Preference mapping methods and applications

P. Schlich

Centre Européen des Sciences du Goût, Dijon, France

Objectives

Preference mapping

- To **introduce** the basics of external preference mapping
- To **discuss** some limitations of the technique
- To **propose** the PrefMaX approach

Applications

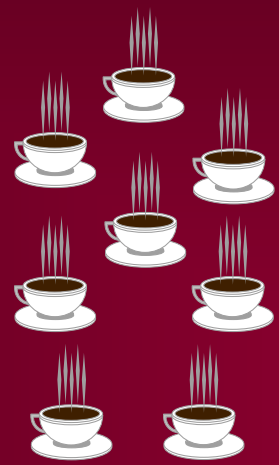
- **Car industry**: optimizing consumer feeling of braking efficiency
- **Tomato market**: a robust French sensory segmentation

Context of Preference Mapping

A consumer panel tastes each product in blind condition

A set of competitive products

A few panelists trained to quantitative descriptive sensory analysis



Statistical modelling

Preference scores

Sensory profiles Product mapping

A car study on braking perception

Safrane2.5dt

Espace

9 Pilots

112 consumers drove each car and gave a liking score of the braking sensation

18 braking attributes

Safrane2.2dt

Scenic1.6e

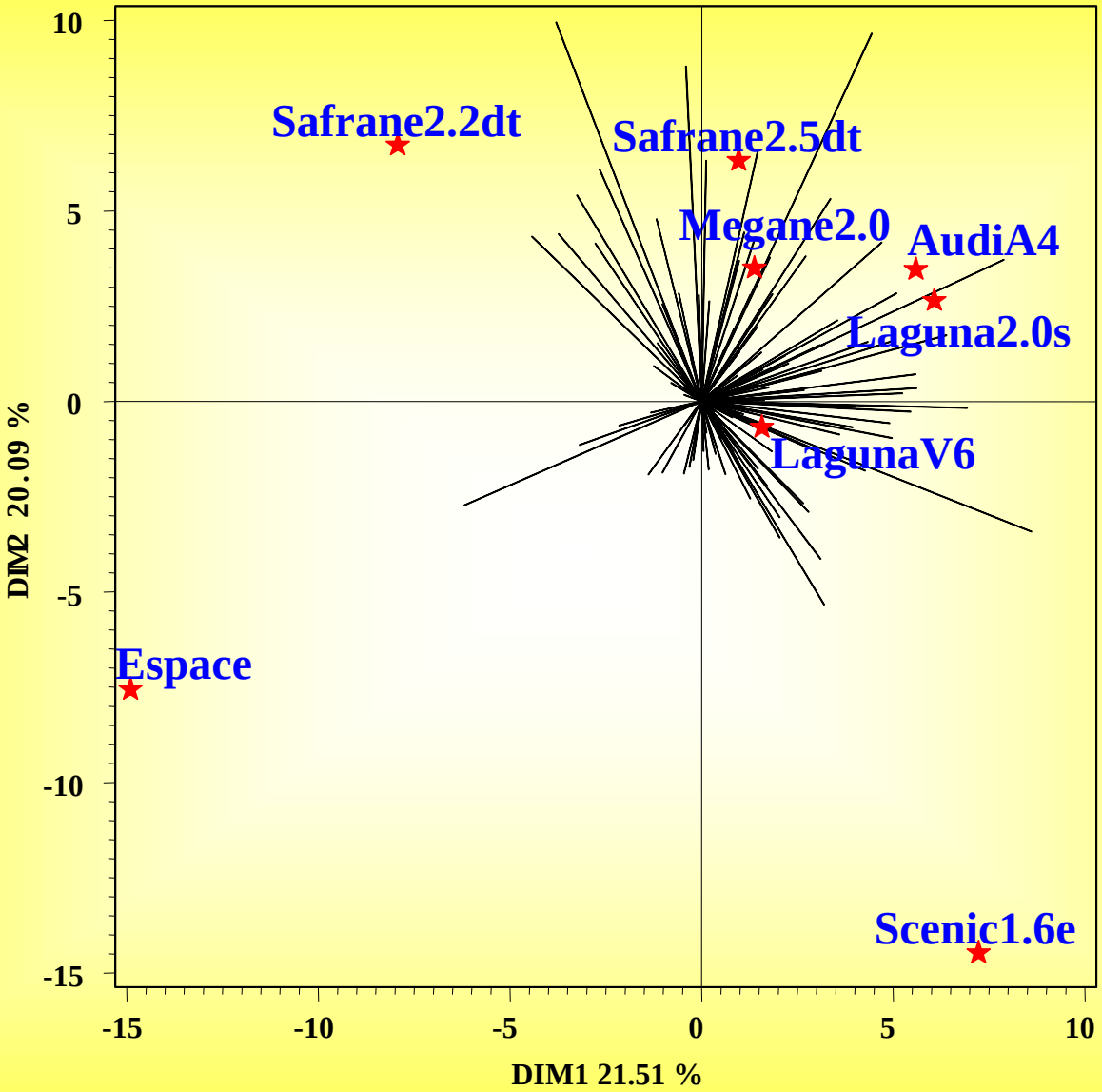
Megane2.0

AudiA4

Laguna2.0s

