



SENSORY & CONSUMER SCIENCE FOR THE WINE INDUSTRY

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DEFENS

Good practices in sensory science

SUBJECTIVE



OBJECTIVE (RELIABLE)



Wittgenstein's duck-rabbit

SUBJECTIVE



OBJECTIVE (RELIABLE)

PRINCIPLES OF GOOD PRACTICE

- SENSORY TESTING ENVIRONMENT (SENSORY LABORATORY)
- INVOLVEMENT OF TRAINED ASSESSORS (PANEL)
- USE OF STANDARDISED SENSORY METHODOLOGIES
- USE OF STATISTICS FOR EXPERIMENTAL DESIGN & DATA ANALYSIS

The sensory lab (ISO 8589)

The sensory laboratory consists of mainly 3 areas:

- ❑ **preparation area** (kitchen equipped with ovens, storage space, refrigerators and other several appliances): should be isolated and equipped with a ventilation system;



The sensory lab (ISO 8589)

The sensory laboratory consists of mainly 3 areas:

- ❑ **evaluation area** (individual sensory booths):

All booths have computers with a specific software for data acquisition. The facility is temperature controlled and provided with controlled lighting to mask visual cues in samples



The sensory lab (ISO 8589)

The sensory laboratory consists of mainly 3 areas:

- ❑ **Area for collective discussions:** room for discussions between panelists and panel leader (descriptive methods, training etc.)



The panel



- ❑ **Inexpert assessors (at least N=100)**→ assessors without any experience in sensory methodology or food product (consumers)
- ❑ **Expert assessors (N=20-50)**→ assessors with experience in sensory methodology (assessors who already performed some sensory test)
- ❑ **Trained assessors (N=8-12)**→ selected assessor with a high experience in sensory methodology and who is able to make consistent and repeatable sensory assessments of various products

The dimension of the panel depends on the methodology chosen and the type of assessors selected

The methods

1 IS THERE ANY DIFFERENCE BETWEEN PRODUCTS?

Discriminant methods

Expert assessors

A) Qualitative/forced choice:

- triangle
- paired comparison
- Duo-Trio
- Two-out-of-five

B) Quali-quantitative methods:

- ranking
- scaling methods:
 - Category scaling
 - Difference-from-control-test

C) Only used for QC:

- In-Out

Analytical methods (must be performed in sensory lab)

2 WHICH IS THE DIFFERENCE BETWEEN PRODUCTS? HOW BIG IS IT?

Descriptive methods

Trained assessors

- sensory profile
- time-intensity

3 IS THE DIFFERENCE IMPORTANT FOR CONSUMERS?

Acceptance & Preference methods

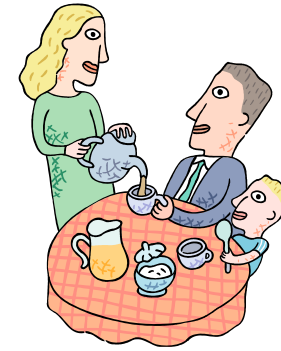
Inexpert assessors

A) Qualitative methods:

- focus group

B) Quantitative methods:

- acceptance & preference



Hedonic methods

Classification of methods according to the research question

DISCRIMINANT METHODS

Applications of discriminant methods

- ❑ Discrimination tests should be used when the sensory specialist wants to determine whether two or more samples are perceptibly different due to a change in:
 - ✓ ingredients
 - ✓ processing
 - ✓ storage conditions
 - ✓ packaging

