



Descriptive Analysis



Specify the intensities of attributes

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Descriptive Analysis (DA)

▣ Content:

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

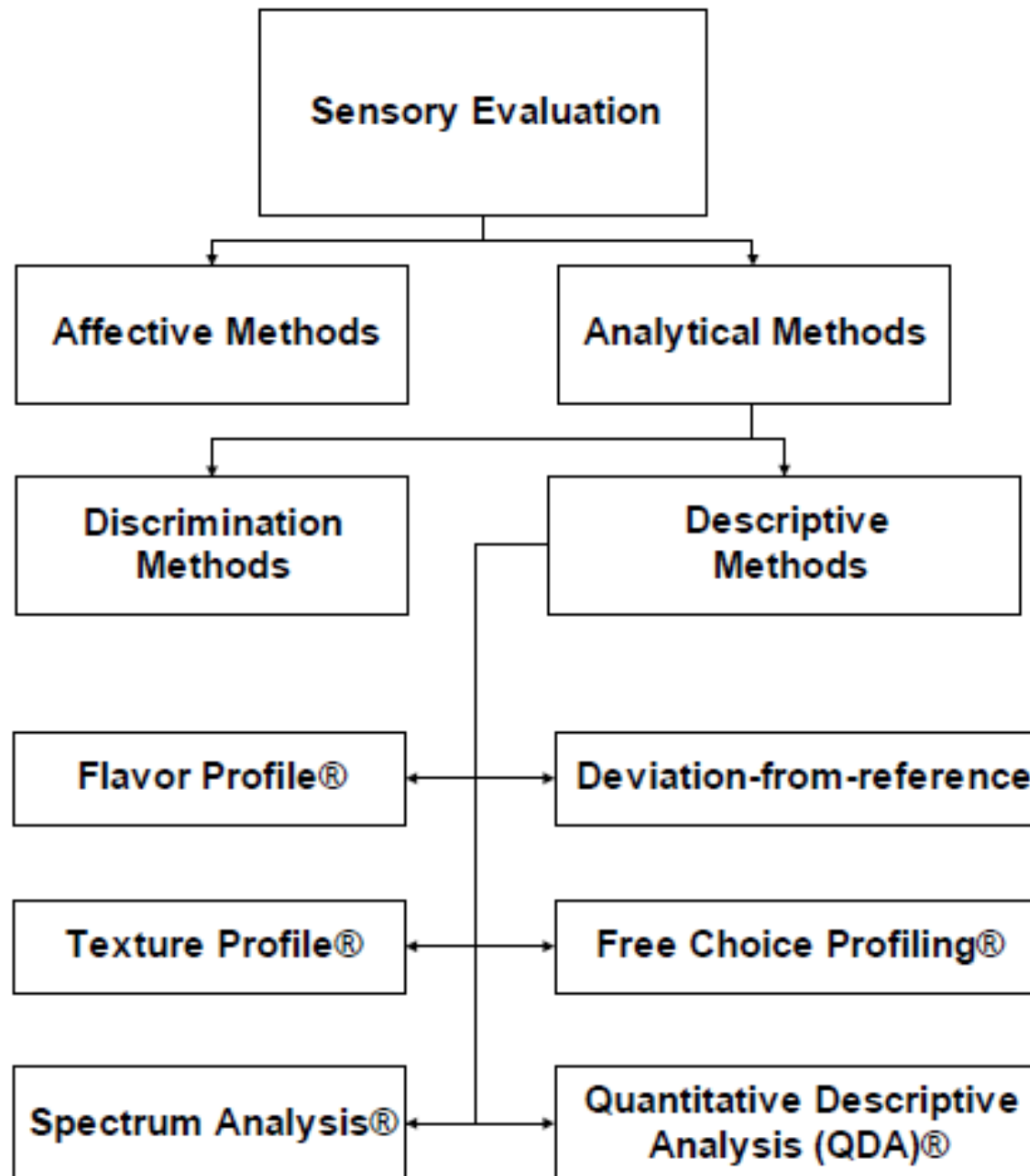


Definition

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





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.**

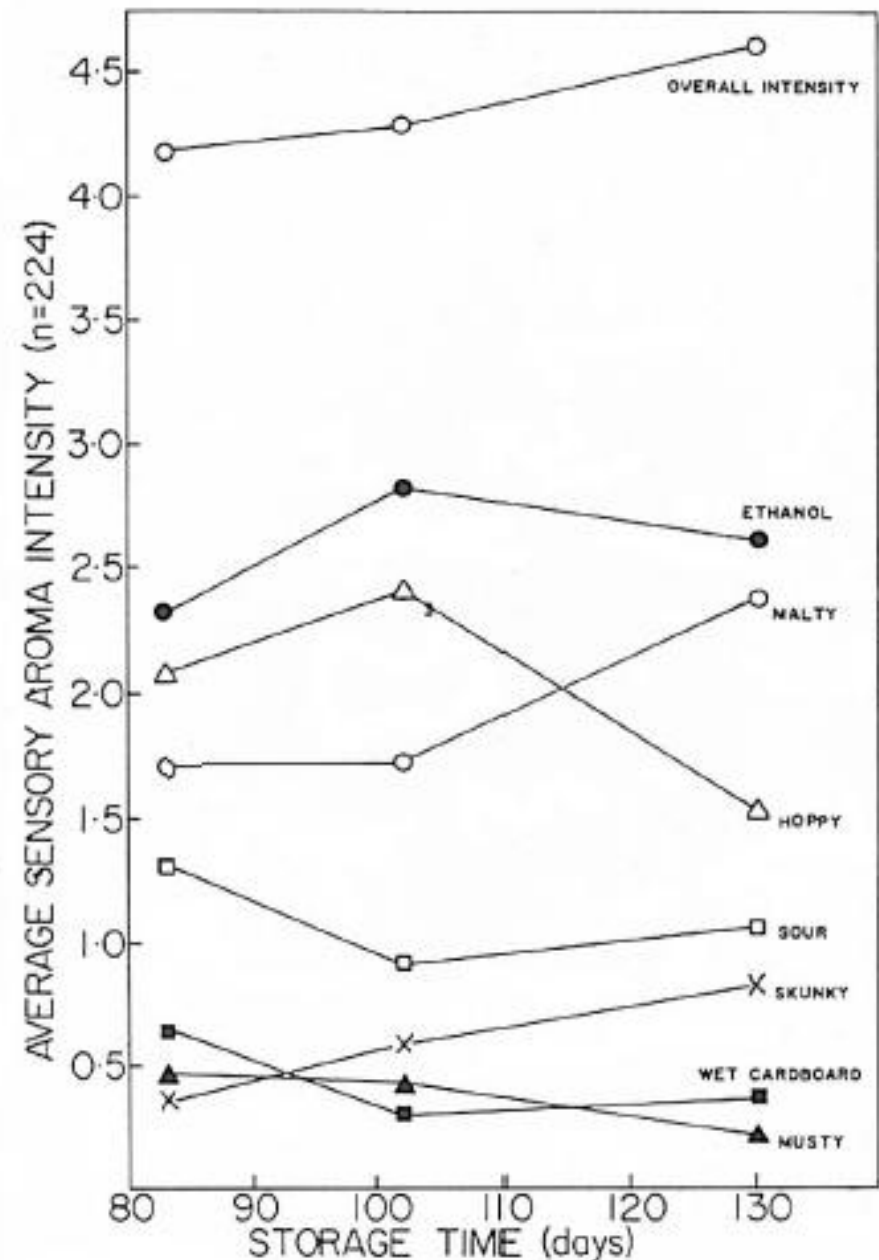


Applications

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

Applications

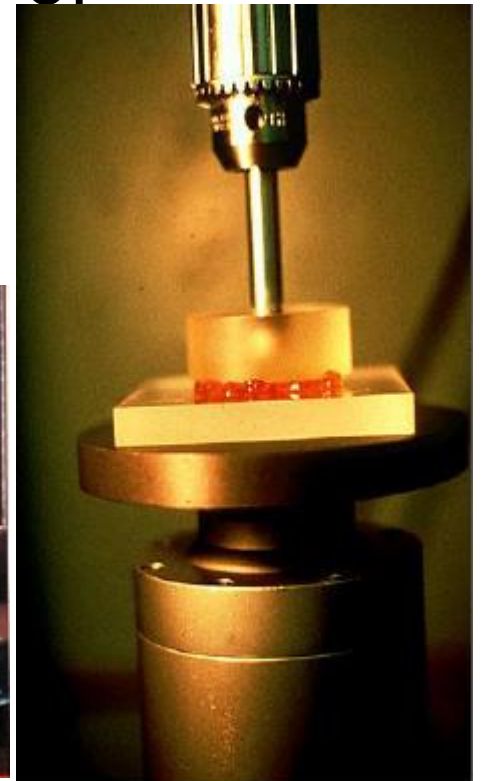
