Proposal of a procedure for sensory characterisation of wines from different subareas of a same D.O.C. (V.Q.P.R.D.)

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SUMMARY

In the course of the present work, which is the first part of a study on the "characterization of Barbera dell'Oltrepò Pavese D.O.C." 30 wines Barbera from 1993 vintage have been compared only regarding their sensory characteristics. An unstructured scale card, composed by 15 descriptors have been used. The terms of description in the card have been those more frequently mentioned by the assessors during some preliminary degustation sessions. All data from sensory evaluation have been elaborated by some consensus statistical methods (Univariate regression, Generalized Procrustes analysis, Consensus PLS) to eliminate systematic differences between judges, consequence of personal scale and/or confusion between attributes. The differences among samples are only slightly changed when the consensus techniques have been used. With the exception of some wines, a good uniformity in sensory characteristics was observed.

Relations between wine sensory descriptors and the altitude of the vineyards have been also studied using PLS method.

INTRODUCTION

The conformity to the chemical and sensory characteristics, that are considered as typical of the place of origin, is one of the factors influencing the judgments on wine quality. The opportunity to bring out viticultural productions from a specific area of cultivation depends on the finding of chemical and/ or sensory parameters of the wines that are able to discriminate the products of this area from the other ones.

The paper we are going to consider represents the first part of a study of characterization of 'Barbera dell'Oltrepò Pavese D.O.C. (V.Q.P.R.D.)'. It only concerns sensory characteristics that are determining factors in the choices and judgements of consumers. The peculiarity of sensory analysis depends on the instrument of measurement been used : that is 'man'. The sensory evaluation of a judge consists, in fact, in the sensation of some stimuli followed by their interpretation using the memory information that derives from individual experiences and/or professional knowlegde. This causes a variability among assessors in the choice and in the use of the terms which describe the perceived sensations. Differences among assessors in the use of an evaluation scale (measurement of the intensity of the perceived stimulus) have been, also observed.

Arnold and Williams (see Piggott, 1986) have reported some factors of variability among assessors, these are :

- assessors vary in the overall level of the scores they give ;
- assessors use different terms or combination of terms to describe the same stimulus ;
- assessors vary in their range of scoring ;
- in extreme cases, assessors perceive different stimuli in the same product ;
- assessors show variation in their use of terms and scales between sessions.

In the course of the present work, sensory data (scores) of 30 Barbera wines derived from different subareas of the "Oltrepò Pavese D.O.C." area and taken from evaluation sheets with unstructured scale (wheel cards) have been compared.

Three different statistical techniques, able to eliminate systematic differences between assessors as a consequence of their own personal scale and/or confusion between attributes, have been used.

Finally, the influence of altitude of vineyards on the sensory characteristics of the wines has been studied.

MATERIALS AND METHODS

30 Barbera dell' Oltrepò Pavese D.O.C. wines from different subareas in the D.O.C. area, were tasted by a panel of eight asssessors during five tasting sessions. The panel was composed of experts working in enology and having a good knowledge of this type of wine. A wheel card with 15 sensory descriptors : two of them for the colour (ruby red and purplish), six for the aroma (floral, fruity, dried fruit, herbaceous, spicy and resinous) and seven for the taste (acidity, tannins, bitter, round, body, persistence and balance) was used. The measurement scale was unstructured. In the course of a preliminary tasting session the assessors indicated on a sheet, similar to the one suggested by Nobel *et al.* (1987), the terms which were considered the most useful in describing the Barbera wines. The 15 descriptors that were chosen were those which were cited most often.

Three procedures (Piggott, 1986) were used to eliminate systematic differences between judges, consequence of personal scale and/or confusion between attributes :

Procedure 1 : Univariate regression

Procedure 2 : Generalized Procrustes Analysis

Procedure 3 : Consensus PLS.