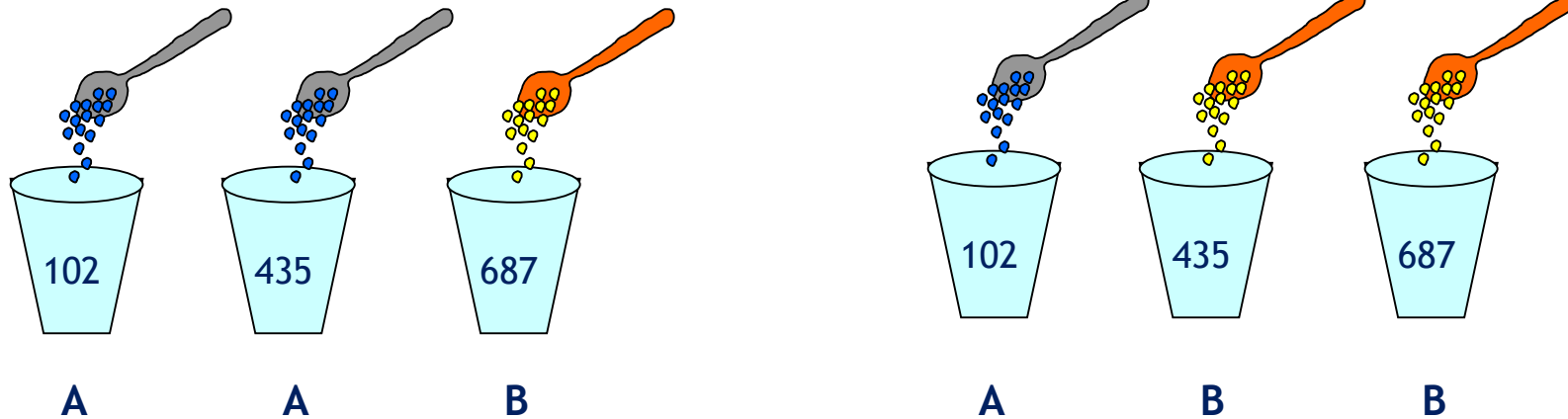
- ❑ Discrimination tests are also used to select, train and monitor assessors

The triangle method

- ❑ It is used to determine whether an overall unspecified sensory difference exists between two products (UNI U590A2520, 2001)
- ❑ Recommended number of assessors: 30-36 to demonstrate that 2 samples are different

The triangle method

Assessors are presented with a triad of samples and informed that two samples are identical. Assessors are asked to determine which is the odd sample. If assessors do not perceive any difference they must guess ($p=1/3$)



6 possible orders of presentation:

AAB ABA BAA
BBA BAB ABB

Example of score-sheet

TRIANGLE METHOD

Type of sample:.....

Date:.....

Name:.....

Set n°:.....

Rinse your mouth with water before beginning. Expectorate the water into the container provided. You received three coded samples. Two of these samples are the same and one is different. Please, taste the 3 samples in the order presented, from left to right. Circle the number of the sample that is different. If no difference is apparent, you must guess.

102

435

687

Comments:

.....