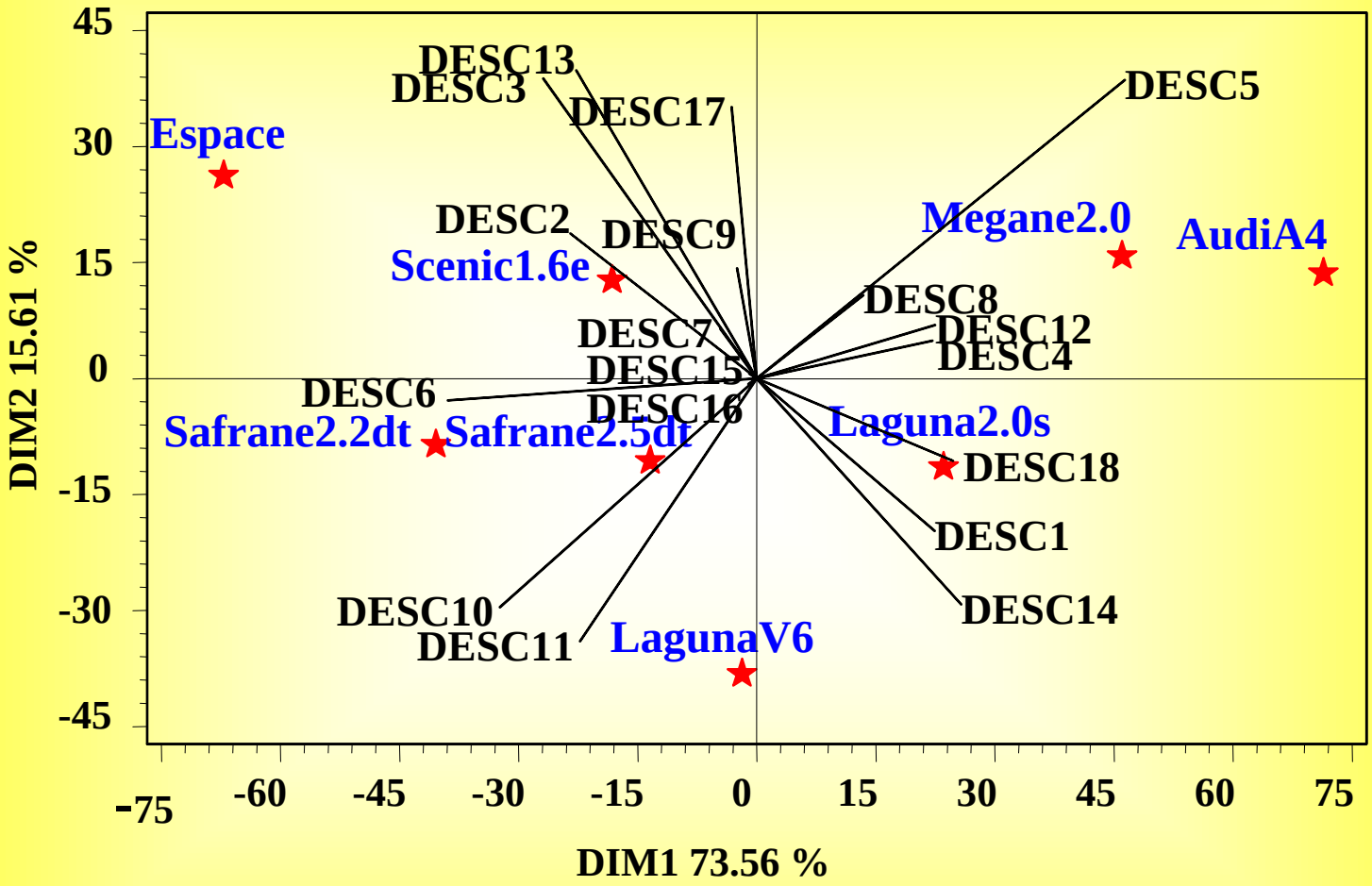
LagunaV6

Internal Preference Mapping



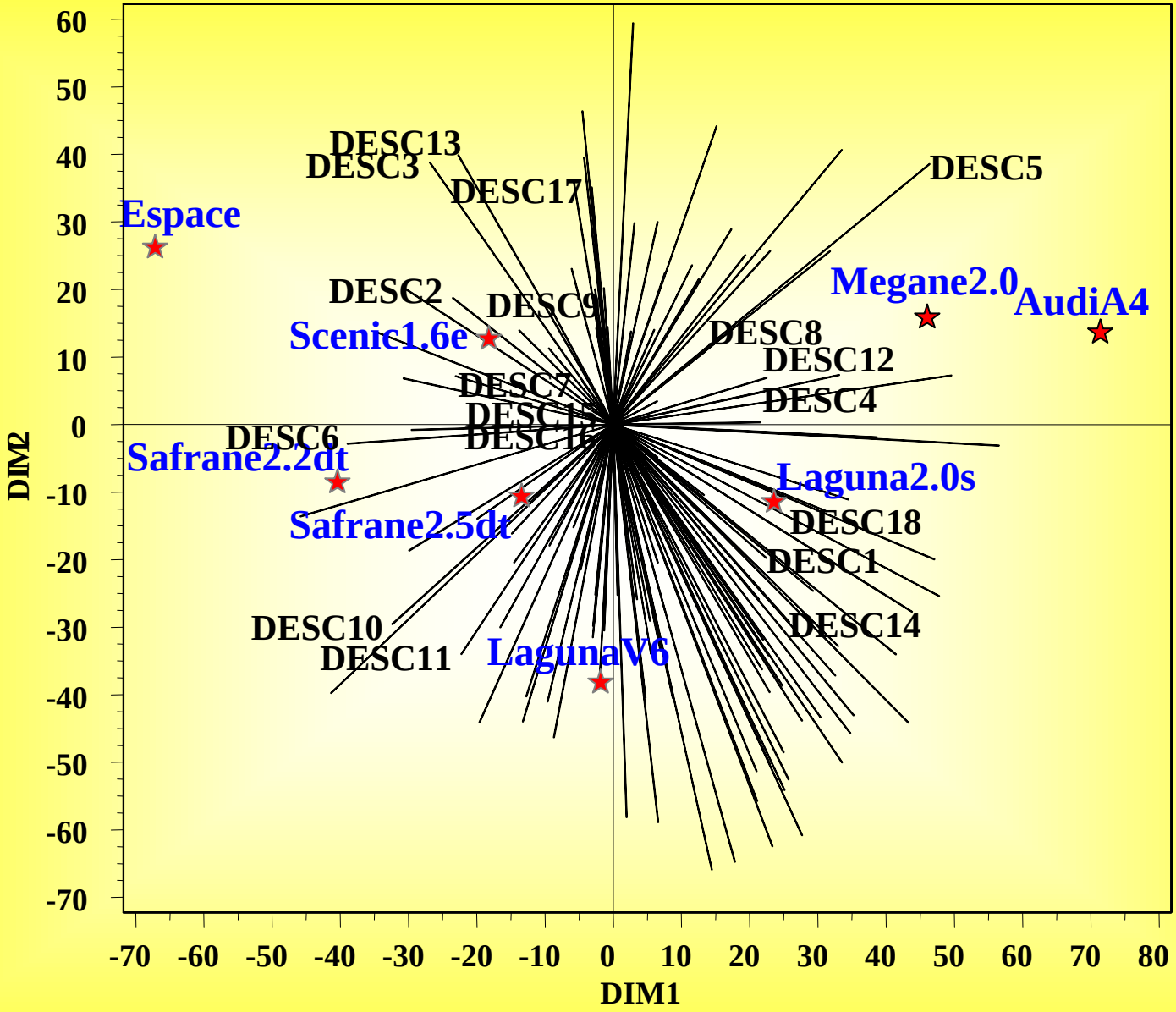
Just a PCA of the liking scores (product as observations and consumers as variables)
Highlighting here a rejection of Espace and a segmenting status of Scenic1.6e

PCA of Braking Profiles by Professional Pilots



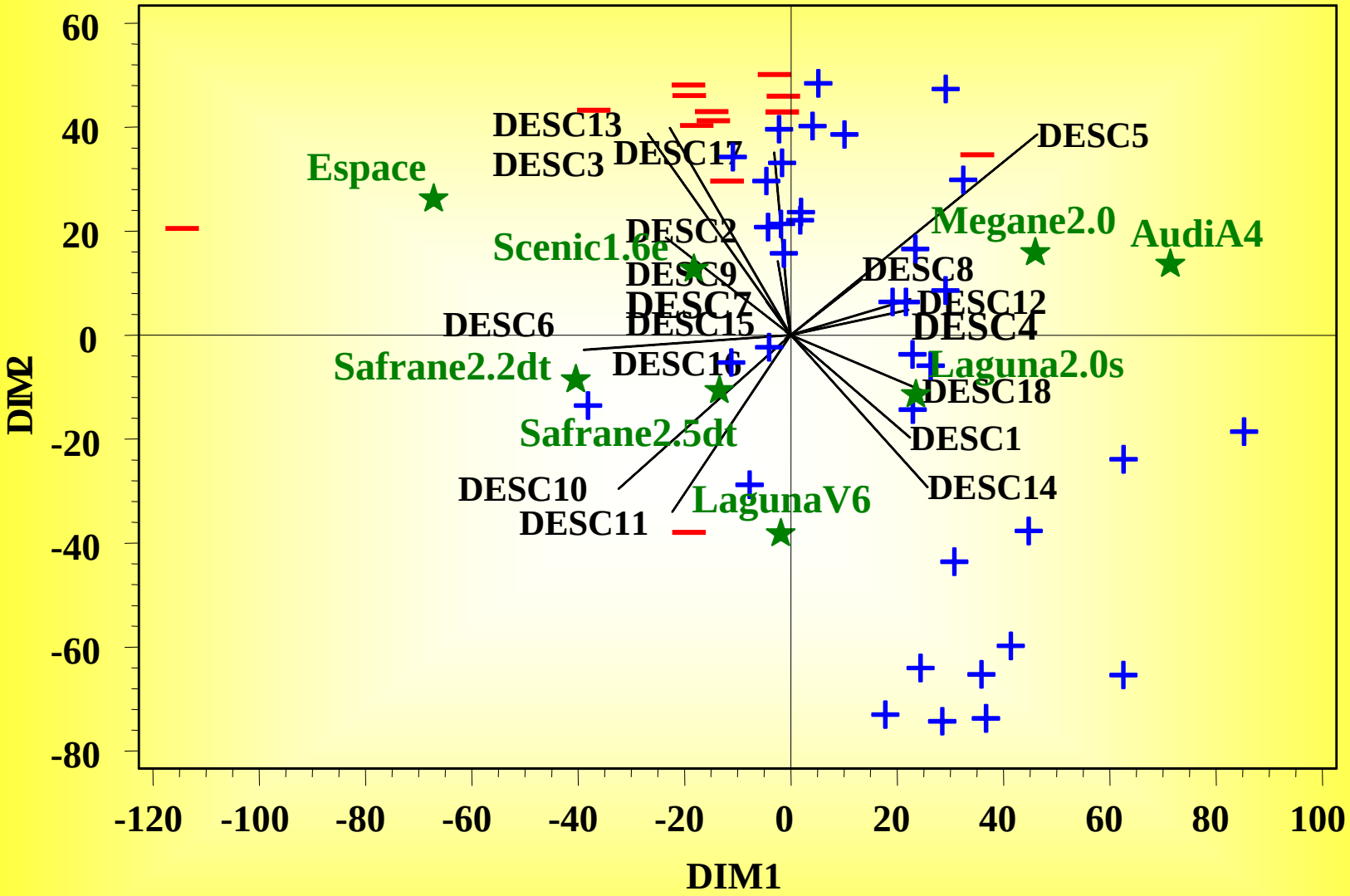
These 2 sensory dimensions (DIM1 and DIM2) are going to be regressors in individual modeling of consumer liking scores

