Descriptive Analysis

Specify the intensities of attributes

Descriptive Analysis (DA)

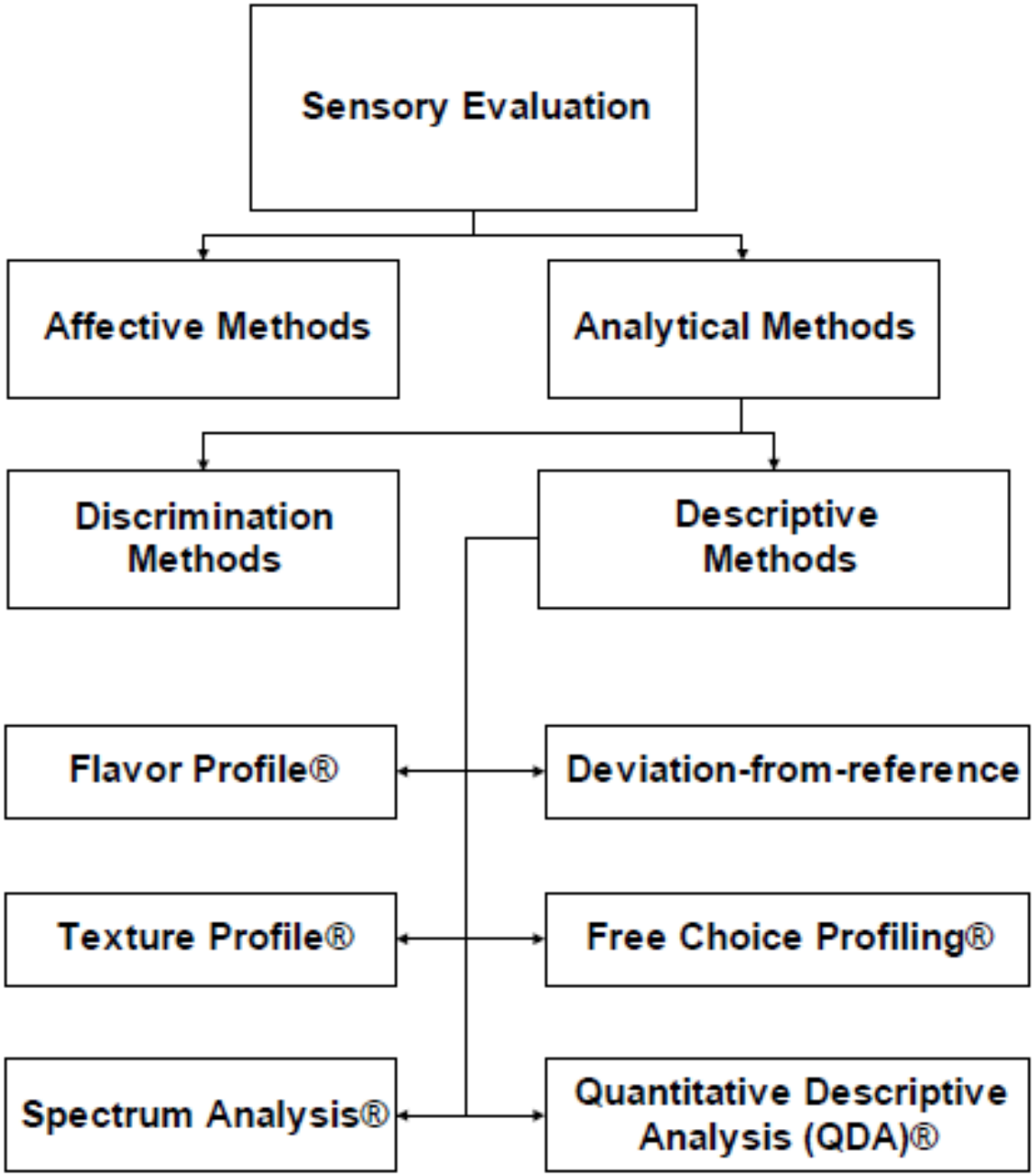
- Content:
  - Definitions
  - Applications
  - Components of DA
  - General procedures
  - Judge performance
  - Descriptive analysis method

Definition

Descriptive analysis methods involve:

- the detection (discrimination)
- the description of the sensory attributes in a product (qualitative)
- and the scaling of the intensities of these attributes (quantitative)

a trained panel of five to twenty judges


Sensory Evaluation
Affective Methods
Analytical Methods
Discrimination Methods
Descriptive Methods
Flavor Profile®
Deviation-from-reference
Texture Profile®
Free Choice Profiling®
Spectrum Analysis®
Quantitative Descriptive Analysis (QDA)®

Applications

- Obtain **detailed profiles** of the appearance, aroma, flavor and oral texture of foods and beverages, or the skinfeel of personal care products, or the handfeel of fabrics and etc.

  More generally, profile the sensory properties of any product.

Applications

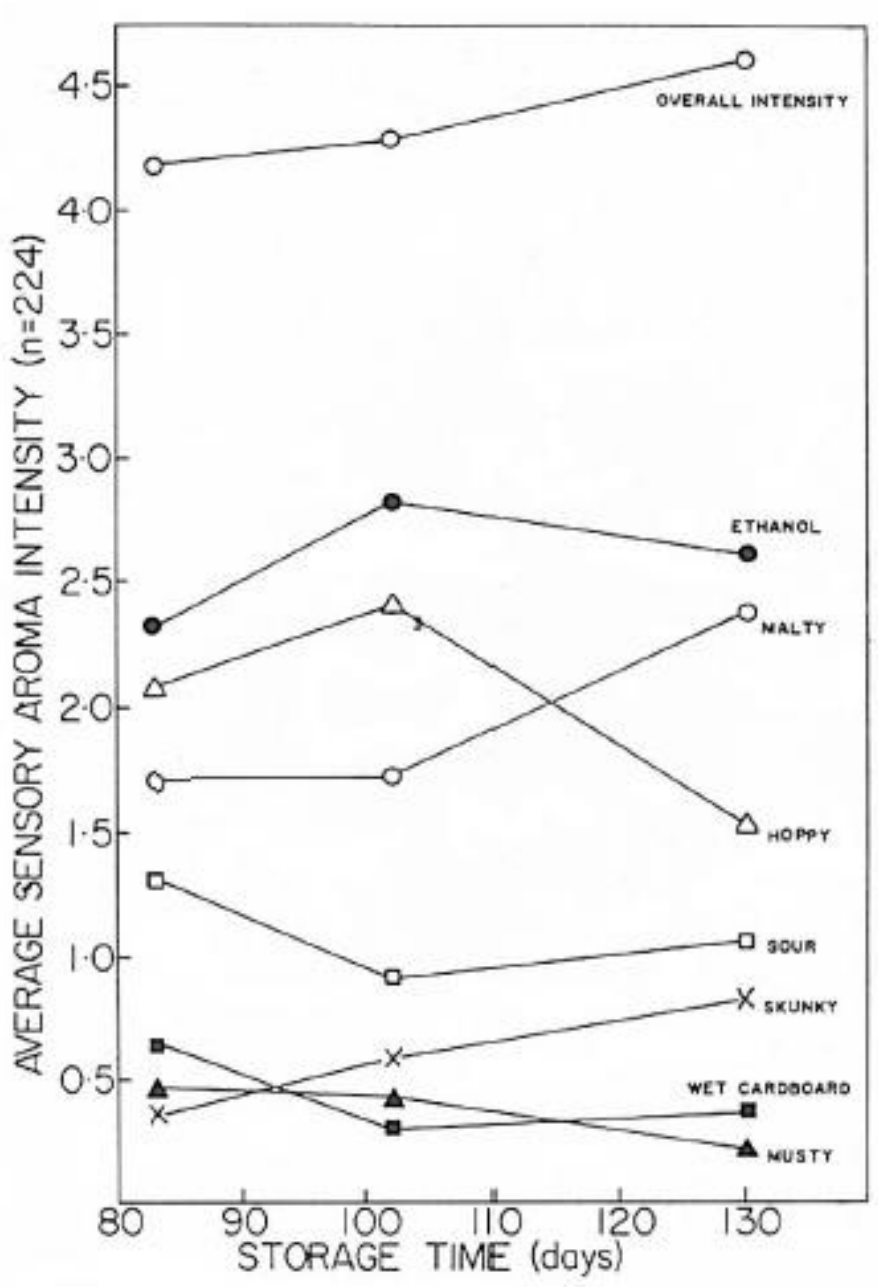
- Define the sensory properties of a target product and document the sensory properties of prototypes for **new product development**.

Applications

- Define the characteristics/specifications of a control for **quality assurance** and **quality control** purposes.

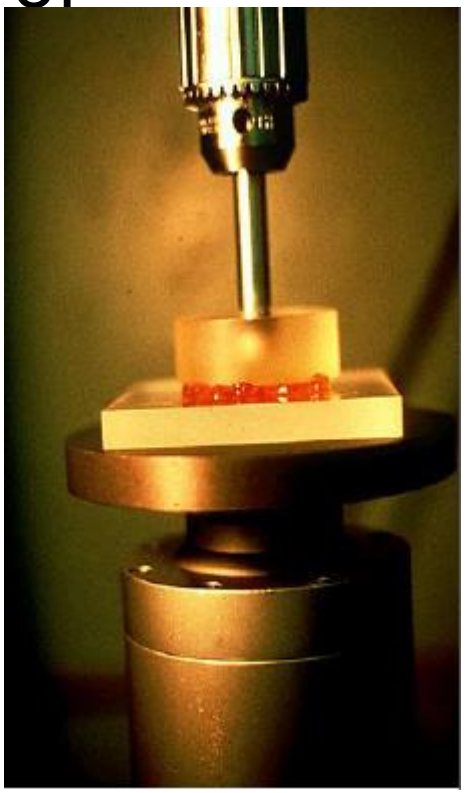
Applications

- Track a product's sensory changes over time to understand **shelf-life properties**.