TRIANGLE METHOD : DATA ANALYSIS

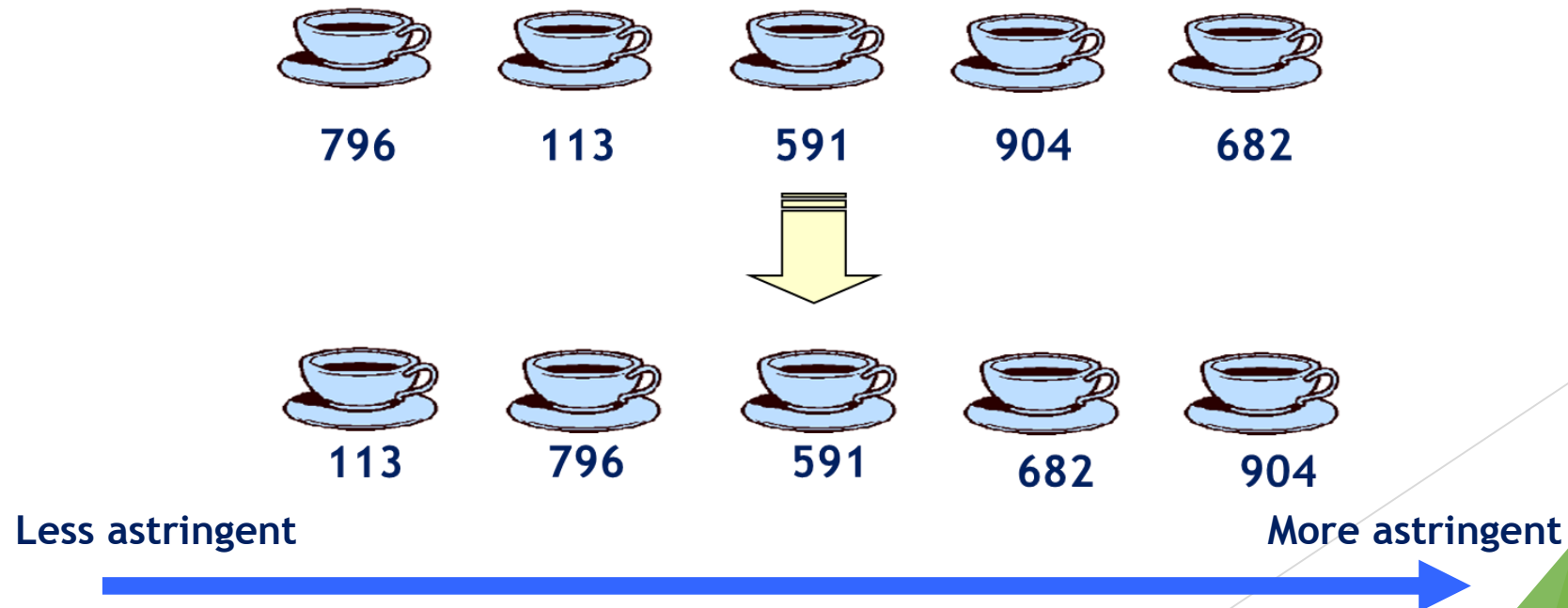
If it is needed to establish whether two samples are **different**, refer to the following table: Number of correct answers to conclude that there is a significant difference between samples

n	α					n	α				
	0.20	0.10	0.05	0.01	0.001		0.20	0.10	0.05	0.01	0.001
6	4	5	5	6	-	27	12	13	14	16	18
7	4	5	5	6	7	28	12	14	15	16	18
8	5	5	6	7	8	29	13	14	15	17	19
9	5	6	6	7	8	30	13	14	15	17	19
10	6	6	7	8	9	31	14	15	16	18	20
11	6	7	7	8	10	32	14	15	16	18	20
12	6	7	8	9	10	33	14	15	17	18	21
13	7	8	8	9	11	34	15	16	17	19	21
14	7	8	9	10	11	35	15	16	17	19	22
15	8	8	9	10	12	36	15	17	18	20	22
16	8	9	9	11	12	42	18	19	20	22	25
17	8	9	10	11	13	48	20	21	22	25	27
18	9	10	10	12	13	54	22	23	25	27	30
19	9	10	11	12	14	60	24	26	27	30	33
20	9	10	11	13	14	66	26	28	29	32	35
21	10	11	12	13	15	72	28	30	32	34	38
22	10	11	12	14	15	78	30	32	34	37	40
23	11	12	12	14	16	84	33	35	36	39	43
24	11	12	13	14	16	90	35	37	38	42	45
25	11	12	13	15	17	96	37	39	41	44	48
26	12	13	14	15	17	102	39	41	43	46	50

If the number of correct answers is equal to or larger than the number indicated in the table, then the two samples are significantly different. These assumptions are based on the values chosen for (tali conclusioni sono basate ovviamente sui rischi accettati in base al livello di sensibilità scelto per determinare il numero di assaggiatori).