The first procedure (REGRESSION) aims to correct for difference of scale of single attributes. The score of a judge j are regressed on those of judge k :

$$1) \quad S_{ij} = a_{jk} + b_{jk} s_{ik} + e_{ijk}$$

The intercept and the slope of the regression equation explain the systematic difference between the two judges ; the error which depends on the judges and on the sample is the residual difference, not explained by scale effects. Between the 8 judges, a reference judge was selected for each attribute, one of the two judges with the higher value of the correlation coefficient. The scores of all judges were the corrected for the systematic differences with the reference judge, as :

$$2) \quad S_{ij} = s_{ir} + e_{ijr}$$

The corrected scores or the centroids of samples were projected on the principal components (eigenvectors of samples, or the centroids, after scaling to mean zero and variance one of attributes).

The second consensus procedure, Generalized Procrustes Analysis (GPA) (Gower, 1975), aims to correct both for the different scale of judges and for confusion in the definition of attributes. GPA is a multistep technique, with three main step, centering, scaling and orthogonal rotation. GPA computes a consensus configuration as a weighted mean of the judges after centering-scaling-rotation. The consensus configuration is projected on the Principal Components, within the loadings of attributes.

The third consensus procedure applies Partial Least Squares regression (PLS), a multivariate regression technique, which main difference with GPA is that the rotation step is unconstrained, generally not orthogonal. PLS can be used for regression of many response variables on many predictor variables, in its version PLS-2. PLS uses an inner diagnostic procedure to avoid overfitting. In this case PLS was used taking as consensus configuration that of one of the two judges with the higher multivariate correlation coefficient (cross-validated explained variance). Equation 1) was modified in its multivariate ,equivalent :

$$3) \quad \mathbf{S}_{IVj} = \mathbf{S}_{IVjk}\, \mathbf{b}_{VVjk} + \mathbf{E}_{IVjk}$$

where **S** is the matrix of scores (on I samples for V attributes, of judge j or of judge k) ; **b** is a matrix of regression cofficients, **E** is the matrix of residuals. The vector of the intercepts is not shown in equation 3).

Consequently, equation 2) is modified in :

$$4) \quad S_{IVj} = S_{IVr} + E_{IVjr}.$$

The data have been elaborated by "QPARVUS" (Forina *et al.*).

RESULTS

The correlation matrix between assessors was calculated for each descriptive term separately. In figure n.1 is reported, for example, the correlation matrix concerning the 'ruby red' descriptor. The correlations between assessors are mostly medium-low or low. This result can depend on two different causes : a low degree of agreement between assessors in their judgement or a good uniformity between wines. When similar products are tasted, the fluctuations in the evaluations only depend on chance and have a random distribution.

The second case is more likely, in fact, in figure n°2 we observe that the distribution of wine scores on the first two principal components (PCA) (the components have been calculated from the overall 15 sensory descriptors after autoscaling) are uniform.

Only a few wines are distinguishable one from another by sensory evaluation. In particular, for example, number 5 compared with number 12 gave a difference in acidity and spicy and resinous aroma and number 19 compared with number 23 wine in persistence, body, bitter and fruity and floral aroma. Then, 3 consensus procedures (Univariate regression, GPA and Consensus PLS) to eliminate systematic differences between judges and to allow a better interpretation of data were used. Figures n° 3, 4 and 5 report the average scores (centroids) of the 30 wines studied on the first two principal components, respectively after the application of Univariate regression, GPA and Consensus PLS analysis.

After the Univariate regression the distribution of wines is still uniform and the contraposition between the wines 5 and 12 and 19 and 23 remains. This consensus procedure caused a rotation of the original data. After GPA a similar result was observed. On the contrary, after Consensus PLS the contraposition between 19 and 23 wines was less obvious.

The relationship between the sensory characteristics of the wines and the altitude of the vineyards of origin was studied using PLS. In general, the degree of association between these variables was rather low. The best correlation between variables is observed when only 'persistence', 'spicy' and ' fruity' are considered (fig. 6).