Applications

- Correlate a product's sensory attributes with instrumental physical or chemical measurements of sensory properties.
  - Color
  - Texture
  - Flavor
  -

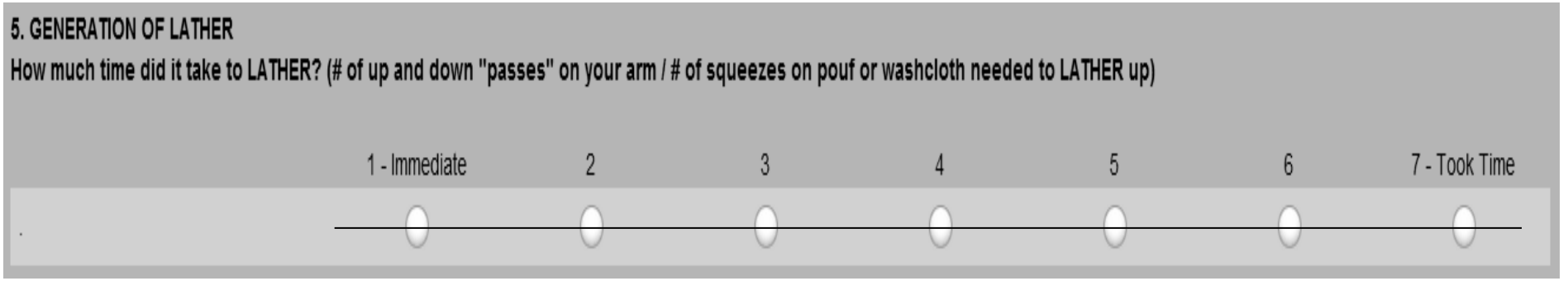


Applications

- Document a products' attributes before a consumer test to help in **questionnaire design and results interpretation**.
- Correlate descriptive profile of products with **consumers' liking mapping** (external preference mapping).

Components of DA

- For all descriptive analysis methods:
  - Descriptor = **qualitative** aspect
  - Intensity scaling = **quantitative** aspect



Components of DA

- Some DA methods also:

- Consider the order of appearance of the attributes (e.g., the Texture profile method)

- Include some integrated or overall measure (of intensity, complexity, balance, quality, …, **NOT LIKING**)

General Procedures

- Recruiting panelists
- Developing an attribute lexicon
- Training panelists
- Validating panelists
- Collecting and analyzing data (actual evaluation)
- Maintaining panelists

Recruiting panelists

- Panelists

  - screened: 2-3 times than the amount of final panelists

  - training

- Execution staff

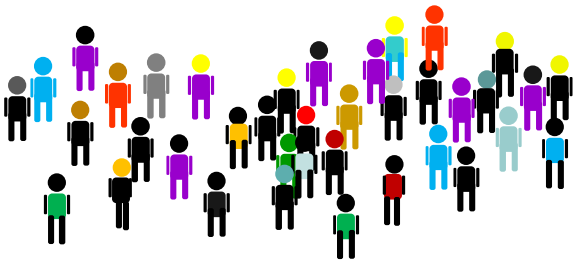
  - panel leader

  - supporting staff

Recruiting panelists

- Screen candidates using an online survey
- Interview candidates in person
- Panelists' qualities to look for:
  - more interested in research than compensation
  - responsible, mature, and scientific-minded
  - avoid loud and/or dominant personalities

(can be intimidating for other panelists during discussion sessions—discourages communication)



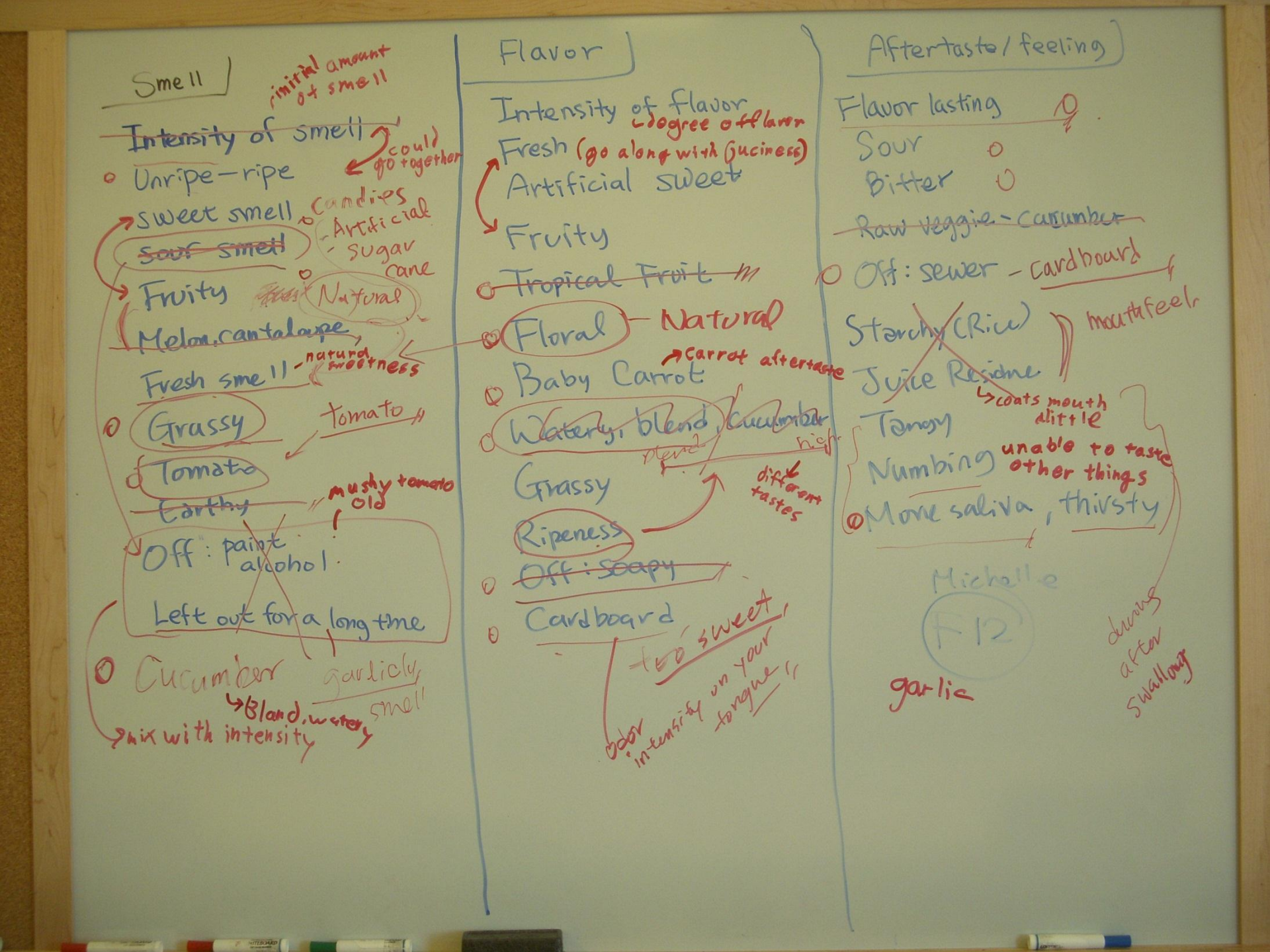
Descriptive Language

- The **perceived sensory attributes** in the products are identified and described by various terms referred to as:
  - Characteristics
  - Descriptive terms
  - Descriptors
  - Attributes
  - Descriptive terminology

Descriptive Language

- Term generation

  - Panelists are given a **range of products** (representative of the samples to be rated in the actual descriptive analysis), and are asked to **develop terms describing** the sensory attributes in the samples (focusing on those attributes for which the samples are ***different***).


Smell
initial amount of smell
Intensity of smell
Unripe-ripe
could go together
Sweet smell
Candies
Artificial sugar cane
Sour smell
Fruity
Natural
Melon, cantalope
Fresh smell
natural sweetness
Grassy
Tomato
Tomato
Earthy
mushy tomato
old
Off: paint alcohol
Left out for a long time
Cucumber
garlicky smell
Bland, watery
mix with intensity
Flavor
Intensity of flavor
degree of flavor
Fresh (go along with juiciness)
Artificial sweet
Fruity
Tropical Fruit
Floral
Natural
Baby Carrot
carrot aftertaste
Watery, bland, cucumber
blend
high
Grassy
different tastes
Ripeness
Off: soapy
Cardboard
too sweet
odor intensity on your tongue
Aftertaste / feeling
Flavor lasting
Sour
Bitter
Raw veggie - cucumber
Off: sewer - cardboard
Starchy (Rice)
Juice Residue
mouthfeel
coats mouth a little
Tangy
Numbing
unable to taste other things
More saliva, thirsty
during after swallowing
Michelle
F12
garlic