- Track a product's sensory changes over time to understand **shelf-life properties**.



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

5. GENERATION OF LATHER

How much time did it take to LATHER? (# of up and down "passes" on your arm / # of squeezes on pouf or washcloth needed to LATHER up)

1 - Immediate

2

3

4

5

6

7 - Took Time





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

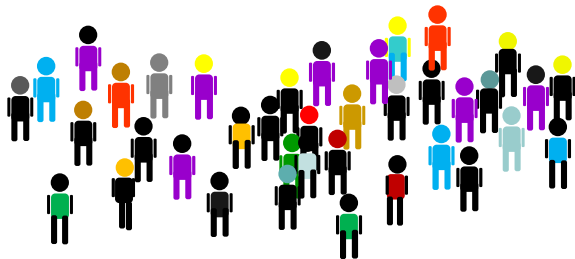
- screened: 2-3 times than the amount of final panelists
- training

▣ Execution staff

- panel leader
- supporting staff

Recruiting panelists

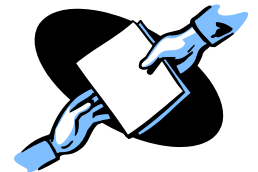
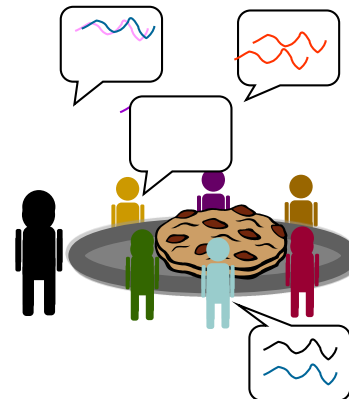
- Screen candidates using an online survey
- Interview candidates in person
- Panelists' qualities to look for:
 - more interested in research than compensation
 - responsible, mature, and scientific-minded
 - avoid loud and/or dominant personalities
(can be intimidating for other panelists during discussion sessions—discourages communication)



Developing an attribute lexicon

► Language development

- relative references
(textbook, past researches, etc.)
- group discussion: delete, select
- citation frequency
- the list of descriptors

