aim of this work is to propose the **TDS-band plot** as a mean for solving this problem.
- The TDS-band plot of a product gives at each time the attribute having the **highest dominance rate within an interval of time** centered on this time (moving average process).

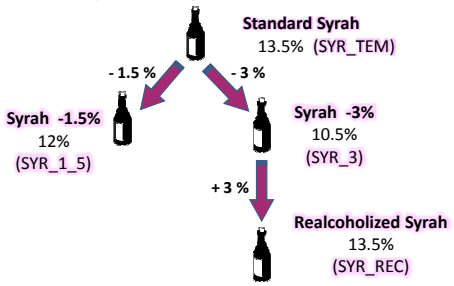
MATERIALS & METHODS

DATA USED AS EXAMPLE

• The TDS data come from the study of the impact of partial dealcoholization on the sensory perception of red wines (Meillon et al., 2009).

• 16 trained panelists TDS-profiled 4 wines in triplicate (in 3 sessions) using 10 attributes of mouth and flavor sensations.

Wines were provided and dealcoholized (reverse osmosis) by UE Pech Rouge (INRA, Narbonne, France) :

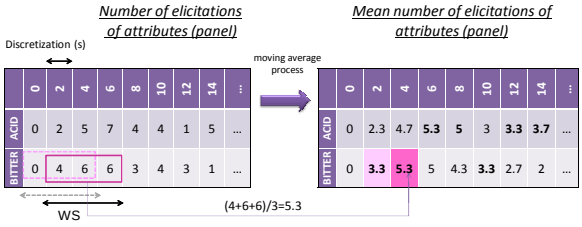


CONSTRUCTION OF BANDS

Parameters defining the moving average process :

- **Discretization** converts continuous time measures in time intervals. Default interval is the first decile of the distribution of all durations of dominance.
- **Window Size** (**WS**) corresponds to the median of the distribution of all durations of dominance.

For a given product, at each time, the dominant attribute is the one with the maximum number of elicitations evaluated by the moving average process.



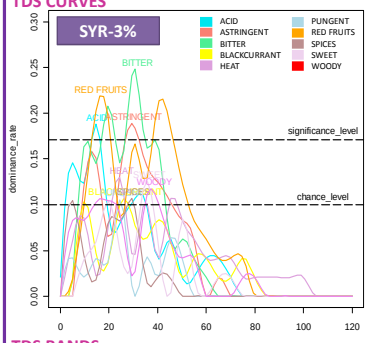
In the above sample, BITTER is dominant at time 2, 4 and 10 seconds.

The resulting sequence of dominances is represented as a time-band of rectangles whose lengths are proportional to durations of dominance. Colors denote the attributes. Rectangles borders are plain if dominance rate is greater than significance level* (panelist accordance), dotted otherwise.

* **Significance level** expresses the smallest value of the proportion being significantly (5 %) higher than the chance level (1/(number of attributes)) in a binomial proportion test .

RESULTS

TDS CURVES

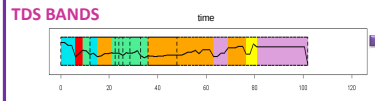


According to TDS curves, "*Syrah (-3%) is first dominated by acid, then bitter and red fruits, next bitter and astringency then red fruits sensations.*"

However, between 5 and 10 seconds, confusion is possible, because of curves smoothing and superimposition. The dominant attribute could be either acid, or bitter or woody. A decision must be taken.

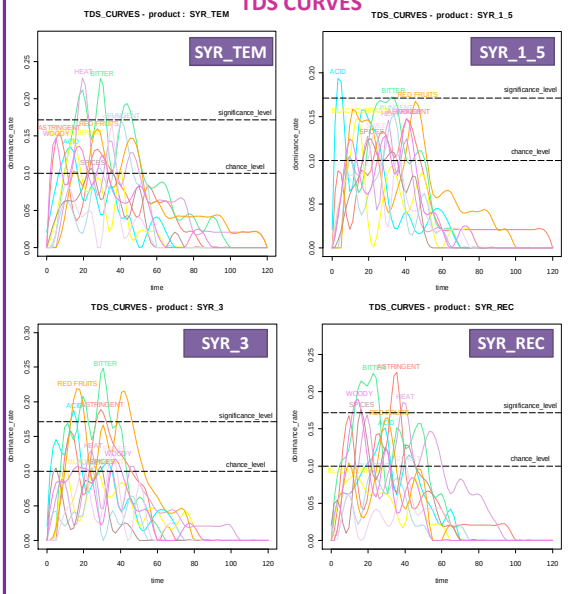
Thanks to TDS bands, a choice is made. The same sequence is found with more precisions :
"Syrah (-3%) is first dominated by acid, then woody and bitter. Then acid, bitter and red fruits are dominant. Final is heat, with short peaks of red fruits and blackcurrant."

TDS BANDS

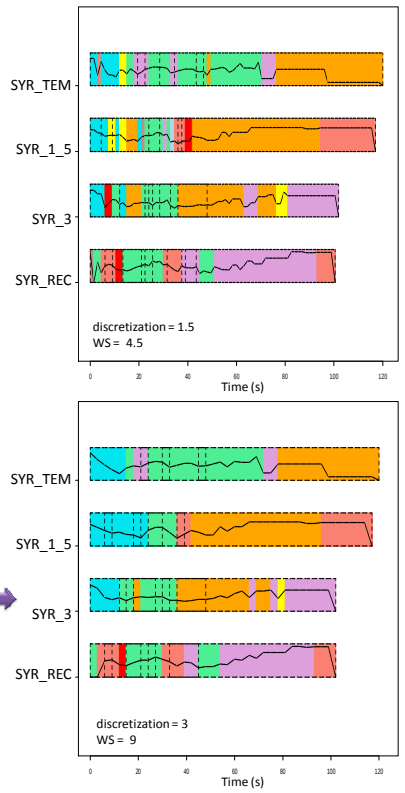


TDS-band plot simplifies TDS curves interpretation by deciding on the best sequence of attribute dominances and by adding the intensity information (if available).

TDS CURVES



TDS BANDS



Panel leader can change the parameters of the moving average process in order to get a smoother sequence with fewer changes. Consequently, the sequence shows the main dominances only.

The bands of every product from a given study are drawn on a single graph, allowing direct visual comparison among products.

CONCLUSION

The TDS-band plot is a **useful simplification of TDS curves** which helps interpretation of data.
On a **single graph**, TDS-band plot provides for each product : its **sequence of dominant sensations**, together with **an assessment of significance, at panel level, of each sensation** and the **evolution of their mean intensities.**
The moving average process replaces TDS-curve smoothing and **provides different levels of interpretation accuracy** thanks to the discretization and window size parameters.

References :

Pineau, N., Schlich, P., Cordelle, S., Mathonnière, C., Issanchou, S., Imbert, A., Rogeaux, M., Etiévant, P., Köster, E. (2009). *Temporal Dominance of Sensations : construction of the TDS curves and comparison with time-intensity.* Food Quality and Preference, 20, 450-455

Meillon, S., Urbano, C., Schlich, P. (2009) *Contribution of the Temporal Dominance of Sensations (TDS) method to the sensory description of subtile differences in partially dealcoholized red wines.* Food Quality and Preference, 20, 490-499

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