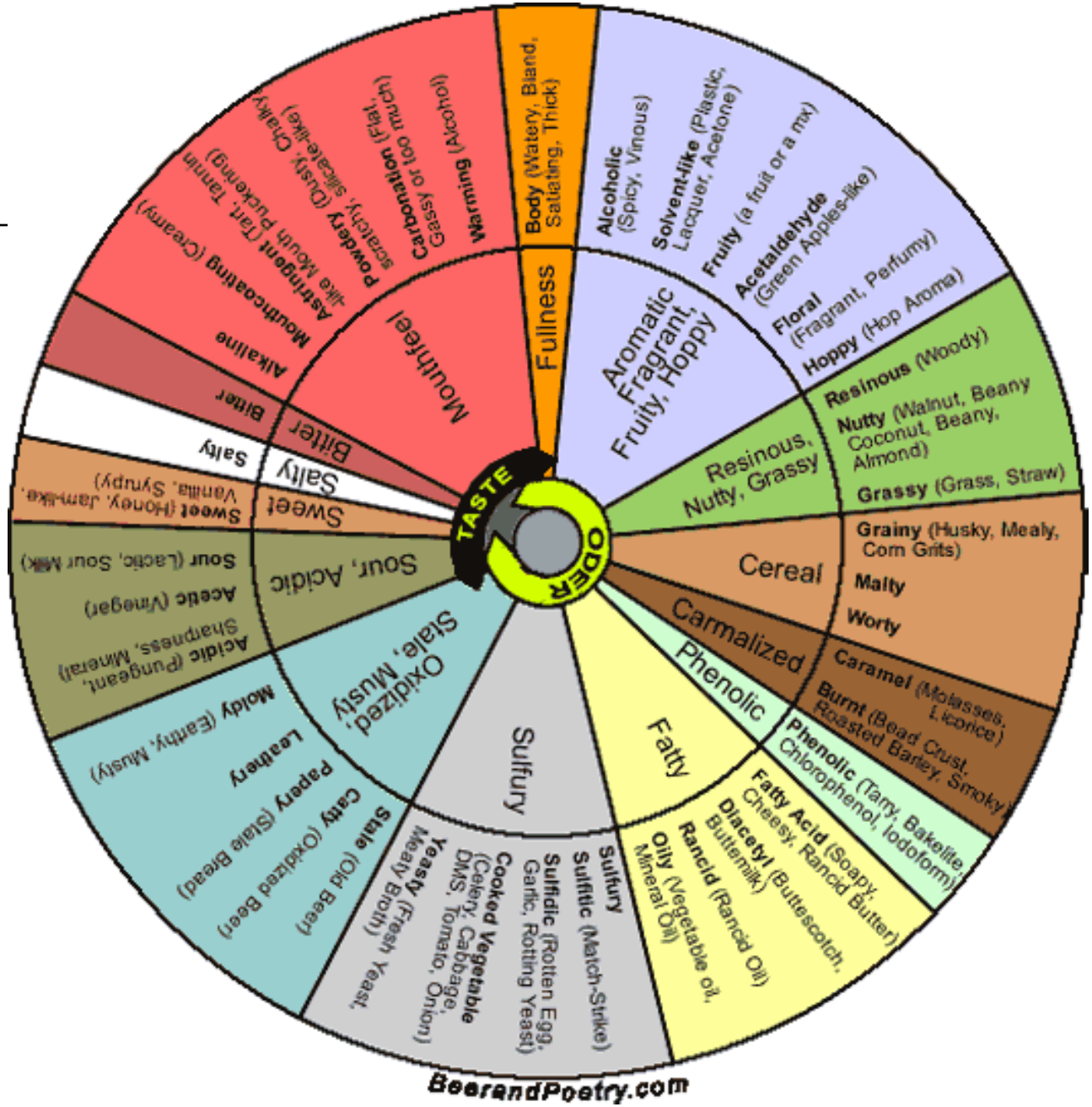
Descriptive Language

- Descriptive terms should be:
  - Objective (not subjective)
  - Unique (no redundancies)
  - Understandable
  - Can be translated into other languages
  - Standards can be prepared

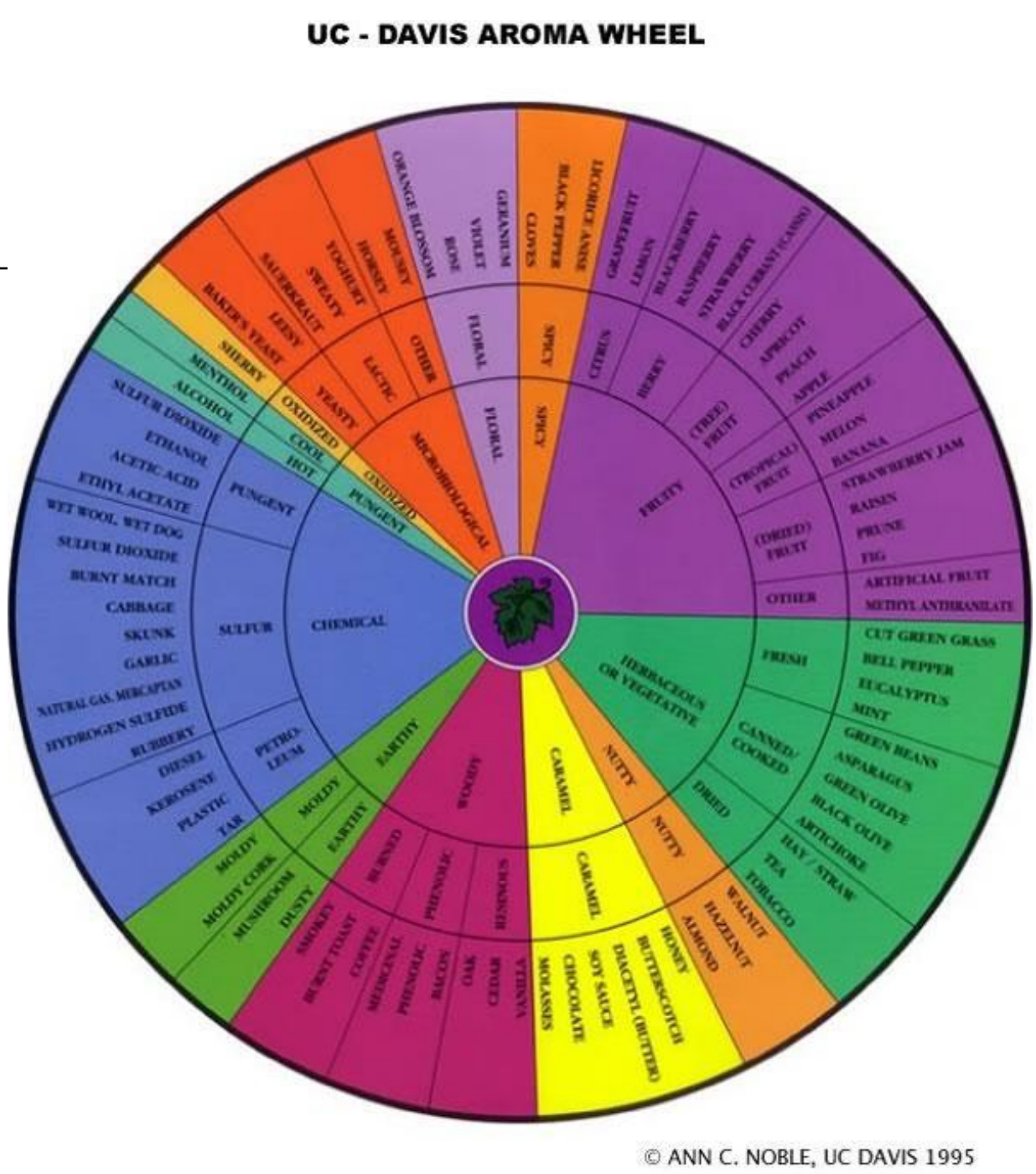
Descriptive Language

- **Flavor or aroma wheels** have been developed by the:
  - Whisky industry (UK)
  - Brewing industry (UK and US)
  - Wine industry (US)

The Beer Flavor Wheel



The Wine Aroma Wheel



Descriptive Language

- **Concept alignment**
  - It is critical that **all judges on the panel understand the descriptive terms in the same way**. This is achieved by:
  - Carefully **defining each term** and its evaluation protocol
  - **Preparing references/standards** for most attributes

References

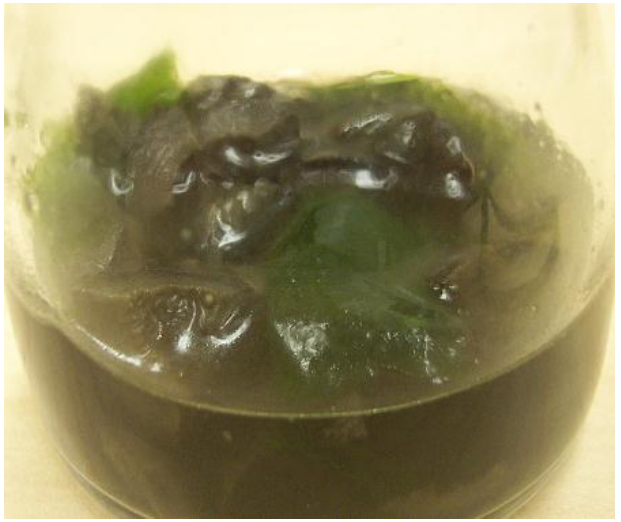
Table 2. Aroma and flavor by mouth terms selected for descriptive analysis and composition of the corresponding reference standards.