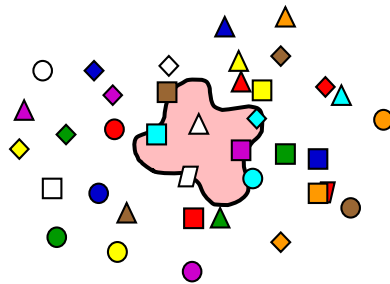


Developing an attribute lexicon

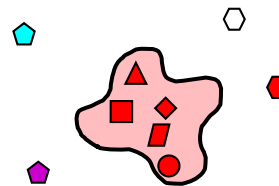
- Concept formation

- define each attribute
- consensus for definitions

still delete same-meaning words



Abstraction

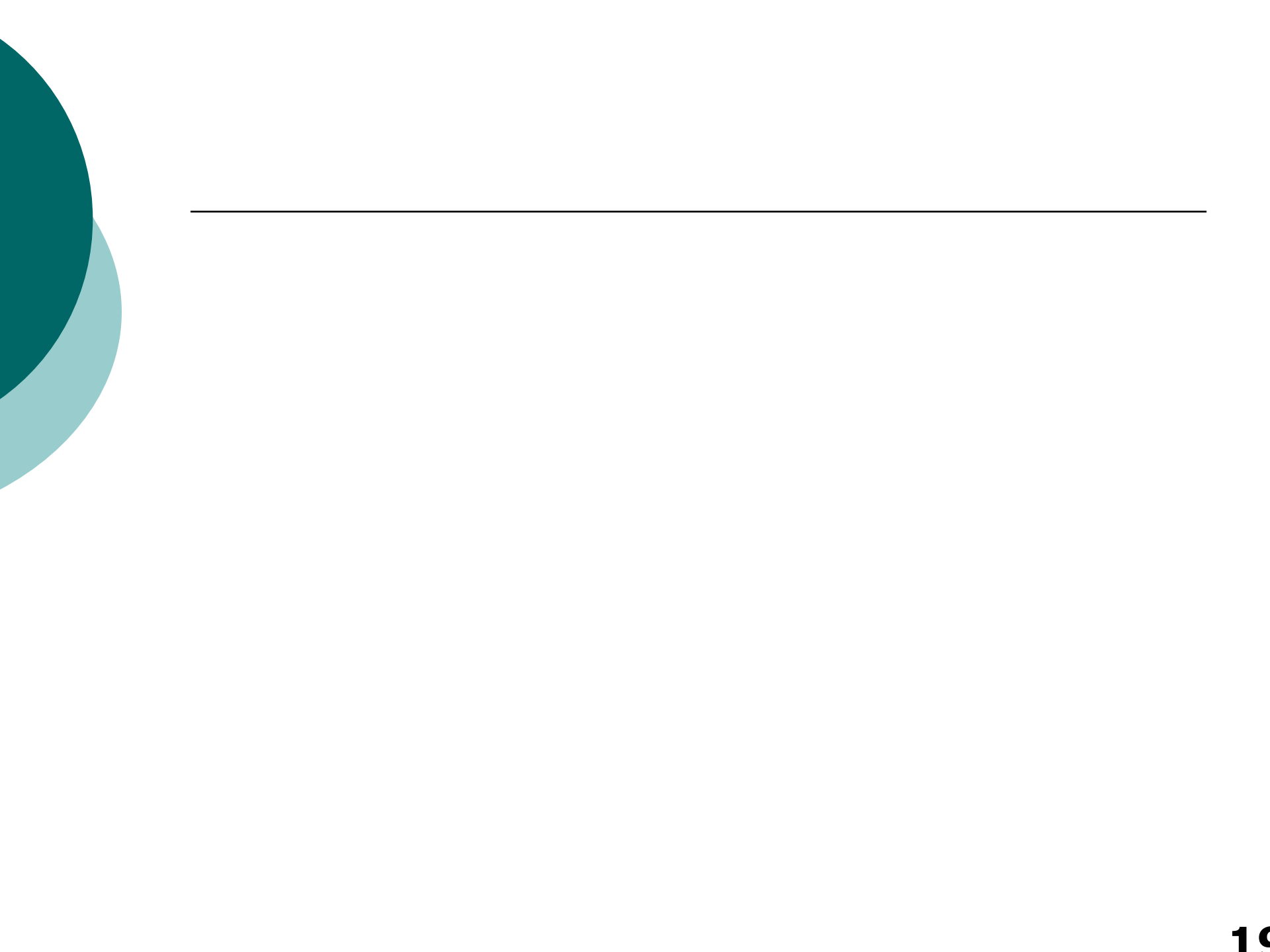


Generalization

Developing an attribute lexicon

- References, standards
 - for each attribute, standards of different intensities







Descriptive Language

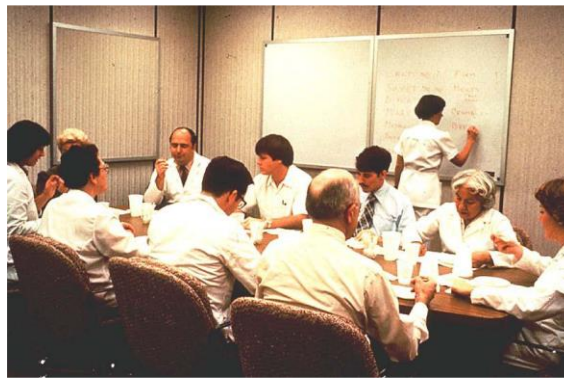
- The **perceived sensory attributes** in the products are identified and described by various terms referred to as:
 - Characteristics
 - Descriptive terms
 - Descriptors
 - Attributes
 - Descriptive terminology