CONCLUSIONS

When the results of the consensus techniques are compared with the before-consensus data, it is evident that the effect is very poor : the original differences between wines are only slightly changed and, in particular, those between the extreme samples (the wine number 5 compared with number 12 and the wine number 19 compared with number 23). In this situation, it is evident that only a small fraction of differences among wines are due to the systematic variability among assessors. The wines were evaluated as being similar ; only in a few cases (in particular 5, 6, 11, 12, 19 and 23 samples) are they distinguishable in some sensory characteristics. On the other hand the wines came from the same D.O.C. area. We also observed a low influence of altitude upon sensory characteristics. In the course of a next study we'll try to verify the influence of other environmental factors (besides altitude) on sensory characteristics with a particular attention on those descriptors as 'persistence', 'spicy' and 'fruity' that were the most tightly associated with the changing of altitude parameter.

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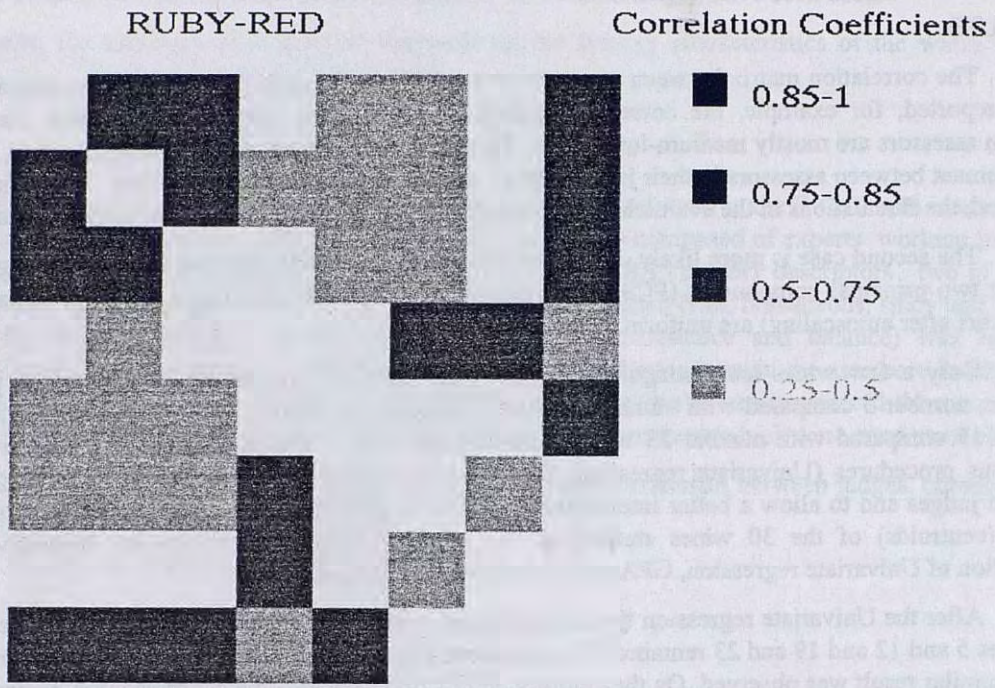

Figure 1. Correlation matrix for 'ruby red' descriptor.