Term	Composition of reference standard
1. Fresh berry (strawberry, raspberry, black currant)	5 mL red berry fruit drink (Capri Sun™) · 3 mL black currant syrup (Vedrenne™)
2. Berry jam (strawberry, raspberry, blackberry)	6.5 g each of strawberry, raspberry and blackberry jam (Empress™)
3. Cherry	5 mL cherry drink (Hi-C™)
4. Prune	10 mL prune juice (Town House™)
5. Spicy (black pepper, cloves)	pinch of black pepper · 2 cloves
6. Mint/eucalyptus	2 cm^2 green mint · 4 cm^2 eucalyptus leaf
7. Earthy (potato, mushroom)	7.5 mL canned potato liquor · 10 mL canned mushroom liquor (Town House™)
8. Leather	4 cm^2 leather
9 Vegetal (green bean, green tea)	10 mL canned green bean liquor (Town House™) · 1.2 g green tea (Dynasty™)
10. Smoke/tar	0.01 mL liquid hickory smoke (Wright's™) · 1 g tar
11. Berry by mouth	1 mL I.F.F.™ strawberry extract in 150 mL Pinot noir
12. Bitterness	0.2 g caffeine in 150 mL water/0.4 g caffeine in 150 mL Pinot noir
13. Astringency	0.6 g aluminum sulfate in 150 mL water/1.2 g aluminum sulfate in 150 mL Pinot noir

* In 30 mL Mountain Castle Burgundy™ (unless otherwise specified)

‘Earthy’ = Soil + olives

‘Ocean-like’
= Green seaweed + anchovy + olives



Intensity Scale

- **Category scale**
  - Unstructured line scale (6-inch, 15-centimete
  - Numerical scale (0-10 or 0-15)
  - Labeled scale (low-high, none-extreme)
  - Anchor points?

Intensity Scale

- Some methods allow judges to use the scale **any way they want** (provided they discriminate among the samples and are consistent with the rest of the panel).

- Other methods require that judges use the scale **exactly in the same way (calibration),** and extensive training is required: judges assign **the same score** to a given sample.

Training

- **Group exercises** (e.g., go around the table and ask for dominant attributes or ratings for a sample, then discuss).
- •**Individual ratings** (e.g., have the panel rate the attributes across a few samples).
- •Plot ratings to show individual panelists.
- •Examine standard deviations.

Judge Performance

- **Performance criteria:**

  1) Ability to discriminate

  2) Reproducibility

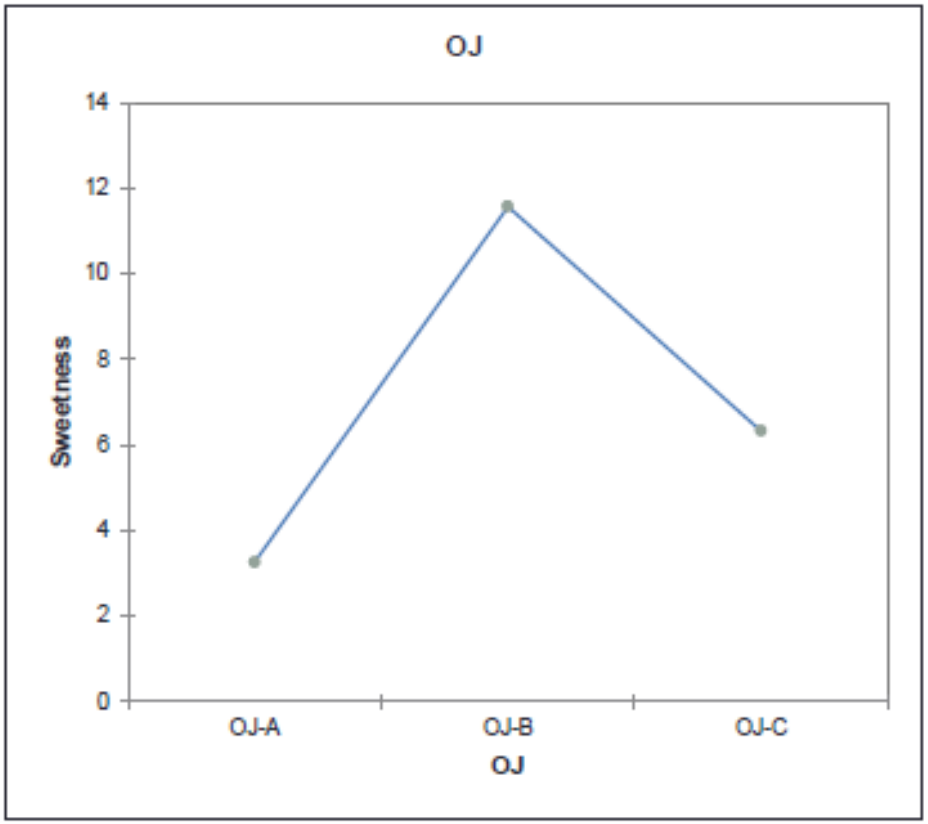
  3) Consistency with the rest of the panel = concept alignment

Judge Performance

Performance criteria:

1) **Ability to discriminate:**

Samples F-ratio in ANOVA

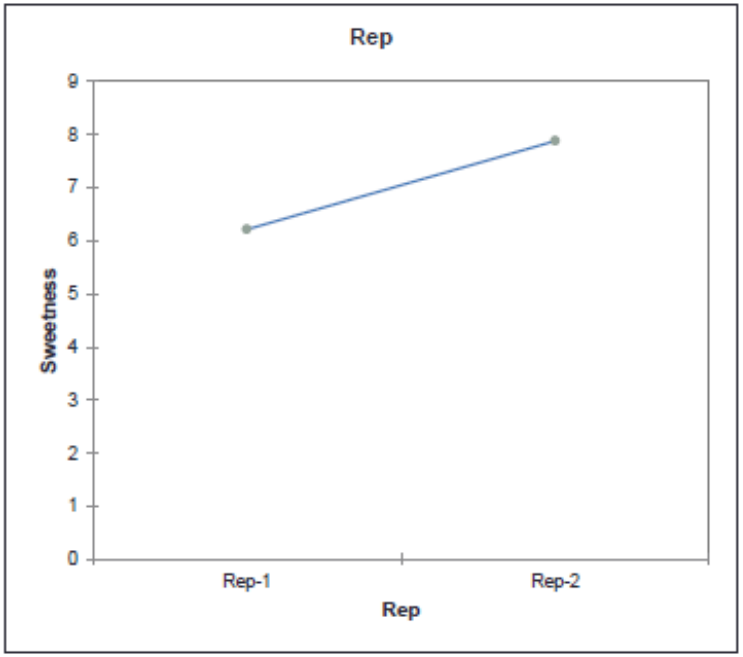


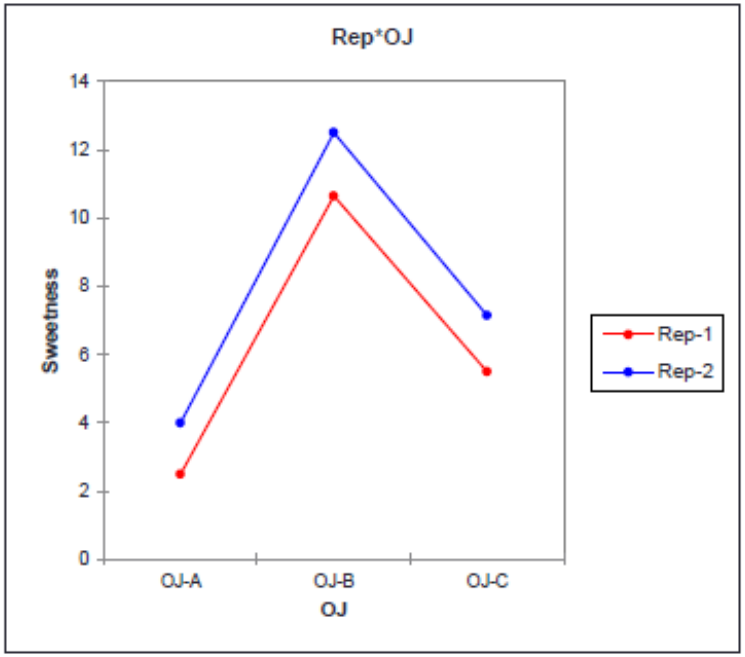
Judge Performance

Performance criteria:

2) Reproducibility

- Replications F-ratio in ANOVA
- Judge by Replication interaction F-ratio in ANOVA



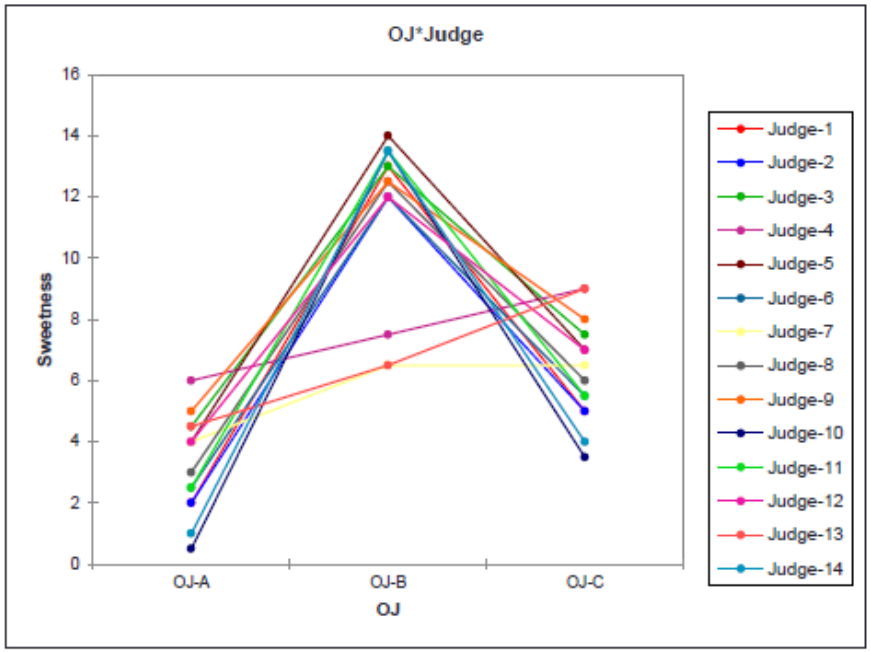


Judge Performance

Performance criteria:

3) Consistency with the rest of the panel = concept alignment

- Judge by Sample interaction F-ratio in ANOVA



Descriptive Analysis Methods

- Flavor Profile Method
- Texture Profile Method
- Quantitative Descriptive Analysis
- Spectrum Method
- Free-Choice Profile
- Flash Profile
- Time-intensity Profile
- Temporary Dominant Scale
- …….