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

Sweet smell

~~Sour smell~~

Fruity

Melon, cantaloupe

Fresh smell

Grassy

Tomato

Earthy

Off: paint, alcohol

Left out for a long time

Cucumber

garlicky, bland, watery

mix with intensity

could go together
candies
Artificial
sugar
cane

Natural

natural
sweetness

tomato

mushy tomato
old

Flavor

Intensity of flavor

Fresh (go along with juiciness)

Artificial sweet

Fruity

Tropical fruit

Floral - Natural

Baby Carrot

Watery, bland, cucumber

Grassy

Ripeness

Off: soapy

Cardboard

too sweet
odor intensity on your tongue

Carrot aftertaste

blend

different tastes

Aftertaste / feeling

Flavor lasting

Sour

Bitter

Raw veggie - cucumber

Off: sewer - cardboard

Starchy (Rice)

Juice Residue

Tangy

Numbing - unable to taste other things

More saliva, thirsty

mouthfeel

coats mouth
a little

Michelle

F12

garlic

during
after
swallowing



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







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-centimeter)
- Numerical scale (0-10 or 0-15)
- Labeled scale (low-high, none-extreme)
- Anchor points?

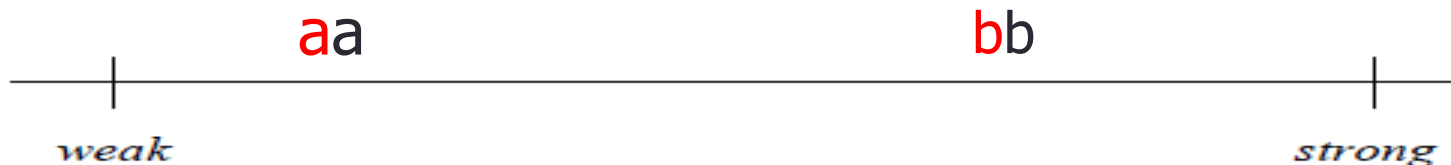


Intensity Scale

- 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:**

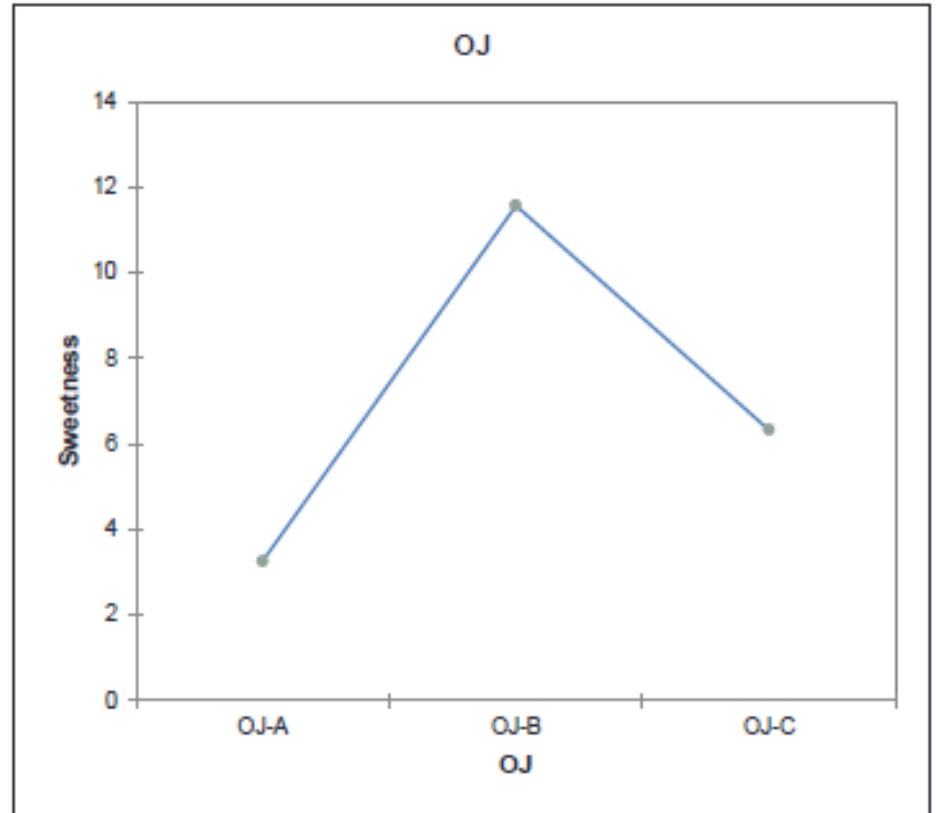
- 1) Ability to discriminate
- 2) Reproducibility
- 3) Consistency with the rest of the panel = concept alignment