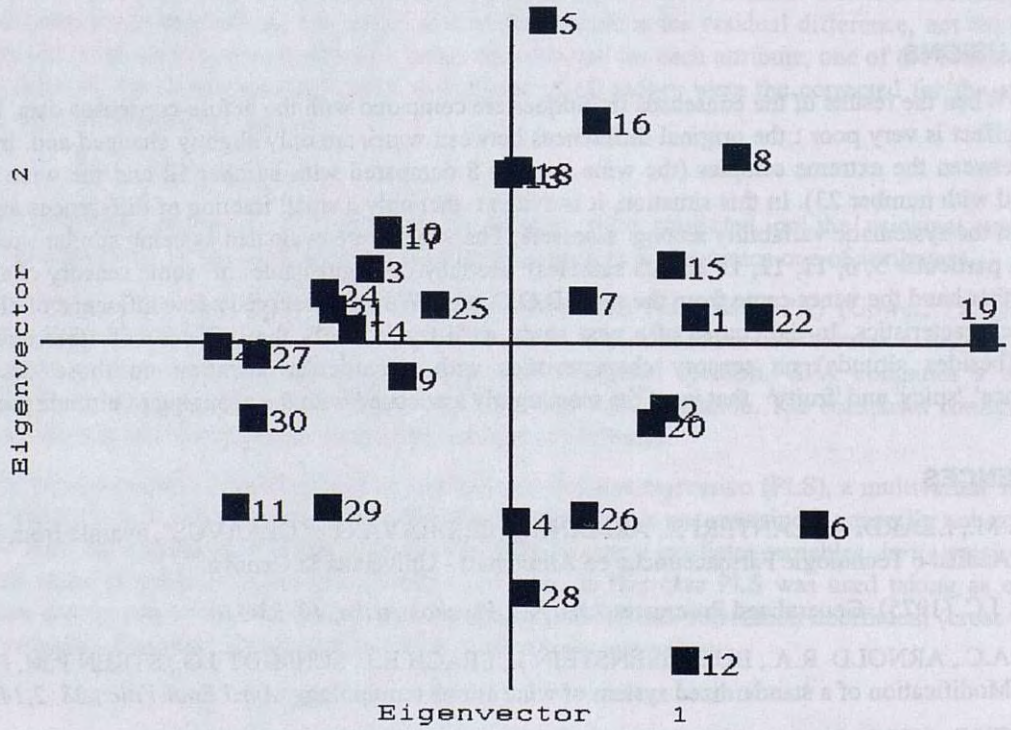

Figure 2. Representation of wines (centroids) on the two principal components (from Principal Component Analysis).

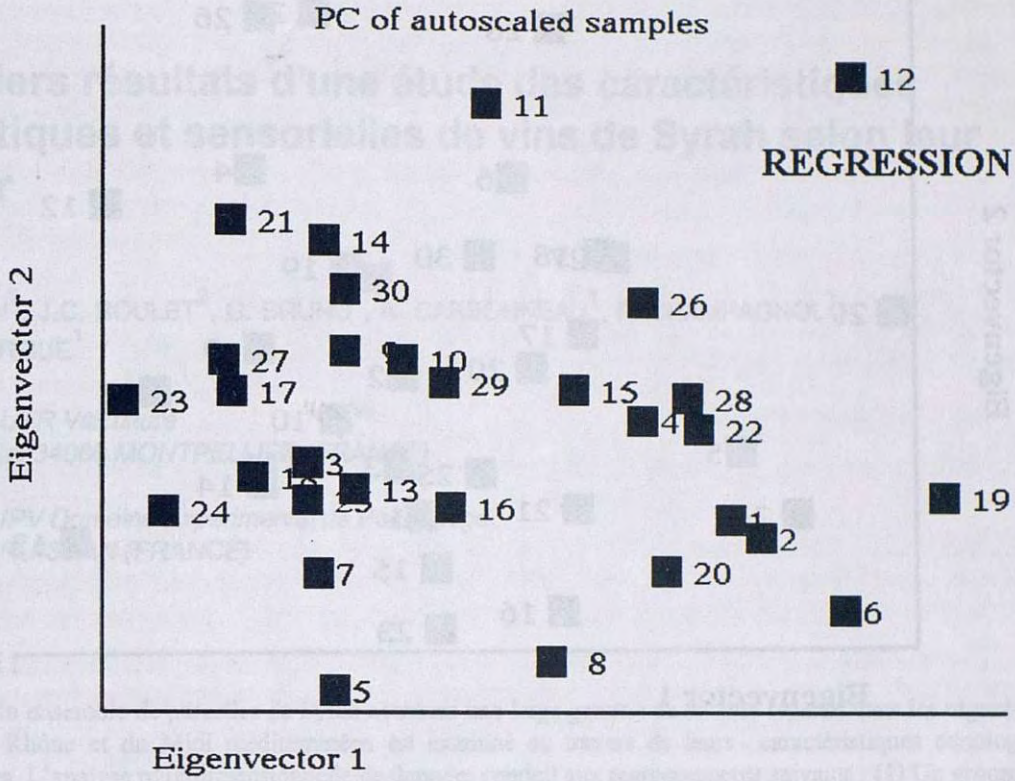

Figure 3. Representation of wines (centroids) after Univariate regression procedure on the two principal components.