The Flavor Profile Method

- Analysis of a product's perceived aroma and flavor attributes, their intensities, order of appearance, and aftertaste by a panel of four to six trained judges.
- The panel **arrives at a 'consensus' profile** for each sample. (not individual ratings)
- Uses a numerical type category scale anchored with words.
- An 'amplitude' (balance/blend) rating generally is included in the profile.

The Flavor Profile Method

The Flavor Profile Method

- Problems associated with the scale:

1) Does not allow for parametric statistical treatment of the data. (need to analyze using a non-parametric statistics.)

2) Not enough categories

3) Threshold category: Prone to response bias

4) Not equally spaced

The Flavor Profile Method

AROMA — Amplitude 3

	Intensity
Hop fragrance	2
Fruity (apple)	2
Sour	1.5
Yeast	) (
Malt	1
Phenylacetic acid (honey)	1

FLAVOR-BY-MOUTH — Amplitude 1

	Intensity
CO_2 tingle	High
Salt	1
Sweet	1
Sour	2
Fruity (winy)	1
Bitter (metallic)	3
Malt	) (
Yeast	1
Others:	
Astringent	

The Texture Profile Method

- Includes specific attribute descriptors for semisolid foods, beverages, skincare products, fabric and paper goods.
- Focuses on texture/feel characteristics.

- The sensory analysis of the texture of a complex food in terms of its **mechanical, geometrical, fat and moisture characteristics,** the degree of each present, and **the order in which they appear** from first bite through complete mastication.

The Texture Profile Method

1. Mechanical properties

Primary (hardness, cohesiveness, springiness, adhesiveness, viscosity)

Secondary (fracturbility, chewiness, gumminess)

2. Geometrical properties

Size and shape (powdery, chalky, grainy, gritty, lumpy, beady)

Shape and orientation (flaky, fibrous, pulpy, puffy, crystalline)

3. Fat and moisture content

Moistness, dryness, oiliness, fattiness

The Texture Profile Method

- Textural attributes are subdivided according to **order of appearance**:

  1. Initial (perceived at first bite)

  2. Masticatory (perceived upon chewing)

  3. Residual (changes induced during mastication and swallowing) - afterfeel

The Texture Profile Method

- Judges are selected on the basis of **ability to discriminate known textural differences** in the products under study.
- •Judges **define all terms and procedures** for evaluation.
- •Samples are **evaluated individually** using category, line or magnitude estimation scales (ratio scale), yet panel verdict may be derived by group consensus.

The Quantitative Descriptive Analysis (QDA) Method

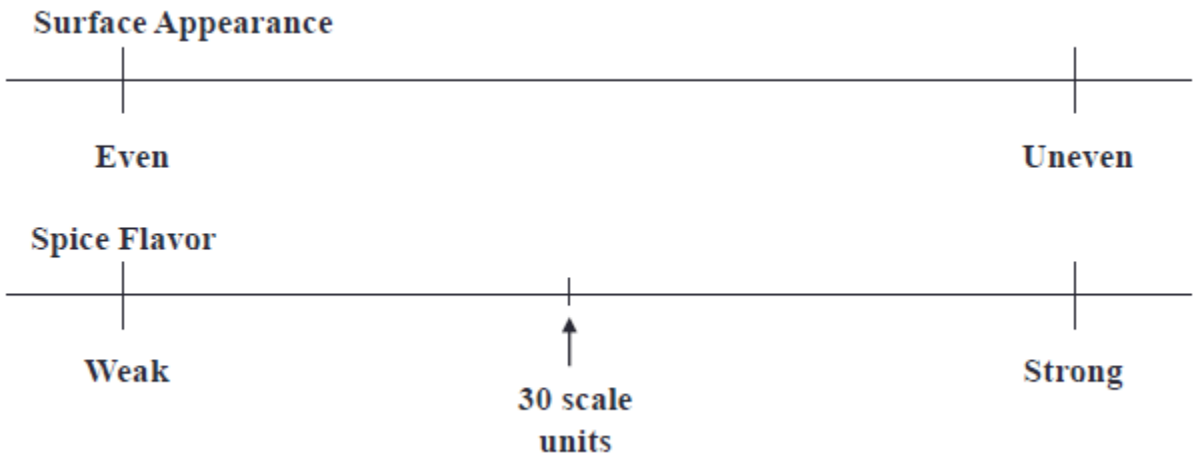
- Measures all sensory attributes
  - •Screening (user of the product; discrimination test) with products from category
  - •Language training is 1 week
  - •Attributes and explanations provided by subjects; references as needed
  - •Panel leader does not participate
  - •Graphic rating scale
  - •Products scored on repeated trial basis
  - •Analyses specified

QDA

- There are four stages to establishing a QDA panel capability:
  - Recruit and screen subjects
  - Develop a scorecard and set of definitions
  - Data collection
  - Analysis and reporting

QDA Graphic Scaling

- QDA® uses a line scale to measure relative intensities for individual dimensions.



- Familiarity with the scale is necessary to use it as an equal interval scale.

Product Evaluation in QDA

- Subjects evaluate products while seated in booths or in typical usage at home
  - Products scored using a repeated trials balanced block design
  - Products are served and scored one at a time (i.e., monadic sequential)

Summary of QDA

- Small panel procedure, 10-12 subjects
  - •Subjects qualified based on liking for and usage of products tested, and their sensory skill with the products being tested
  - •Training with the products being tested
  - •Measures all sensory attributes
  - •Attributes and definitions provided by the subjects (a consumer language)

Summary of QDA

- References may be used during training
- Graphic rating scales to provide intensity measures
- Products individually scored on a repeated trials basis
- Analysis of variance (and other statistics) used to identify product attribute differences, subject sensitivity and reliability, and the overall quality of the information

The Spectrum Method

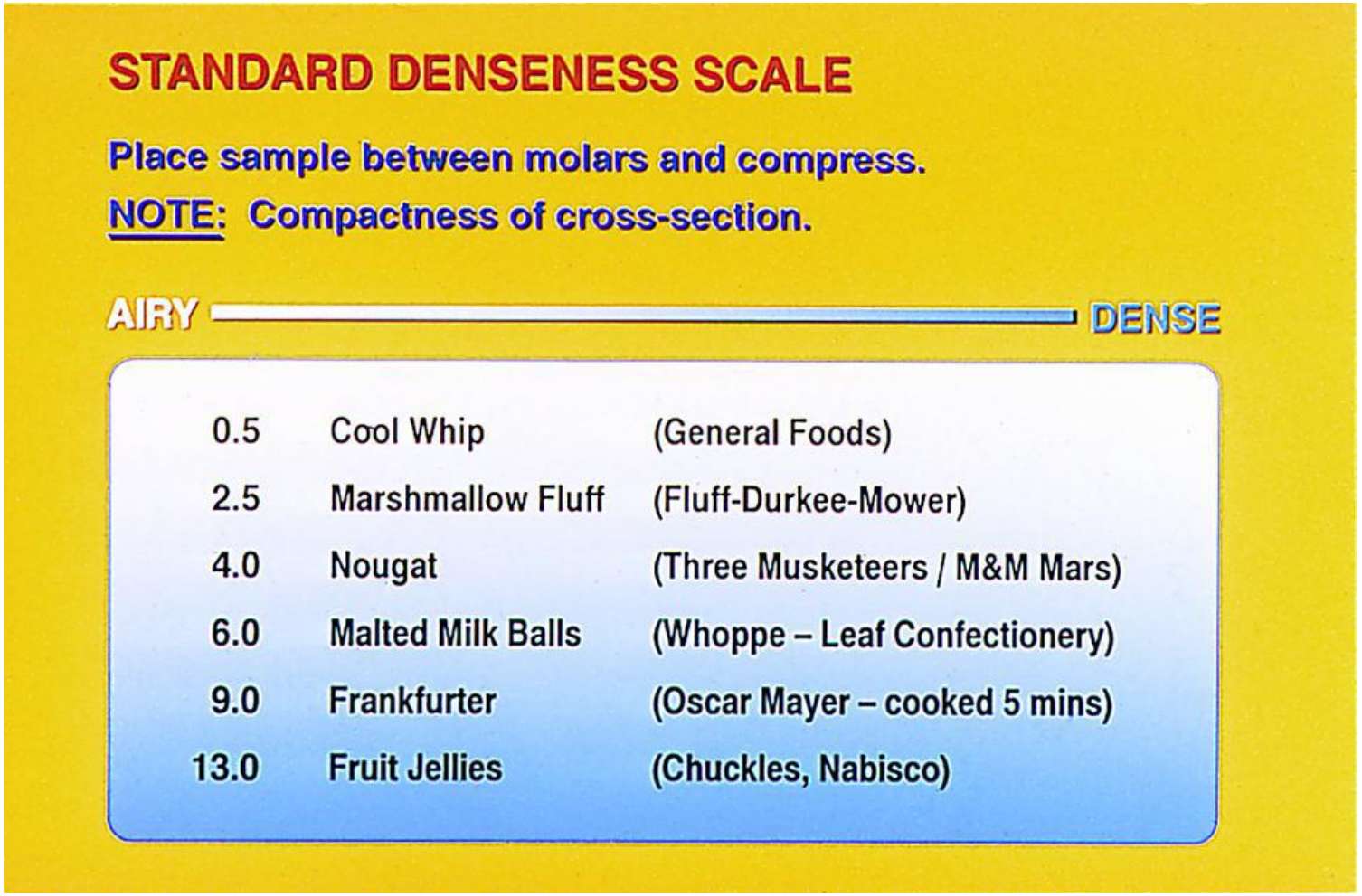
- ***Provides the tools*** – reference lists of descriptors, scaling procedures and methods of panel training – with which to design a descriptive procedure for a given product.