Judge Performance

Performance criteria:

1) Ability to discriminate:

Samples F-ratio in ANOVA

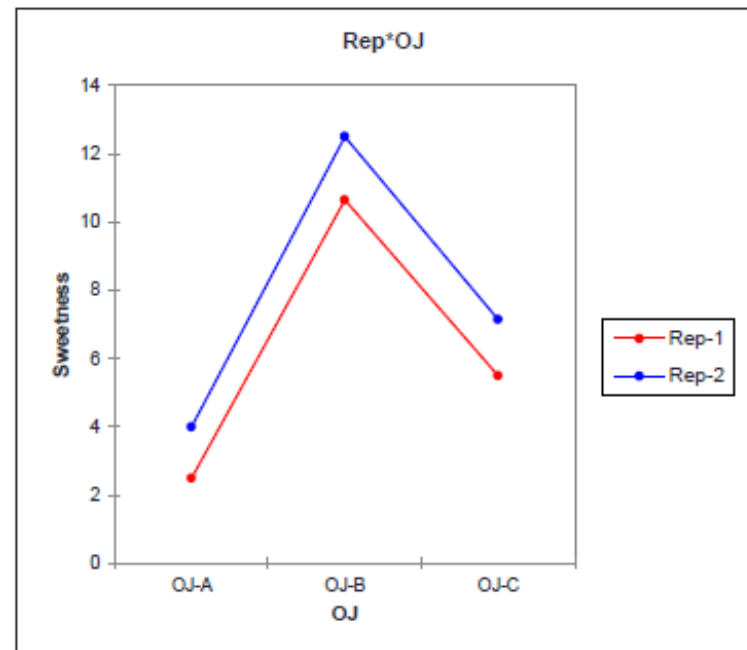
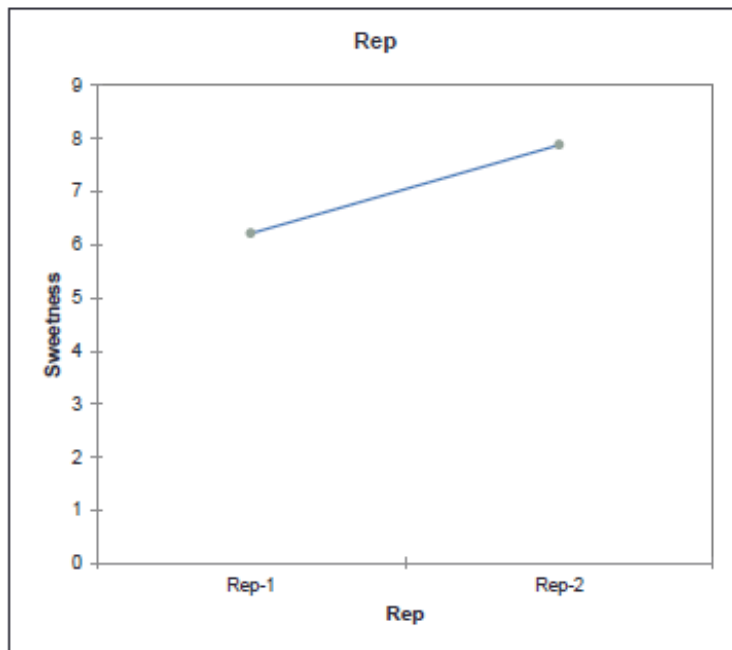