External Preference Mapping by Vectorial Model



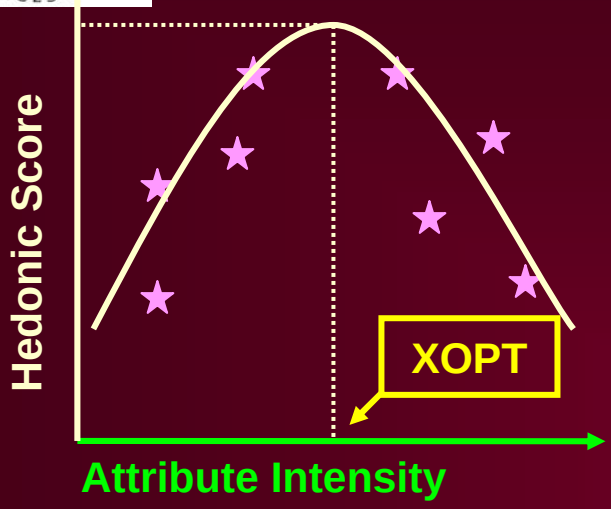
Each arrow indicates the optimal sensory direction for a given consumer
The length of the arrow is proportional to the quality of the fit

External Preference Mapping by Circular Model



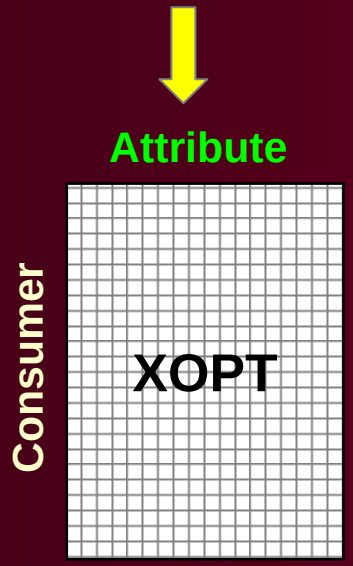
Each + sign (resp. - sign) locates the ideal car (resp. anti-ideal car) of a given consumer
Consumers with non significant regression are not represented

PrefMaX Method

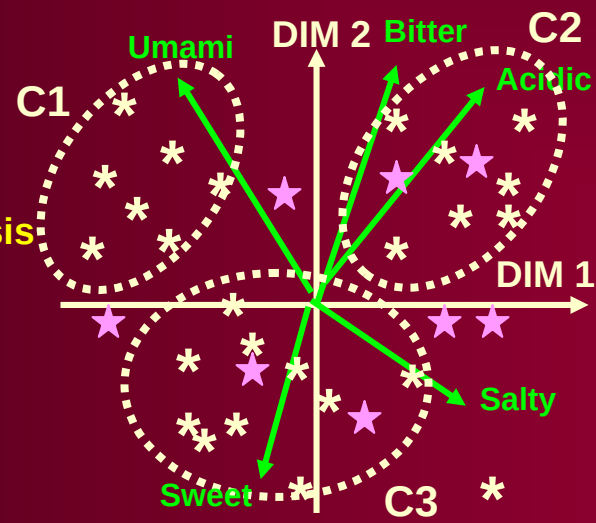


For each pair of consumer/attribute:

1. Fit a quadratic regression of hedonic scores on attribute means
2. Define optimal intensity (XOPT)
3. Store all XOPT into a *consumer x attribute* matrix
4. XOPT matrix is the input of subsequent analyses
5. In these analyses, weight each XOPT by the R^2 from the corresponding quadratic regression