•Uses a 15-cm graphic scale or a 15-point numerical scale.

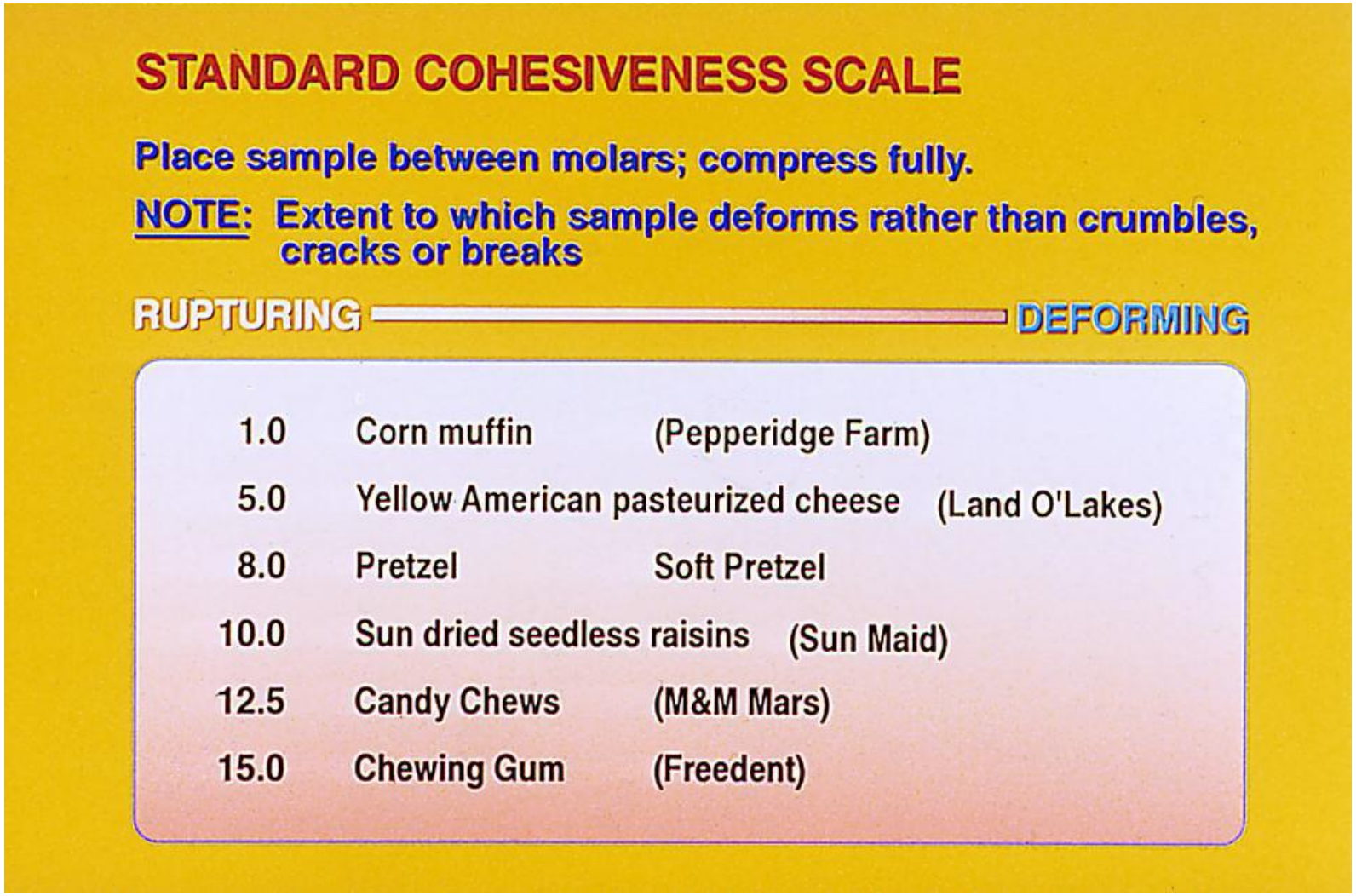
•Standards – used to anchor scale

•Long training required

The Spectrum Method



The Spectrum Method



The Spectrum Method

8. Standard Viscosity Scale

Scale value	Reference	Brand/type/manufacturer	Sample size
1.0	Water	Bottled Mountain Spring	½ tsp.
2.2	Light cream	Sealtest Foods	½ tsp.
3.0	Heavy cream	Sealtest Foods	½ tsp.
3.9	Evaporated milk	Carnation Co.	½ tsp.
6.8	Maple syrup	Vermont Maid, R. J. Reynolds	½ tsp.
9.2	Chocolate syrup	Hershey Chocolate	½ tsp.
11.7	mixture: ½ cup condensed milk + 1 T. heavy cream	Magnolia Sweetened Borden Foods	½ tsp.
14.0	Condensed milk	Borden Foods	½ tsp.

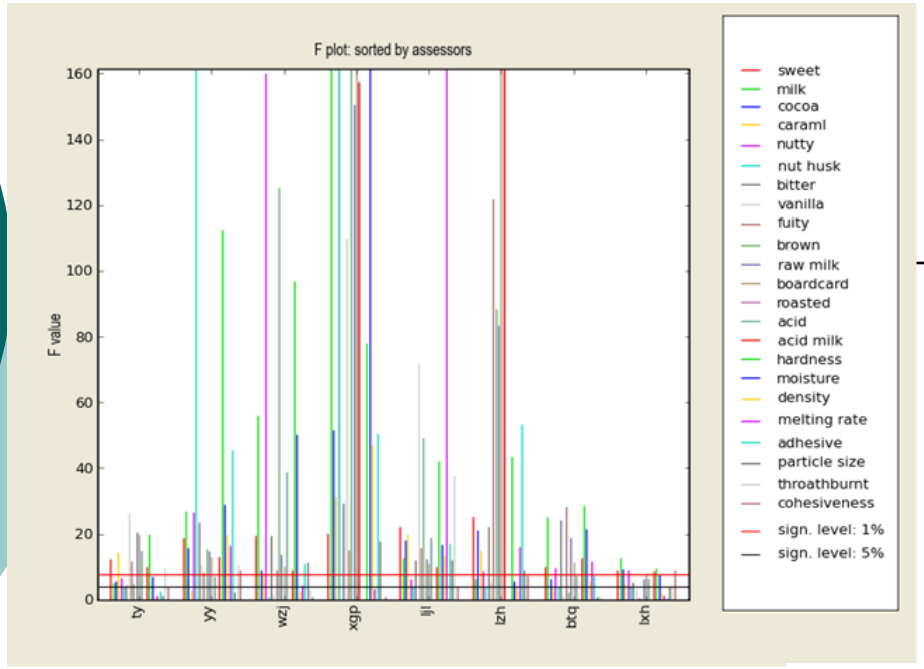
Technique: (A) Place 1 tsp. of product close to lips; draw air in gently to induce flow of liquid; measure the force required.
(B) Once product is in mouth, allow to flow across tongue by moving tongue slowly to roof of mouth, measure rate of flow (the force here is gravity).

Definition: The rate of flow per unit force:
(A) the force to draw between lips from spoon
(B) the rate of flow across tongue.

[Not viscous ---------- Viscous]