The ranking method (ISO 8587)

- Assessors are presented with three or more samples which are to be arranged in an ascending or descending order of intensity of a specified attribute
- It is recommended to compare simultaneously from 3 to 6 samples (from 10 to 12 if only appearance is assessed). The differences may not be quantified
- Recommended number of assessors: 20-30



The ranking method

Data are analysed by means of the Friedman rank test (ISO/WD 8587)

$$\chi^2 = 12 / G * C (C + 1) * (R_1^2 + R_2^2 + R_3^2 + R_4^2) - 3 * G * C (C + 1)$$

$$(R_i - R_j) > 1.96 * \sqrt{G * C (C + 1) / 6}$$

DESCRIPTIVE METHODS

Applications of descriptive methods

- Evaluation of the effect of ingredient and process variables on product sensory attributes
- Evaluation of sensory attributes over time (shelf-life study/wine aging)
- Evaluation of the relationship between sensory and instrumental analyses
- Evaluation of how close a new product formulation is to the target (product development)
- Definition of sensory standard specifications for monitoring food quality
- Evaluation of the sensory attributes that are important to acceptance
- Evaluation of sensory attributes competitors' products

The sensory profile method (ISO 13299)

Definition:

Quali-quantitative description of the sensory attributes (appearance, aroma, taste, texture) of one or more products

Assessors:

It is recommended to use 8-12 assessors trained at the least to be consistent and reproducible

Replications:

At least 3

Choice of the scale:

It is possible to use numerical or verbal category scales, continuous or discontinuous scales

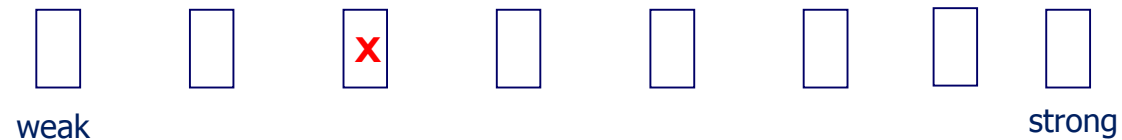
The sensory profile method (ISO 13299)

Examples of scales

Continuous scales



Discontinuous



Numerical scale



The sensory profile method (ISO 13299)

QUALITATIVE ANALYSIS (training phase)

1. Definition of and agreement on a sensory vocabulary
2. Setting up of reference standards for each sensory attribute. The reference standards correspond to the anchors of the intensity scale

Example of common vocabulary

Table 1 | List of the 12 sensory descriptors of Romagna Sangiovese PDO wines with their relevant definitions and reference standards.

Descriptor	Definition	Reference standard
Odor		
Fruity	Characteristic odor of a combination of blueberry, raspberry, and blackberry perceived by means of the sense of smell (orthonasal perception)	Infusion (24 h, 4°C) of 12 blueberries, two raspberries, and one blackberry in 0.5 l of red table wine
Spicy	Characteristic odor of a combination of spices (cinnamon and clove) perceived by means of the sense of smell (orthonasal perception)	Infusion (24 h, 4°C) of 16 cloves and one cinnamon stick in 0.5 l of red table wine
Vanilla	Characteristic odor of vanilla perceived by means of the sense of smell (orthonasal perception)	Commercial liquid vanilla odorant (2 ml) dissolved in 0.5 l of red table wine
Woody	Characteristic odor of toasted wood perceived by means of the sense of smell (orthonasal perception)	Guaiacol in red table wine (2 ppb)
Taste		
Sour	One of the basic tastes, caused by solution of acidic compounds perceived in the oral cavity	Anhydrous citric acid (2 g) in 0.7 l of red table wine
Bitter	One of the basic tastes, caused by solution of bitter compounds perceived in the oral cavity	Caffeine (0.8 g) in 0.5 l of red table wine
Flavor		
Fruity	Characteristic odor of a combination of blueberry, raspberry, and blackberry perceived by means of the sense of smell during swallowing (retronasal perception)	Infusion (24 h, 4°C) of 12 blueberries, two raspberries, and one blackberry in 0.5 l of red table wine
Spicy	Characteristic odor of a combination of spices (cinnamon and clove) perceived by means of the sense of smell during swallowing (retronasal perception)	Infusion (24 h, 4°C) of 16 cloves and one cinnamon stick in 0.5 l of red table wine
Woody	Characteristic odor of toasted wood perceived by means of the sense of smell during swallowing (retronasal perception)	Guaiacol in red table wine (2 ppb)
Mouthfeel		
Astringent	Mouth dryness caused by tannins and perceived in the oral cavity	Dissolve 1.5 g of tannin in 750 ml of red table wine
Alcohol	Characteristic heat/burning sensation perceived in the oral cavity	Mix 40 ml of 95% ethyl alcohol with 500 ml of red table wine
Body	Characteristic perceived in the oral cavity, due to the friction among the molecules in a liquid, that gives to it a limited fluidity and mobility	Mix 6 ml of glycerol with 1 l of red table wine