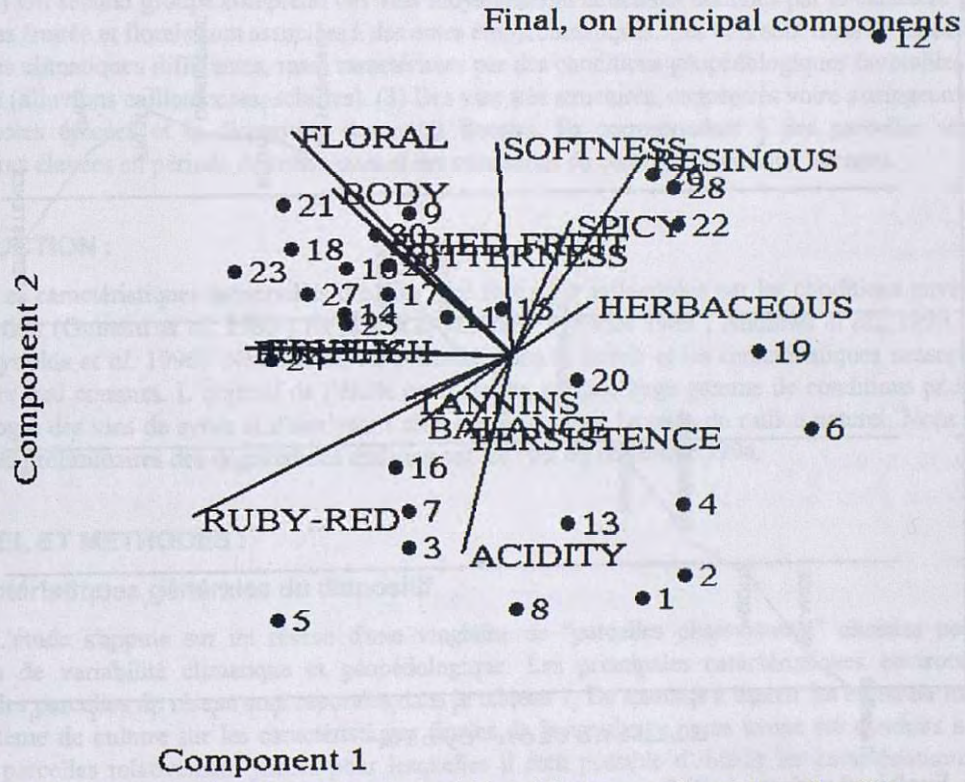

Figure 4. Representation of the wines (centroids) and the sensory descriptors after GPA procedure on the two principal components.