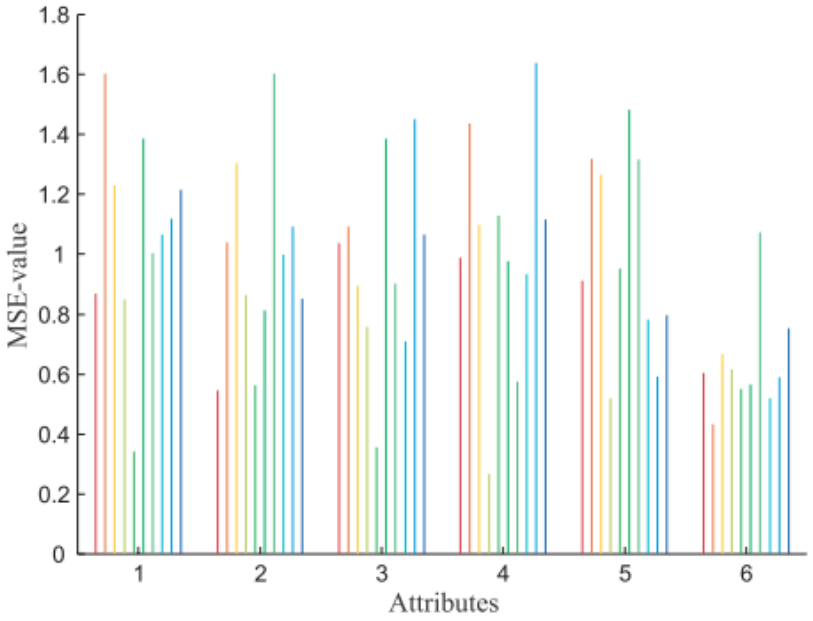
The Spectrum Method

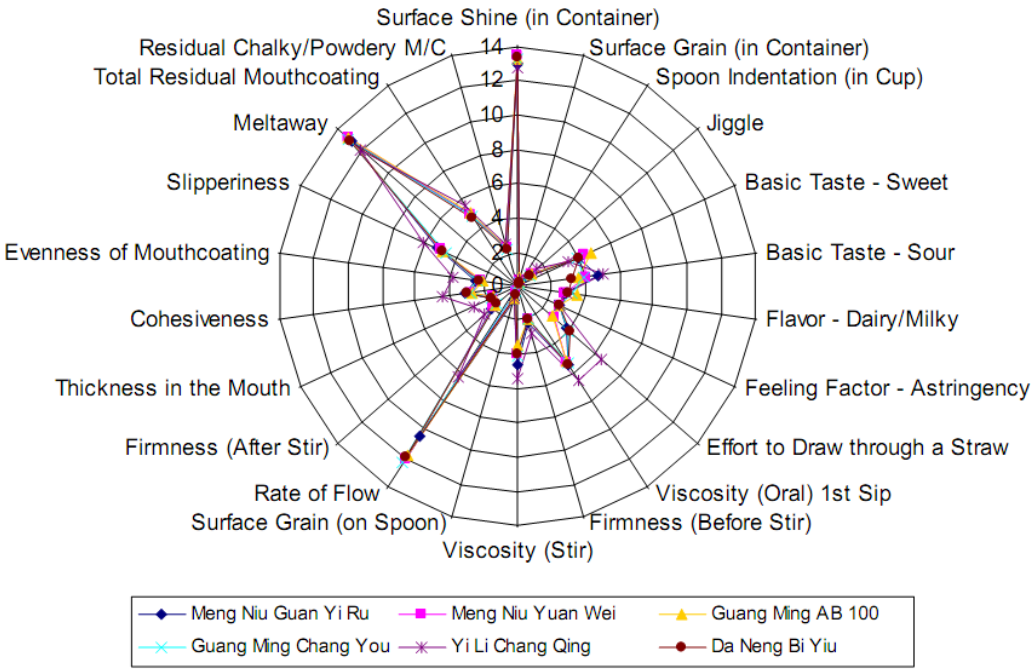
- Claims to provide **'absolute' ratings**
- Judges are **extensively trained** to produce the same ratings for the same samples
- The Spectrum Method is well suited for ***quality assurance*** (if product specifications include a specific attribute profile).

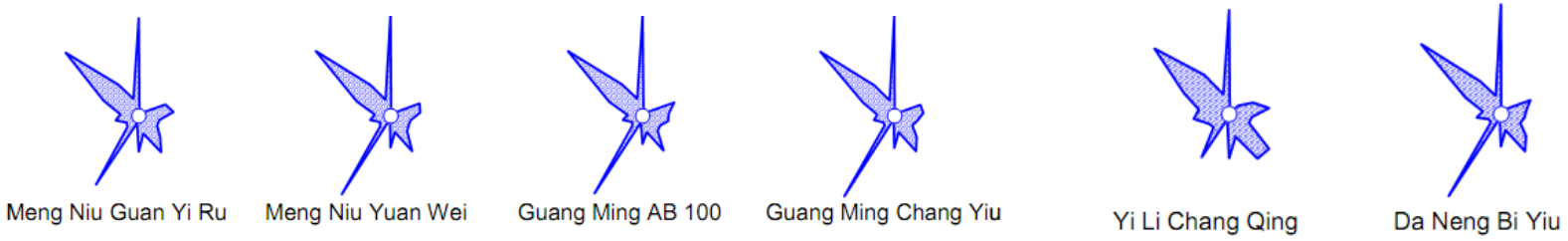


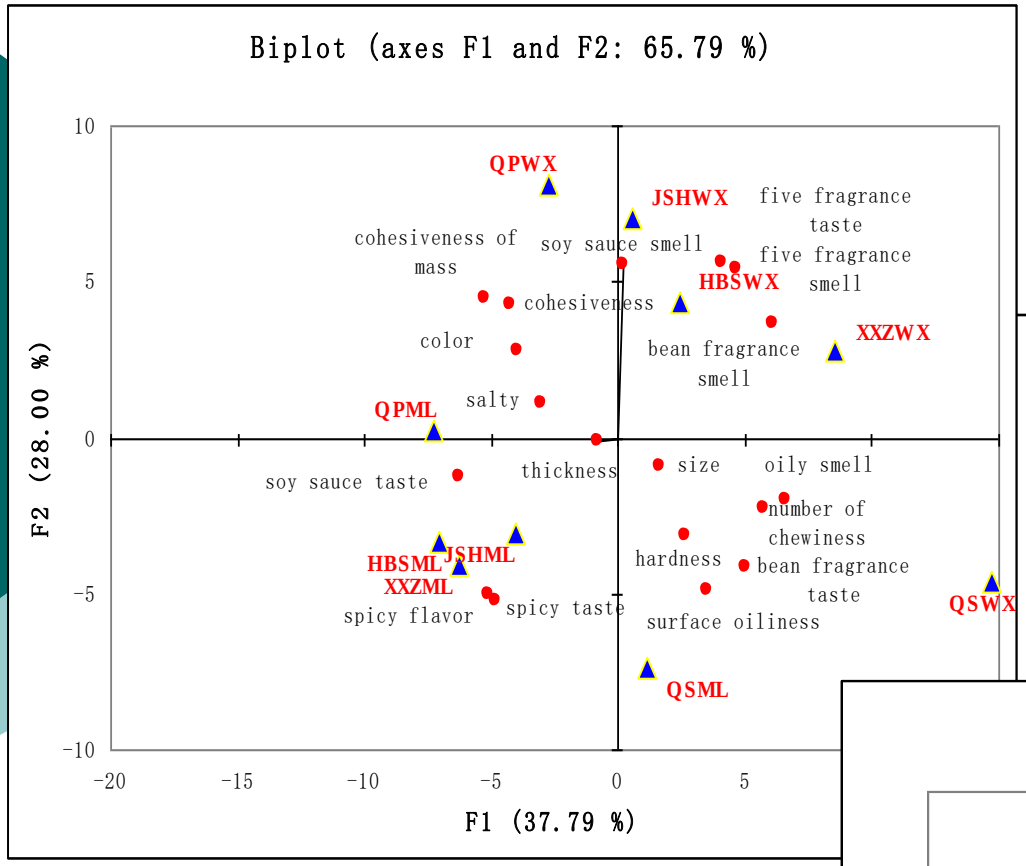
F value: difference within group/difference between groups

MSE: repeatbility

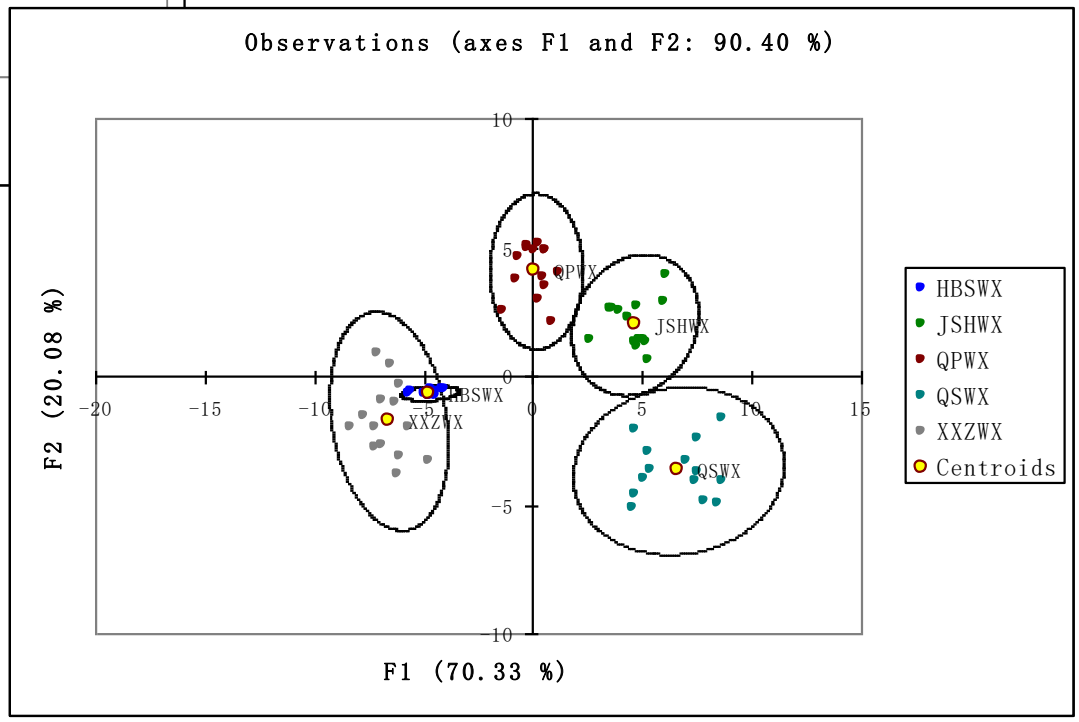



Surface Shine (in Container)
Surface Grain (in Container)
Spoon Indentation (in Cup)
Jiggle
Basic Taste - Sweet
Basic Taste - Sour
Flavor - Dairy/Milky
Feeling Factor - Astringency
Effort to Draw through a Straw
Viscosity (Oral) 1st Sip
Firmness (Before Stir)
Viscosity (Stir)
Surface Grain (on Spoon)
Rate of Flow
Firmness (After Stir)
Thickness in the Mouth
Cohesiveness
Evenness of Mouthcoating
Slipperiness
Meltaway
Total Residual Mouthcoating
Residual Chalky/Powdery M/C
14
12
10
8
6
4
2
0
Meng Niu Guan Yi Ru
Meng Niu Yuan Wei
Guang Ming AB 100
Guang Ming Chang You
Yi Li Chang Qing
Da Neng Bi Yiu