**Sangiovese di
Romagna red wines**

The sensory profile method (ISO 13299)

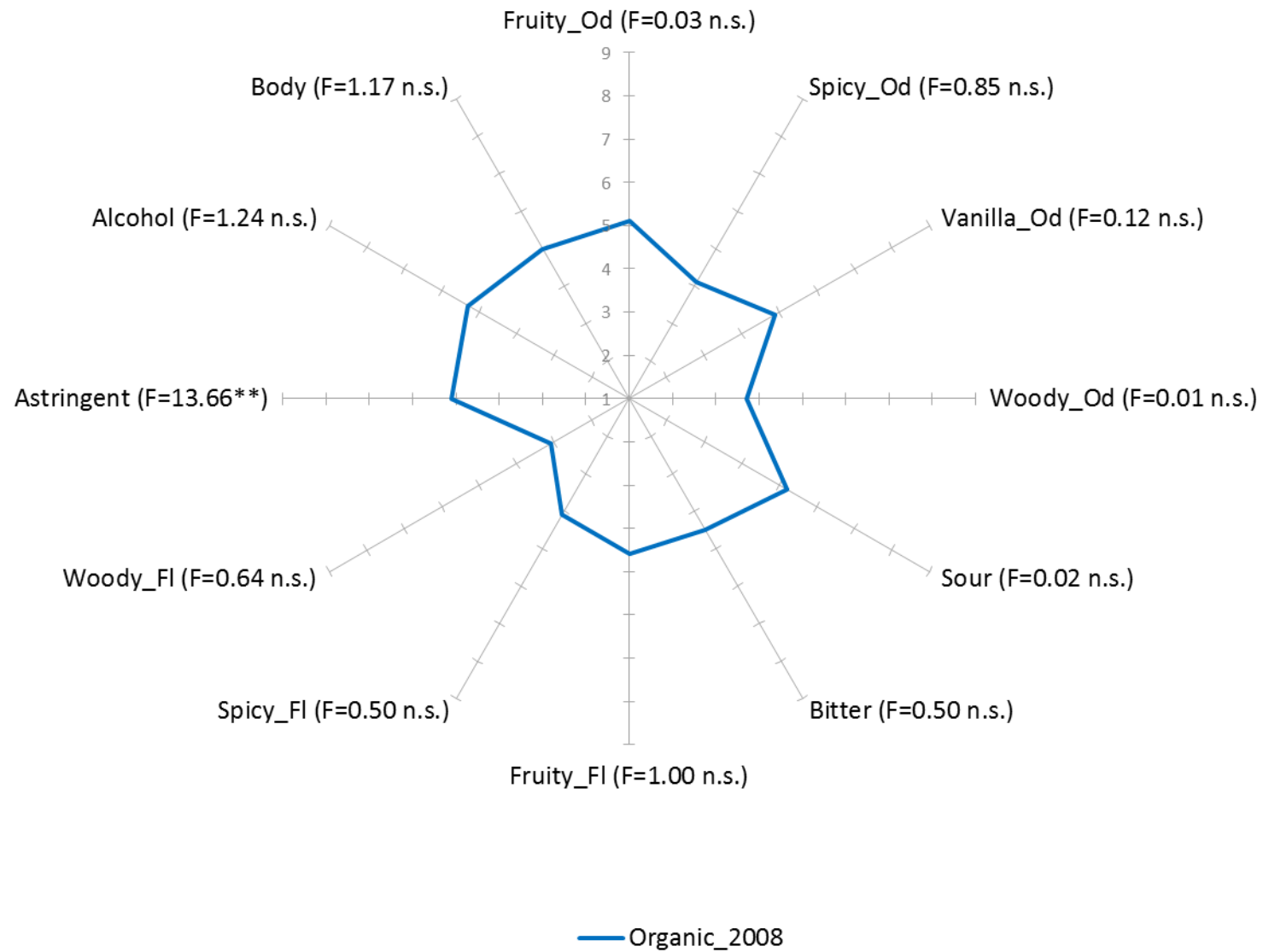
QUALITATIVE ANALYSIS (training phase)