Judge Performance

Performance criteria:

2) Reproducibility

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

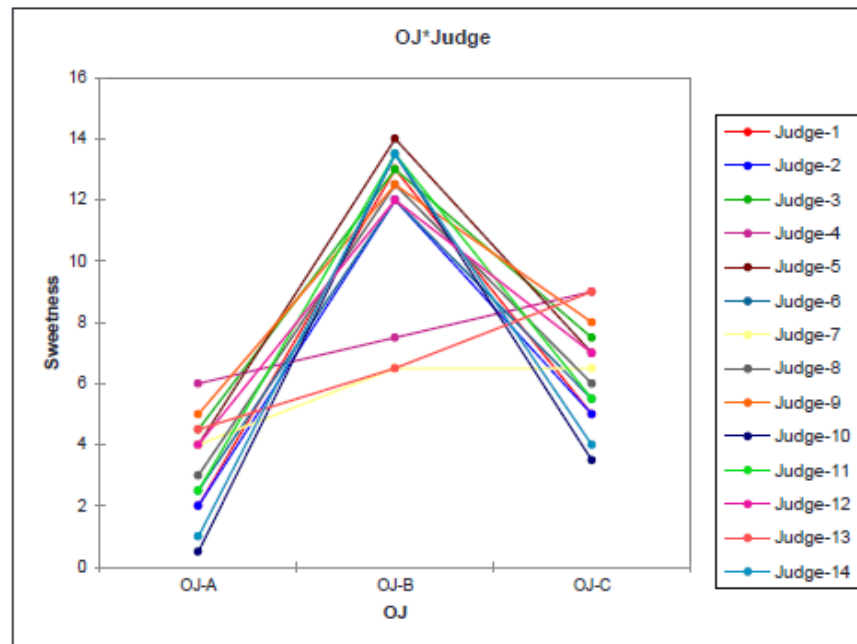


Judge Performance

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

FLAVOR PROFILE

INTENSITY

- | | |
|-----|-------------|
| 0 | not present |
|) (| threshold |
| 1 | slight |
| 2 | moderate |
| 3 | strong |



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

CO₂ 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 (fracturability, 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

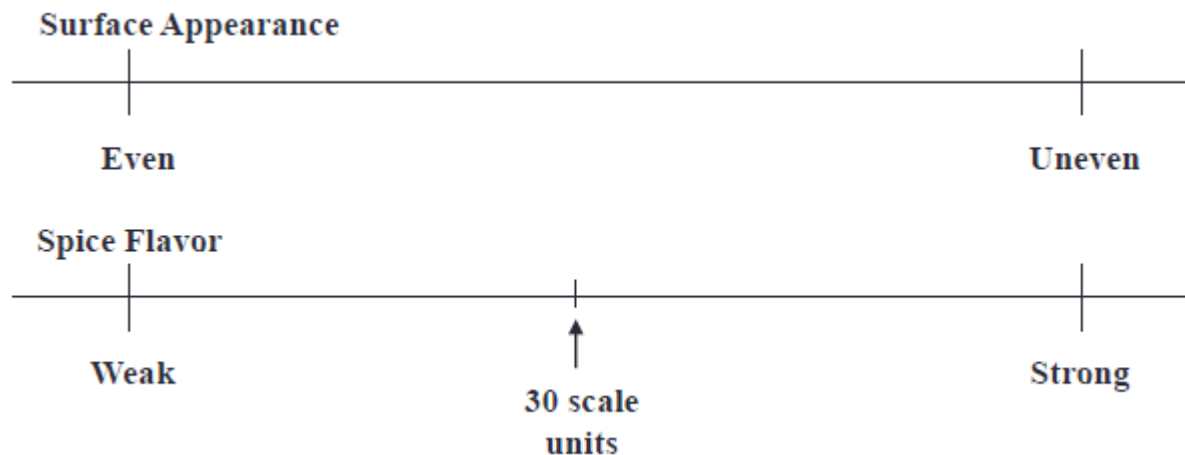


QDA

- 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

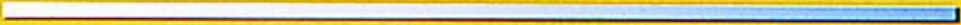
- ***Provides the tools*** – reference lists of descriptors, scaling procedures and methods of panel training – with which to design a descriptive procedure for a given product.
 - Uses a 15-cm graphic scale or a 15-point numerical scale.
 - Standards – used to anchor scale
 - Long training required

The Spectrum Method

STANDARD DENSENESS SCALE

Place sample between molars and compress.