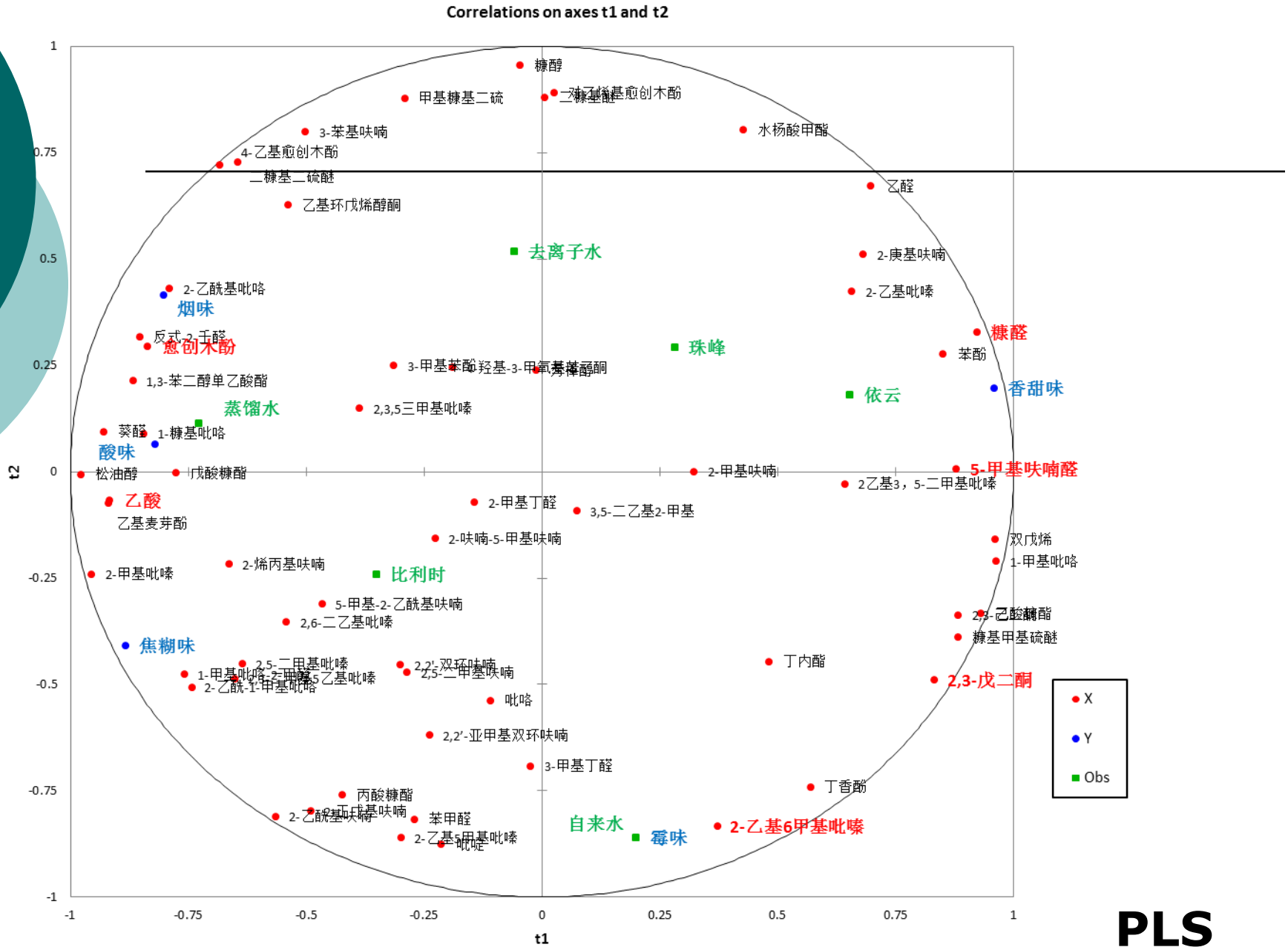

Meng Niu Guan Yi Ru
Meng Niu Yuan Wei
Guang Ming AB 100
Guang Ming Chang Yiu
Yi Li Chang Qing
Da Neng Bi Yiu


Biplot (axes F1 and F2: 65.79 %)
QPWX
JSHWX
five fragrance taste
cohesiveness of mass
soy sauce smell
five fragrance smell
HBSWX
cohesiveness
color
bean fragrance smell
XXZWX
QPML
salty
soy sauce taste
thickness
size
oily smell
number of chewiness
HBSML
JSHML
XXZML
hardness
bean fragrance taste
spicy flavor
spicy taste
surface oiliness
QSWX
QSML
F2 (28.00 %)
F1 (37.79 %)

PCA


Observations (axes F1 and F2: 90.40 %)
QPWX
JSHWX
HBSWX
XXZWX
QSWX
HBSWX
JSHWX
QPWX
QSWX
XXZWX
Centroids
F2 (20.08 %)
F1 (70.33 %)

DA


Correlations on axes t1 and t2
t1
t2
1
0.75
0.5
0.25
0
-0.25
-0.5
-0.75
-1
-1
-0.75
-0.5
-0.25
0
0.25
0.5
0.75
1
糠醇
甲基糠基二硫
二糠基醚
3-苯基呋喃
水杨酸甲酯
4-乙基愈创木酚
二糠基二硫醚
乙醛
乙基环戊烯醇酮
去离子水
2-庚基呋喃
2-乙酰基吡咯
烟味
2-乙基吡嗪
糠醛
反式-2-壬醛
愈创木酚
珠峰
苯酚
3-甲基苯酚
羟基-3-甲氧基苯乙酮
1,3-苯二醇单乙酸酯
依云
香甜味
蒸馏水
2,3,5三甲基吡嗪
葵醛
1-糠基吡咯
酸味
松油醇
戊酸糠酯
2-甲基呋喃
5-甲基呋喃醛
2乙基3，5-二甲基吡嗪
乙酸
2-甲基丁醛
3,5-二乙基2-甲基
乙基麦芽酚
2-呋喃-5-甲基呋喃
双戊烯
2-烯丙基呋喃
1-甲基吡咯
2-甲基吡嗪
比利时
5-甲基-2-乙酰基呋喃
2,6-二乙基吡嗪
焦糊味
2,5-二甲基吡嗪
2,2'-双环呋喃
丁内酯
1-甲基吡咯
2,5-二甲基呋喃
2-乙酰-1-甲基吡咯
2,3-戊二酮
吡咯
2,2'-亚甲基双环呋喃
3-甲基丁醛
丁香酚
丙酸糠酯
2-乙酰基呋喃
苯甲醛
自来水
霉味
2-乙基6甲基吡嗪
吡嗪
X
Y
Obs

PLS

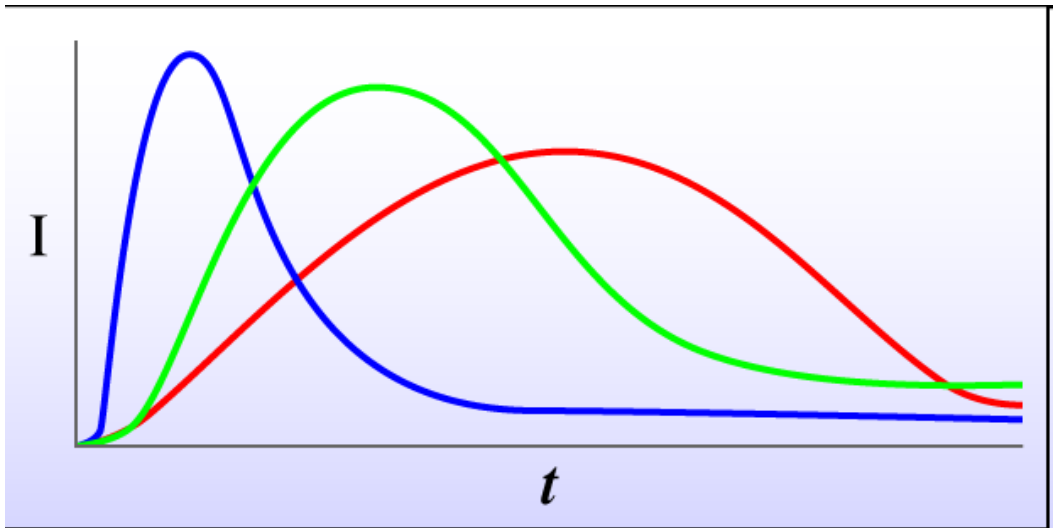
Free-Choice Profiling

Steps:

- Each judge receive all products and describes.
- Produces own list of terms: own concepts and labels
- Personalized scoresheet is created
- Practice a few times to (make sure to be internally consistent)
- Rate products with ones own descriptor list
- Analyze data: Generalized Procrustes analysis

Time-Intensity Profiling

- The time-intensity technique monitors the **intensity** of specific attributes ***over time***.
- The data is **continuously recorded** with a joystick or mouse interfaced to a computer.



Time-Intensity Profiling

Examples:

- Chewing gum (matrix release)
- Chocolates (fats – flavor release; melting)

Time-Intensity Profiling