Cov PCA
Cluster Analysis



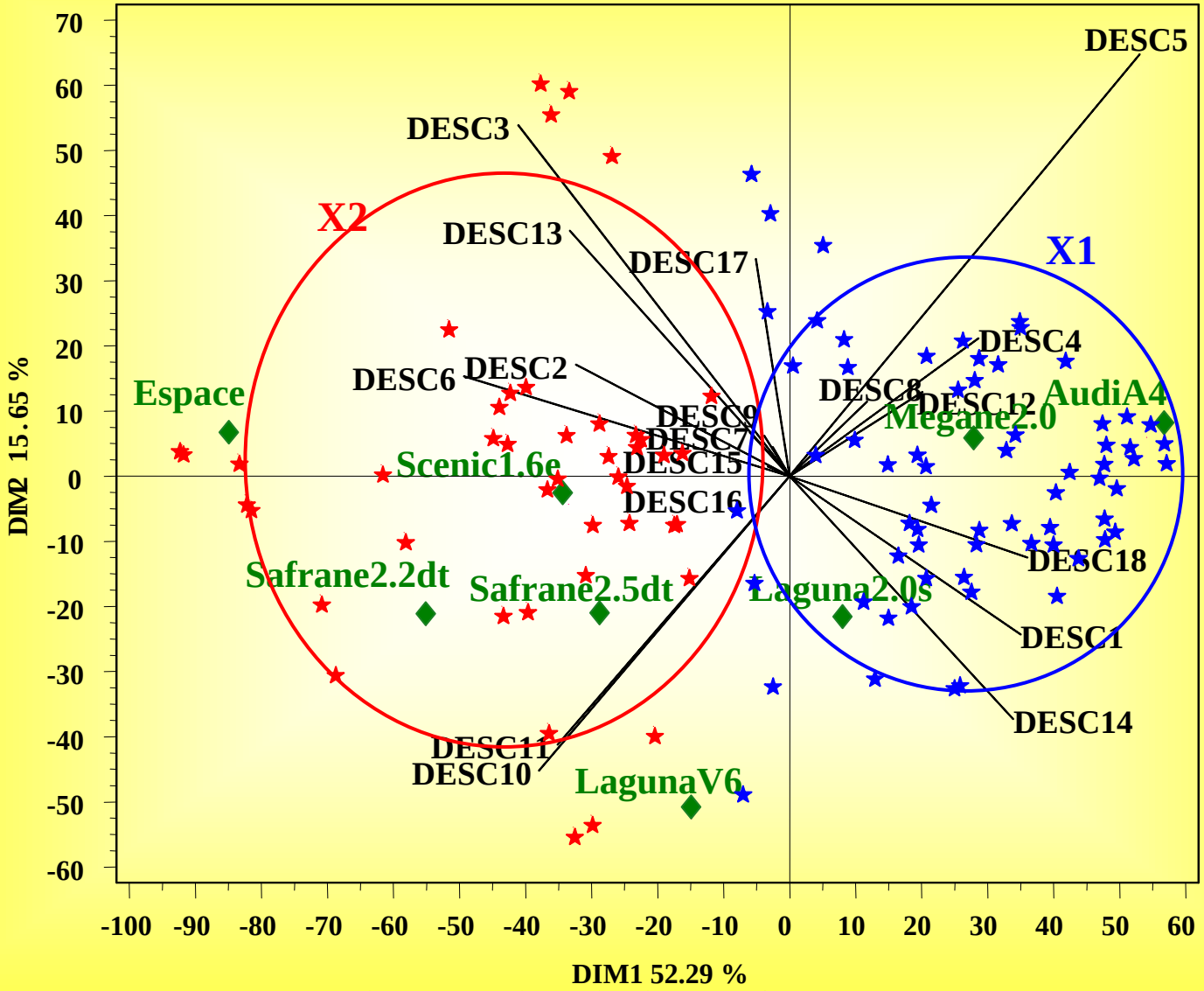
Optimal Sensory Recipes by Consumer Segment

Attribute	C1	C2	C3
Acidic	0	+	-
Bitter	0	+	-
Salty	-	0	0
Sweet	0	-	+
Umami	+	0	0

Each white star is the ideal point of a consumer

Each violet star is a product projected onto the map as a supplementary point using its attribute mean intensities