NOTE: Compactness of cross-section.

AIRY  DENSE

0.5	Cool Whip	(General Foods)
2.5	Marshmallow Fluff	(Fluff-Durkee-Mower)
4.0	Nougat	(Three Musketeers / M&M Mars)
6.0	Malted Milk Balls	(Whoppe – Leaf Confectionery)
9.0	Frankfurter	(Oscar Mayer – cooked 5 mins)
13.0	Fruit Jellies	(Chuckles, Nabisco)

The Spectrum Method

STANDARD COHESIVENESS SCALE

Place sample between molars; compress fully.

NOTE: Extent to which sample deforms rather than crumbles, cracks or breaks

RUPTURING ————— **DEFORMING**

1.0	Corn muffin	(Pepperidge Farm)
5.0	Yellow American pasteurized cheese	(Land O'Lakes)
8.0	Pretzel	Soft Pretzel
10.0	Sun dried seedless raisins	(Sun Maid)
12.5	Candy Chews	(M&M Mars)
15.0	Chewing Gum	(Freedent)

The Spectrum Method

8. Standard Viscosity Scale

Scale value	Reference	Brand/type/manufacturer	Sample size
1.0	Water	Bottled Mountain Spring	1/2 tsp.
2.2	Light cream	Sealtest Foods	1/2 tsp.
3.0	Heavy cream	Sealtest Foods	1/2 tsp.
3.9	Evaporated milk	Carnation Co.	1/2 tsp.
6.8	Maple syrup	Vermont Maid, R. J. Reynolds	1/2 tsp.
9.2	Chocolate syrup	Hershey Chocolate	1/2 tsp.
11.7	mixture: 1/2 cup condensed milk + 1 T. heavy cream	Magnolia Sweetened Borden Foods	1/2 tsp.
14.0	Condensed milk	Borden Foods	1/2 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).

The rate of flow per unit force:

Definition: (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).



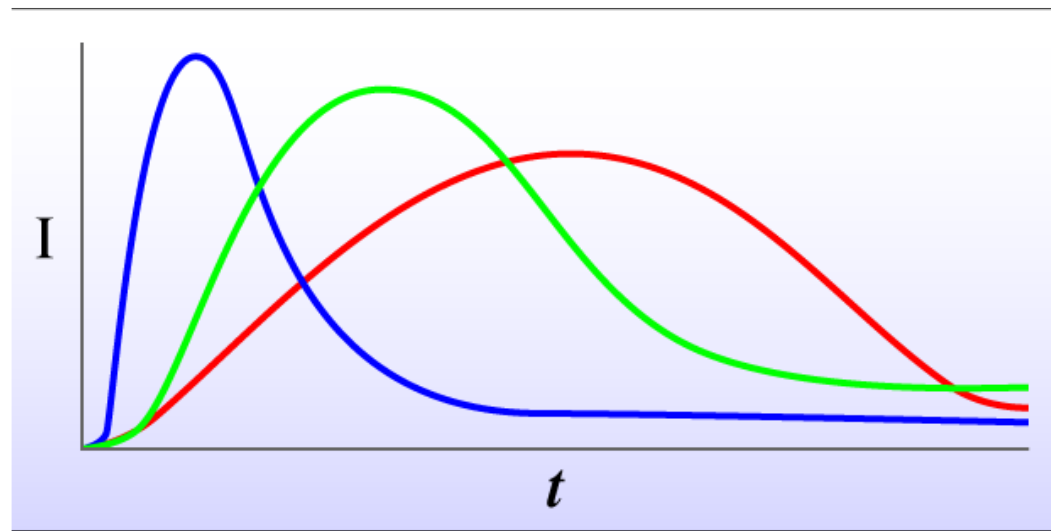
Free-Choice Profiling

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

T-I Bitterness of IAA's in H₂O (18 Ss x 3 Reps)

