Personalized holistic approaches handled by Hierarchical Multiple Factor Analysis (HMFA)

Example in which free choice concerning the kind of questionnaire is given to consumers

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INTRODUCTION

Holistic methods are made to evaluate consumers' global assessment of products according to their own criteria. Several different holistic approaches (Categorization, Free Sorting, Napping, etc.) exist. However, consumers can be more at ease using one method than an other. In this study, free choice is given to consumers concerning the method. **How to handle data in which consumers do not use the same holistic method ?**

PRODUCTS SPACE

The aim is to evaluate the perception of wines through their labels. Therefore, 16 wine labels were conceived according to an 2^{7-3} experimental design as follows:

Factor		Label A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Design	1: Yellow / -1: Red Castle	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1
Appellation	1: Bordeaux / -1: Bordeaux Supérieur	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
Vintage	1:2006 / -1 : 2008	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
Price	1: €3,95 / -1: €5,80	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	1	-1	1	-1
Medal	1: absence / -1 : presence	1	-1	-1	1	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1
Aging	1: no / -1 : oak aged	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1
Bottling	1 : elsewhere / -1 : at the estate	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1

Label A :

Label B :

Label O :

Label P :

DATA COLLECTION

The consumers were asked to sort the 16 labels according to the perception of the wines they imply. The consumers have to set in the same group the labels which, according to them, confer the same image to the wine. They have free choice between two holistic methods. The two questionnaires are as follows:

Free Sorting (FS)

Regroup the labels as:

- *Two labels set in the same group confer to wines similar images;*
- *Two labels set in different groups confer to wines different images.*

The amount of groups created and the amount of labels per group are free. The only constraint is to make between 2 and 15 groups.

To each *"FS consumer"* corresponds one categorical variable (named "Group"). One category represents one group created by the consumer.

Sorted Napping (SN)

Place the labels on the tablecloth as:

- *Two labels are all the more close that they confer to wines similar images;*
- *Two labels are all the more distant that they confer to wines different images.*

Bring the labels together in different groups.

The amount of groups created and the amount of labels per group are free. The only constraint is to make between 2 and 15 groups.

To each *"SN consumer"* correspond two quantitative variables (coordinates of the labels on the tablecloth, named "X" & "Y") and one categorical variable (named "Group").

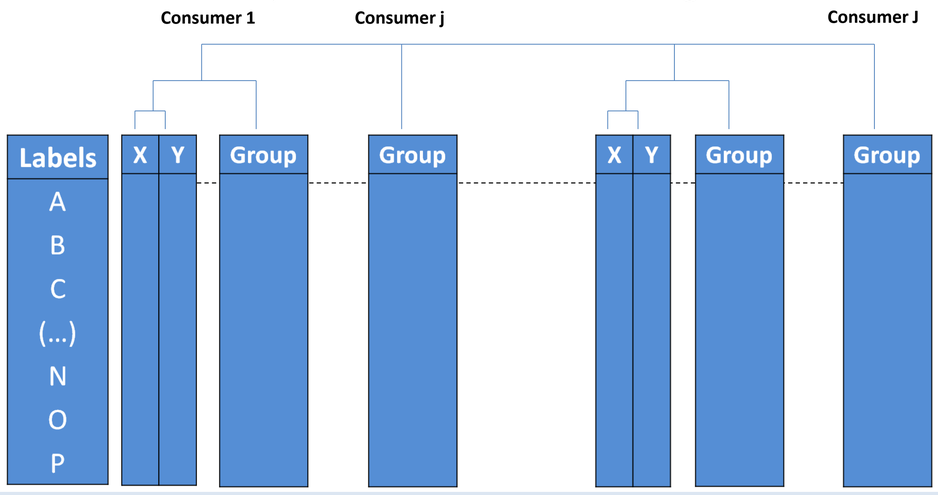
DATA STRUCTURE AND METHODOLOGY

Data Structure :

In rows: the 16 labels In columns: the 67 consumers' answers

1 FS consumer = 1 categorical variable;

1 SN consumer = 2 quantitative variables & 1 categorical variable.



The variables are hierarchically structured :

- Variables of one consumer are brought together;
- For each SN consumer, a distinction is made between the two coordinates in one hand and the groups created in the other hand (e.g. consumer 1 on the data table).

Methodology :

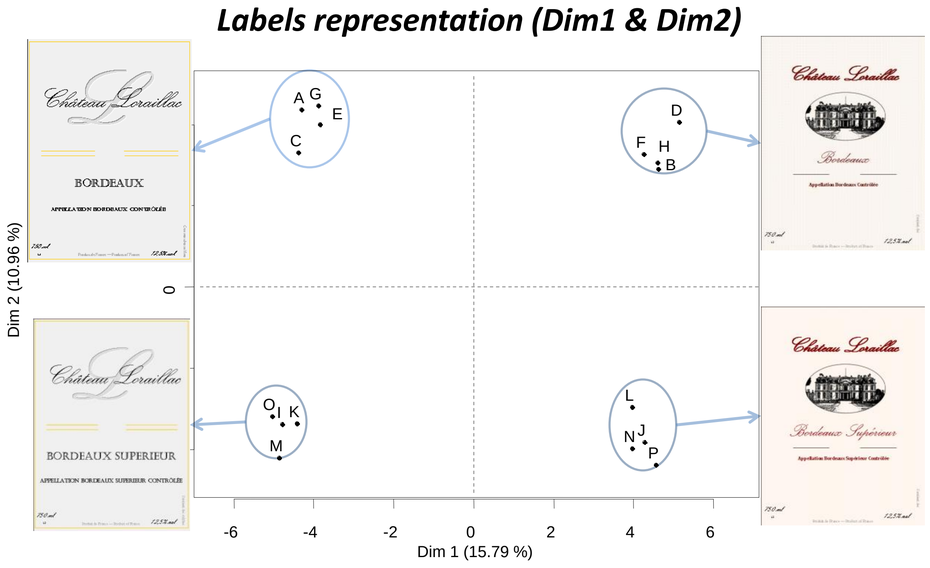
The appropriate statistical method to handle data in which the variables are hierarchically structured is the **Hierarchical Multiple Factor Analysis** (HMFA). This method enables as well to handle both quantitative and/or categorical variables.