PrefMaX Segmentation in 2 groups



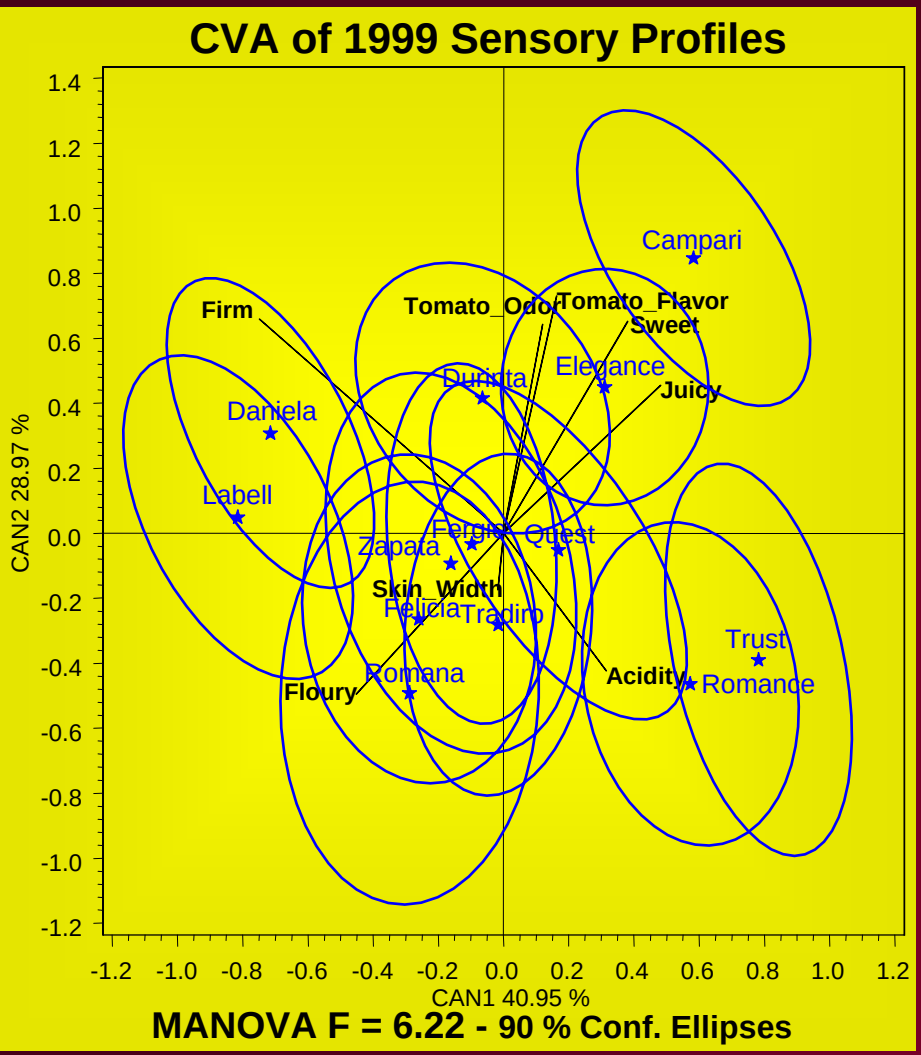
Each star locates the ideal car of a given consumer

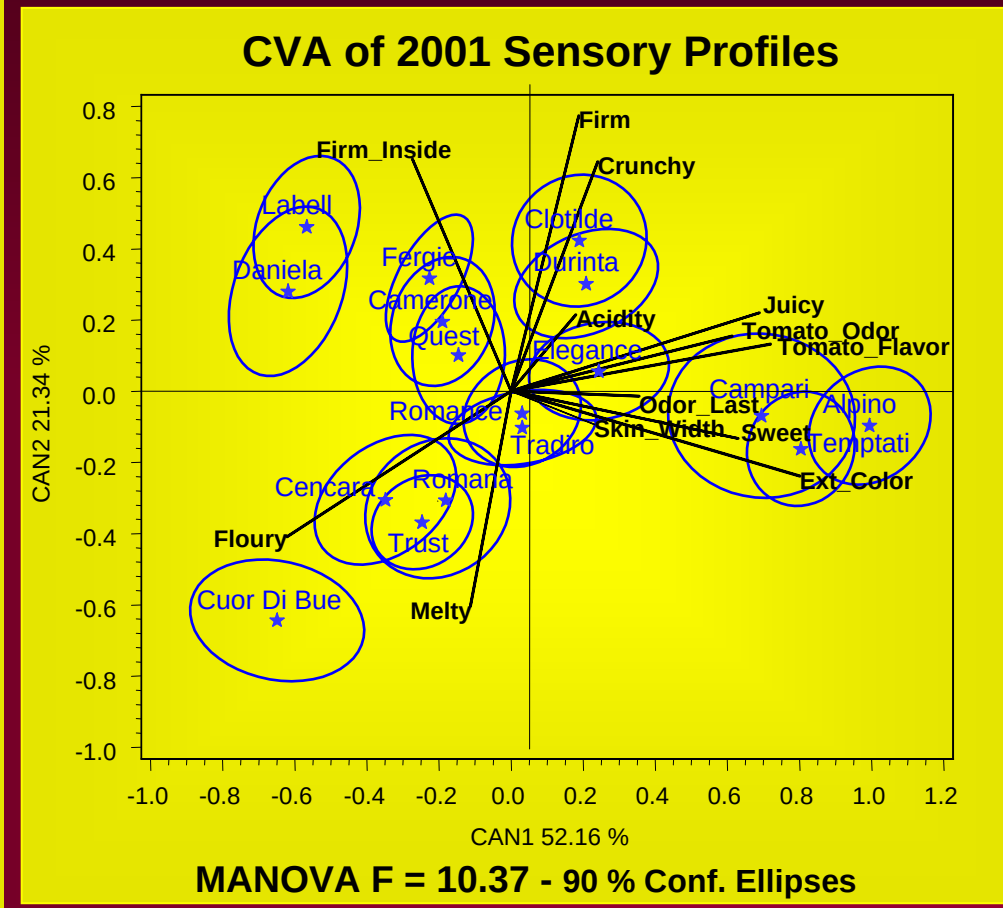
Blue and red segments contains respectively 66 and 44 consumers