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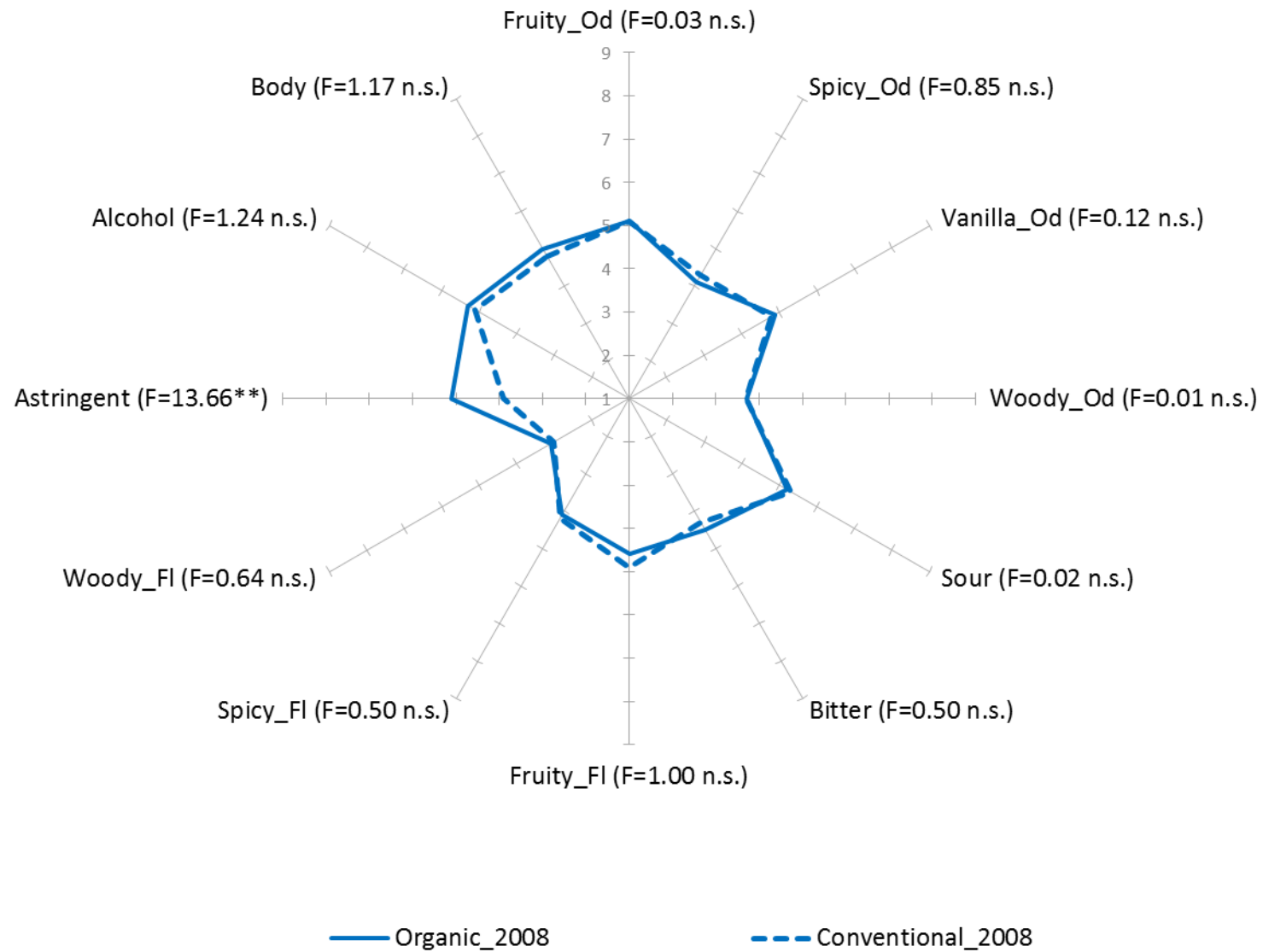
QUANTITATIVE ANALYSIS (evaluation phase)

