# The analysis of sensory profiling data revisited by scaling. Univariate and multivariate implications on panel performances and product differences

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## Aims and Scope

Sensory profiling data features a panel of trained judges having scored the intensities of a number of sensory attributes, possibly belonging to several sensory modalities, on a number of products to be compared. The panel leader should first monitor panelist performances, including at least repeatability, discrimination and agreement with the panel. Several systems were proposed for monitoring those performances and we will focus on the CAP (Control of Panelist performances) proposed by Schlich (1997). Indeed, CAP was accepted by a large number of users who for using it contributed to build the SensoBase composed of the raw data of about 1 500 sensory profiling studies. Then the panel leader has to find out the differences among products for each attribute separately and for all of them simultaneously by a multivariate approach. Sensory community has been using principal Component Analysis (PCA) of the product mean table for that purpose. We argued that Canonical Variate Analysis (PCA) (Peltier, Visalli, & Schlich, 2015b) is a better solution. However, we did not find many differences when comparing them on hundreds of studies (Peltier, Visalli, & Schlich, 2015a).

All of these approaches assume that the panelists use a comparable width of the sensory scales, which is in practice known to be untrue, either due to psychological, physiological or both reasons. (Brockhoff, Schlich, & Skovgaard, 2015) proposed the Mixed Assessor Model (MAM) to take this scaling heterogeneity into account. The MAM includes individual scaling parameters cleaning off the product by panelist interaction from the panel heterogeneity towards scaling. We proposed an extension of the CAP system to the MAM model under the name MAM-CAP (Peltier, Brockhoff, Visalli, & Schlich, 2014).

Considering several attributes simultaneously, we proposed to define a single scaling coefficient per panelist applying to every attributes and being interpreted as a psychological component of the scaling (Peltier, Visalli, & Schlich, 2016). Thus, we proposed to correct the usual scaling coefficient by this overall scaling coefficient in order to get a physiological component of scaling. Finally, we defined a new MAM-CVA by taking into account the scaling effect (Peltier, 2015). Applied to several hundreds of datasets from the SensoBase, this method provided significantly higher discriminative product maps compared to both PCA and CVA.

Furthermore, panelists can also differ on the average of their sensory scores, rather or in addition to their differences on the variances of individual scores. We call this effect the level effect to differentiate it from the scaling effect. The panelist factor included in most ANOVA models of sensory data actually express this level effect. However, we applied the idea of decomposing, for each individual, this effect into a psychological component identical for every attribute and a physiological component specific to each attribute (Peltier, Visalli, & Schlich, 2017). It results in a new and final version of the MAM-CAP table offering individual control of use of scale toward both dispersion (scaling) and localization (level) of individual scores.

To popularize the use of these techniques in the sensory community, we have developed two R-packages: one for the MAM-CAP and one for the MAM-CVA techniques. Note that both of them also allow performing the regular CAP and CVA techniques, in such a way that the users are able to compare classical and new approaches on their own data.

The aim of this tutorial is first to introduce the theory behind these new techniques and then to demonstrate the use of the corresponding R-packages. Furthermore, these techniques are also available in the TimeSens® software which makes them easily available to panel leaders who cannot necessarily be able to play with R-packages. A brief demonstration of how to easily use them from TimeSens® will be conducted.

**Outline:**

The following topics will be included:

- Theory of MAM, MAM-CAP and MAM-CVA (1h30)
- Demonstration of the R-Packages and of the TimeSens® software (30m)
- Participants play with the R-packages and/or the TimeSens® software with the help of the instructor (1h00)

**Duration:** 0.5 day

**Audience:** Anyone interested in an introduction to the MAM and in an update about related techniques. Anyone willing to learn how to analyze their own data with these techniques either in R or in TimeSens®

**Background:** Basic knowledge about simple ANOVA will be required.

**Software:** R and TimeSens® will be used

**Requirements:** Participants are encouraged to bring their own laptop in order to be able to play with the R-packages and/or with the TimeSens® software in the last part of the tutorial. Either they can bring their own datasets for analyzing them or they will be able to play with the ones used by the instructors during the tutorial.

**References:**


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Peltier, C., Brockhoff, P. B., Visalli, M., & Schlich, P. (2014). The MAM-CAP table: A new tool for monitoring panel performances. Food Quality and Preference, 32, Part A(0), 24-27.

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Peltier, C., Visalli, M., & Schlich, P. (2015b). Canonical Variate Analysis of sensory profiling data. Journal of Sensory Studies, 30, 316-328.

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