Tomato experiments

Material & Methods	1999 experiment	2001 experiment
Tomato varieties	13 varieties served raw with nothing else	17 varieties 11 from 1999 plus 6 others
Sensory panels	13 trained panelists profiled each variety in duplicate	14 trained panelists profiled each variety in duplicate
Sensory profiles	8 attributes	13 attributes the 8 from 1999 plus 5 others
Consumers	215 consumers	361 consumers different from 1999
Hedonic scoring	Complete design in 2 sessions Texture, taste and overall liking	Incomplete design in a single session 10 out of 17 varieties Overall liking only
U&A questionnaire	83 questions	83 questions

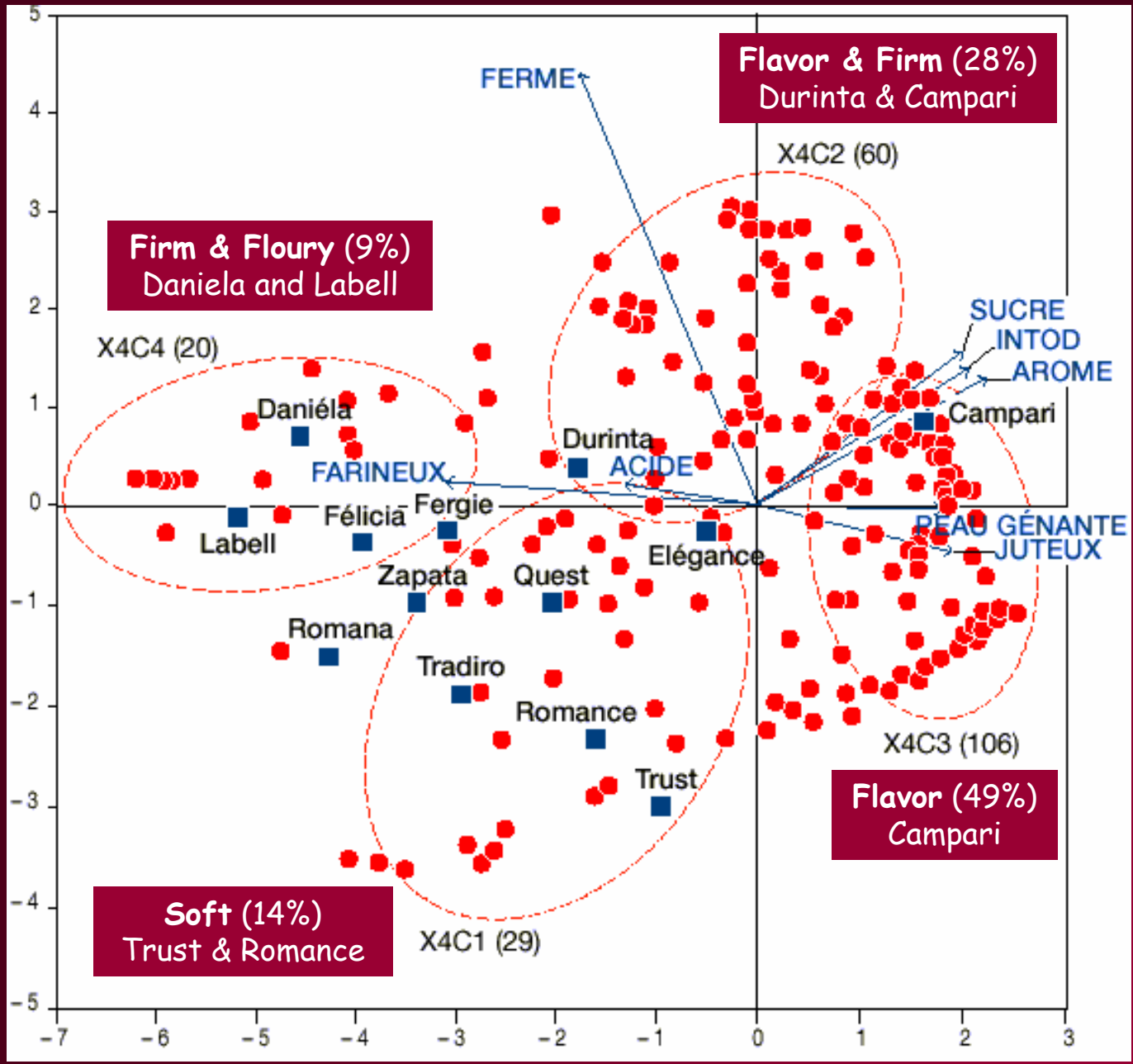
Comparing sensory profiles from 1999 and 2001