3. Evaluation of the intensity of each sensory attribute (3 replicates)
4. Data analysis and interpretation of results

Spiderplot – Profilo sensoriale di vino sangiovese di Romagna



Spiderplot – Profilo sensoriale di vino sangiovese di Romagna



AFFECTIVE METHODS

Applications of hedonic methods (ISO 11136)

- ☐ comparing a product with competitor products
- ☐ optimising a product so that it obtains a high hedonic rating or is liked by a large number of consumers
- ☐ helping to define a range of products to correspond to a particular consumer target population
- ☐ helping to define a best-before date
- ☐ assessing the impact of a product formulation change on the pleasure given by the product

Hedonic methods (ISO 11136)

Aim

To measure the degree of liking of a given product

Methods

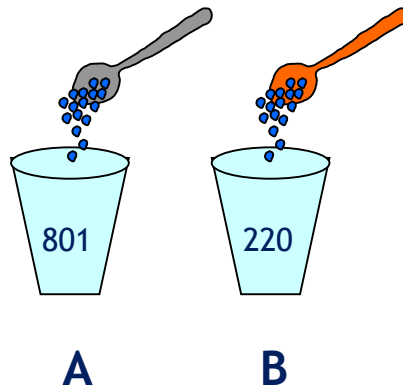
- Paired comparison test
- Ranking test
- Hedonic scales