In HMFA, the same "weight" is given to:

- Each consumer, regardless to the method used;
- The two coordinates on the tablecloth in one hand and the groups created in the other hand, within each SN consumers.

RESULTS

Labels representation (Dim1 & Dim2)



Each four-label's group is illustrated by one label in which only the common factors are represented.

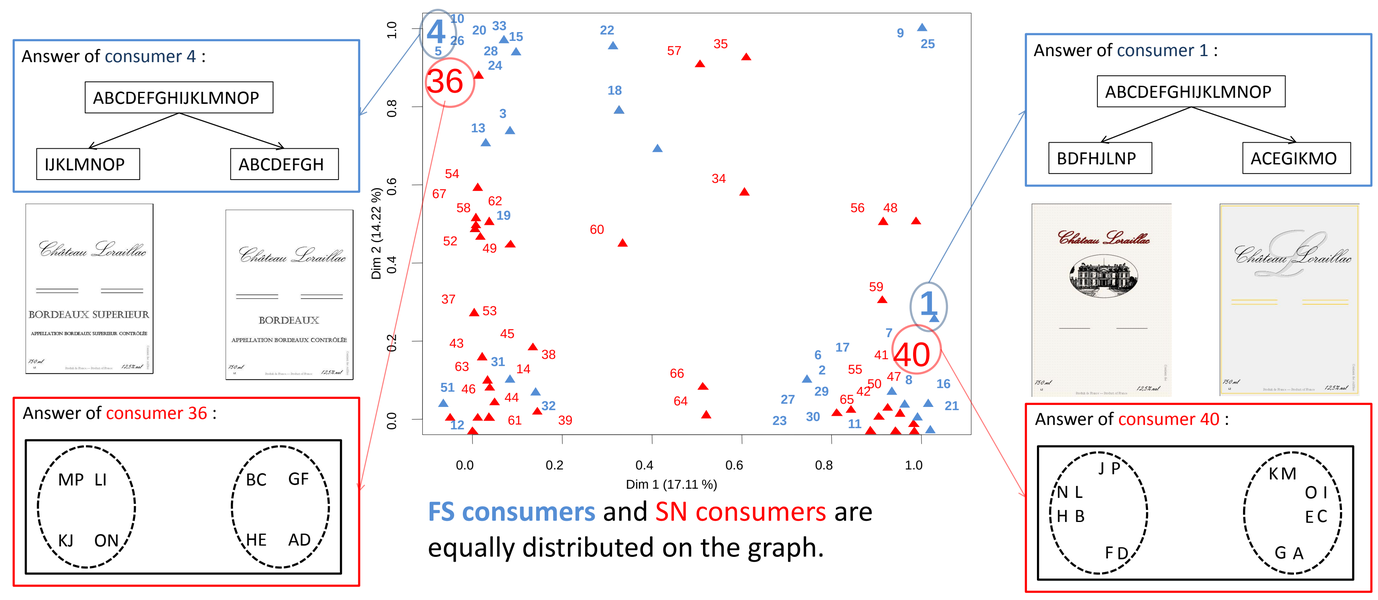
HMFA provides a representation of the individuals (16 labels) in which two labels are closed if a lot of consumers, **whatever the method they use**, consider they are close.

On the whole, the main criterion used by consumers to separate the labels is the **Design** (axis 1).
Secondly, consumers have separated the labels according to the **Appellation** (axis 2).

On the second individual map factor (not presented here), the **Vintage** (respectively **the Price**) corresponds to the 3rd dimension (respectively the 4th).

Consumers representation (Dim1 & Dim2)

performed with FACTOMINER



FS consumers and **SN consumers** are equally distributed on the graph.

HMFA also provides a representation of the groups (67 consumers). Regardless to the method they use, all consumers are represented on the same graphic which illustrate the simultaneous analysis of data of different kind:

-The factorial coordinate on dimension *s* of consumer *j* assesses the prominence of dimension *s* in the answer of consumer *j*;
- Examples of consumers' answers:

. **consumer 1**: Free Sorting
. consumer 40: Sorted Napping
→ Labels sorted according to the Design (high coordinates on the 1st axis).

. **consumer 4**: Free Sorting
. consumer 36: Sorted Napping
→ Labels sorted according to the Appellation (high coordinates on the 2nd axis).

CONCLUSION

Consumers can be more or less at ease with the use of one holistic method than an other. In this study, to make it easier for them, free choice is given between two different holistic methods (Free Sorting and Sorted Napping). Hierarchical Multiple Factor Analysis enables to jointly analyze the results in a global approach. The interpretation's rules are simple as they are similar to the ones of usual Factor Analysis. This study does not show any influence of the method's choice on the criteria used by consumers to separate the products. Actually, the representation of the consumers does not distinguish FS consumers in one hand to SN consumers in the other hand: consumers are quite equally distributed in this graphic.