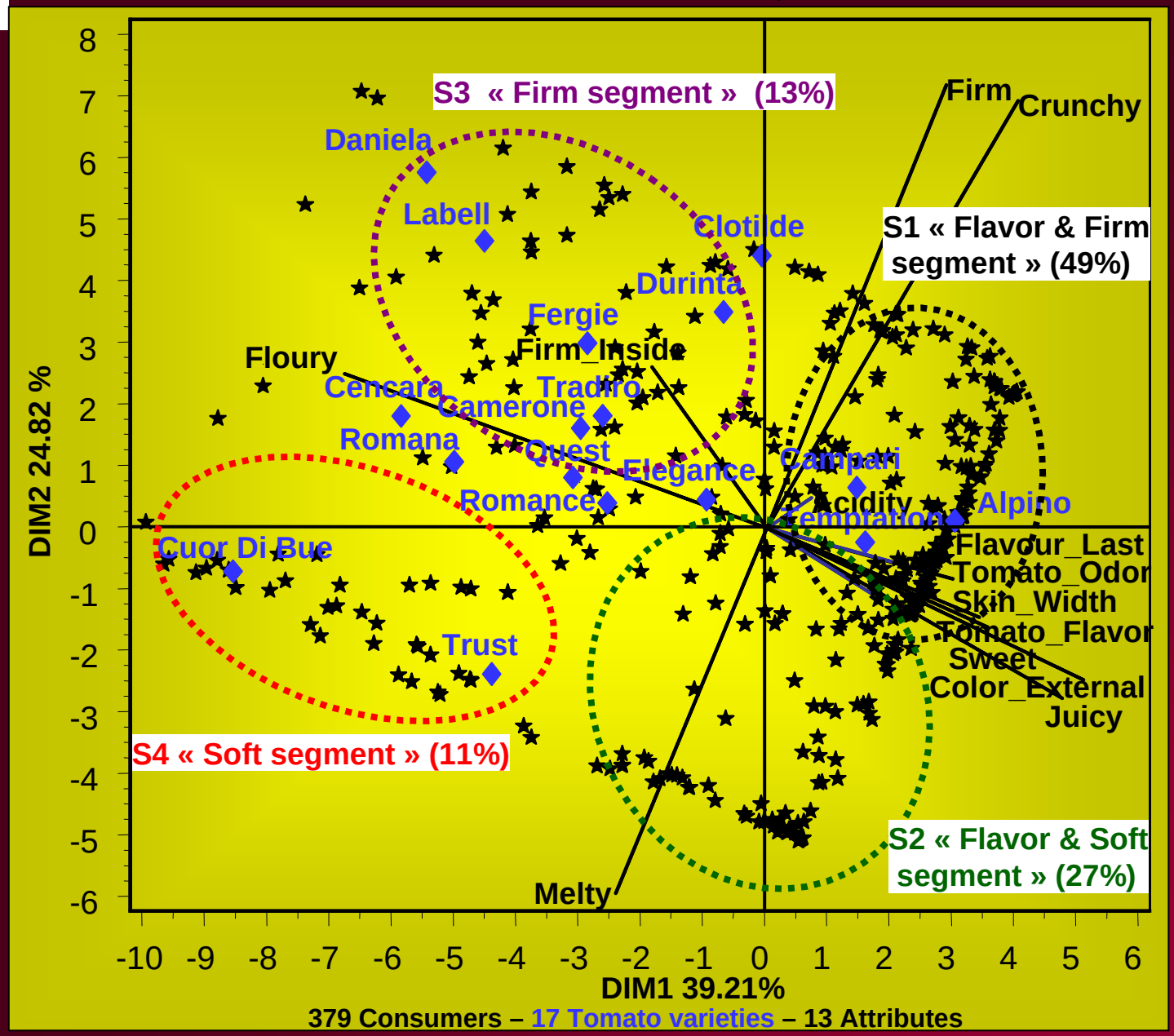
Yes, training can dramatically improve a sensory panel over time !

1999 Tomato PrefMaX



In 2001, each consumer tested only 10 among the 17 varieties using a MOLS design

2001 Tomato PrefMaX



Optimal sensory recipes by 2001 consumer segments

R^2 weighted-average of PrefMaX optimal sensory levels by segment

Attribute	F Segment	ALL (n=379)	S1 (n=185)	S2 (n=104)	S3 (n=49)	S4 (n=41)
Juicy	305.6	7.57	**8.08**	**8.12**	5.28	5.03
Color_External	45.72	7.09	**7.69**	**7.38**	5.37	4.81
Sweet	92.00	6.10	**6.48**	**6.27**	4.70	4.25
Tomato_Flavor	96.92	7.43	**7.77**	**7.56**	6.30	5.36
Tomato_Odor	147.8	7.02	**7.34**	**7.09**	5.98	5.27
Odor_Last	133.9	5.84	**6.08**	**5.94**	5.06	4.71
Skin_Width	41.44	5.92	**6.13**	**6.13**	5.09	4.94
Crunchy	247.3	5.31	**6.30**	3.61	**6.11**	2.49
Firm	224.4	4.94	**5.85**	3.34	**6.05**	2.87
Acidity	12.61	4.95	**5.11**	4.70	4.91	4.52
Melting	161.8	5.70	4.65	**6.82**	4.50	**7.19**
Floury	172.7	1.52	0.71	1.13	**4.10**	**4.94**
Firm_Inside	58.23	5.42	5.19	4.96	**6.76**	**6.18**

Pseudo-F for VARCLUS partitions from 2 to 8 segments respectively:
317, 301, **399**, 376, 328, 323, 384

The tomato sensory segmentation

Conclusion

Prefmap

- Predicting consumer liking by sensory description brought to sensory analysis its practical **justification** and its **development beyond food**
- **PrefMaX** improved the classical techniques,
  others valuable developments exist (using PLS for instance)

Car study

- Demonstrated the value of the sensory approach in the car industry
- Predicting **subjective perception** of **objective properties**

Tomato study

- The sensory segmentation discovered is currently used for **communication**
- Producing the missing « **soft fully aromatic variety** » is on the way…