Number and type of suggested judges

Inexpert judges (consumers of the product), at least 100 subjects

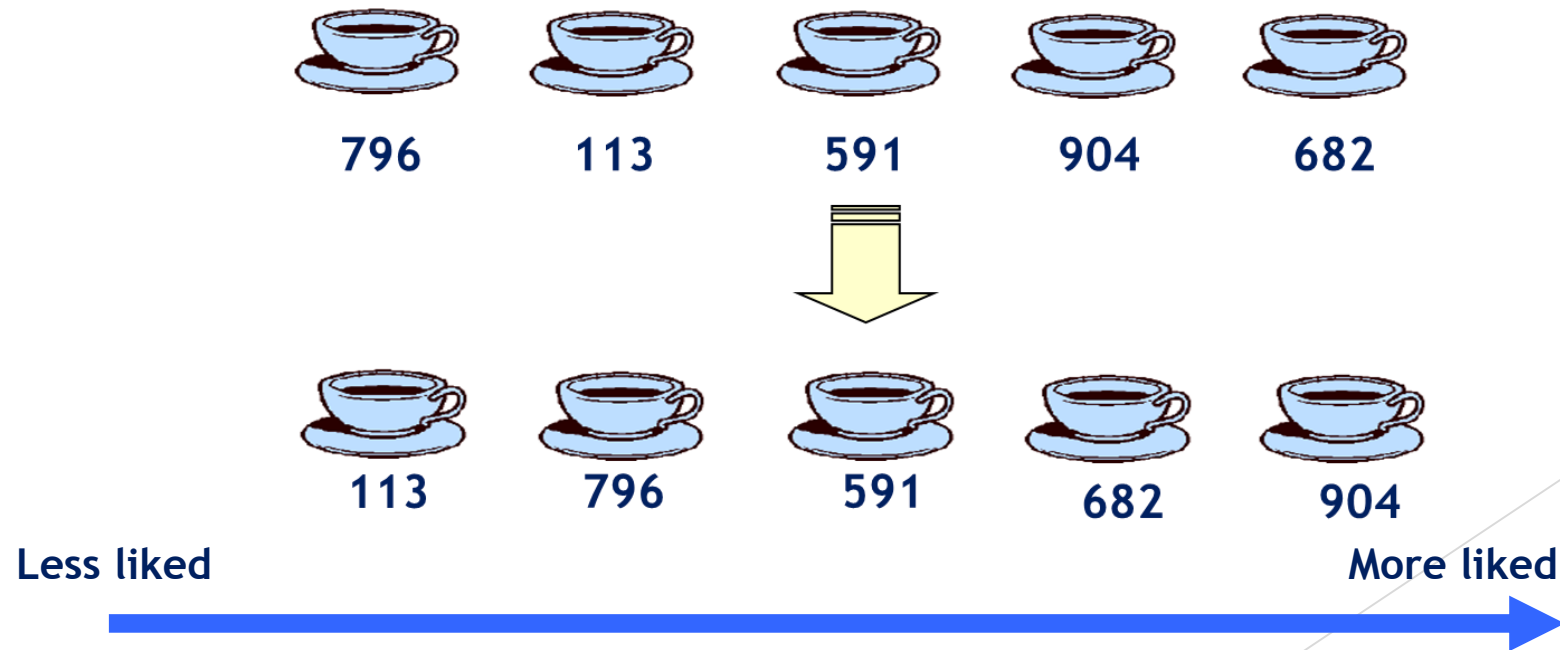
Paired comparison method

- ❑ It is used to investigate whether two products differ in a specific sensory attribute
- ❑ Consumers are presented with two samples (A and B) and asked to indicate which is the most preferred



The ranking method

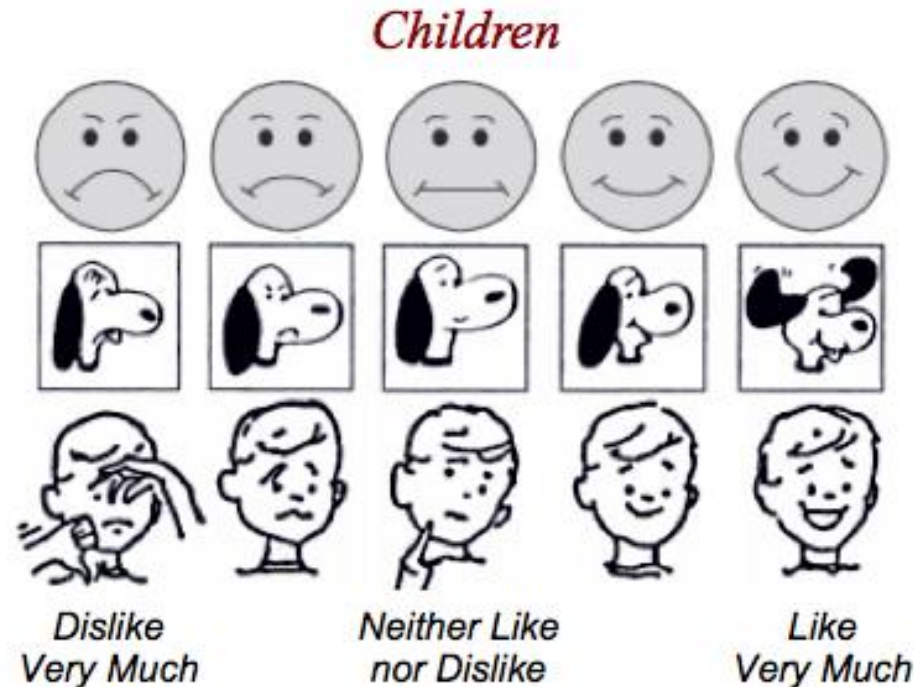
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- Recommended number of assessors: 20-30



Hedonic rating method

Consumers are asked to rate the degree of liking of the product in question using the following 9-points hedonic scale:

- Adult*
- ☐ Like extremely
 - ☐ Like very much
 - ☐ Like moderately
 - ☐ Like slightly
 - ☐ Neither like or dislike
 - ☐ Dislike slightly
 - ☐ Dislike moderately
 - ☐ Dislike very much
 - ☐ Dislike extremely



Thank you for your attention