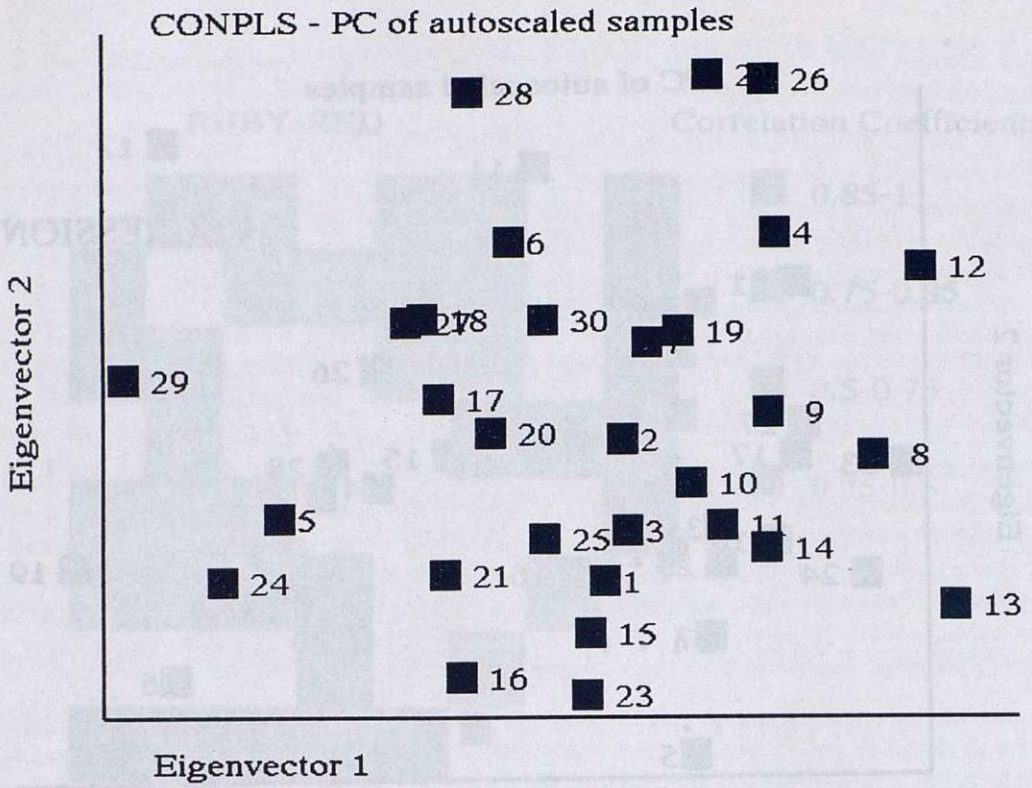

Figure 5. Representation of wines (centroids) after Consensus PLS procedure on the two principal components.

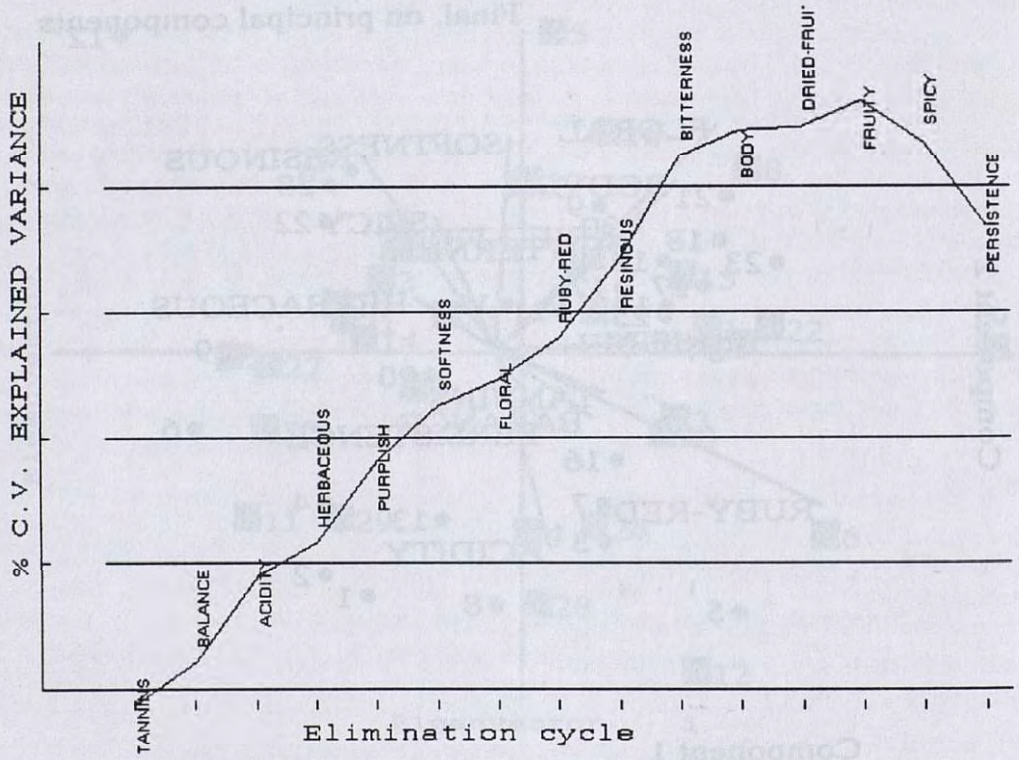

Figure 6. Explained variance in PLS regression between 'Altitude' parameter and the sensory descriptors.