

Sensory Evaluation

Food Formulation,
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Poste 2



Defining Sensory Evaluation

Sensory evaluation is a scientific discipline used to evoke, measure, analyze and interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing.

Table 2.1 Sensory evaluation activities within a company

Product development
Product reformulation/cost reduction
Monitoring competition
Quality control
Quality assurance
Product sensory specification
Raw materials specifications
Storage stability
Process/ingredient/analytical/sensory relationships
Advertising claims

what sensory evaluation is capable of doing,

1. Provide quantitative information about the sensory properties of all company and competitive products.
2. Provide useful and timely information and recommendations about product sensory properties as requested.
3. Maintain a pool of individuals qualified to participate in a wide range of tests.
4. Develop methods that are unique to specific products and methods that are for general use.
5. Develop methods and procedures for relating sensory and analytical information for use in product research, quality control, and quality assurance.
6. Maintain awareness of new developments in product evaluation and their application to the company.
7. Provide assistance to other groups in the company, on request.
8. Ensure that no product of the company fails because of a sensory deficiency.

Table 2.2 A guide for allocating space for sensory testing^a

Area (ft ²)	Number of booths	Number of staff	Annual volume of testing	Number of subjects
400	5-6	1-2	200-300	100-200
600	6	2-3	300-400	200
800	6-8	4	400-600	300-400
1000	8	5-6	700-800	400-500
1500-2000	2 × 6	8-9	≥1000	>500

^a The entries are estimates of the amount of space, booths, and staff that are capable of doing a specified number of tests. Additional information about the use of the table can be found in the text.

Table 2.4 Categories of tests and examples of methods used in sensory evaluation

Category	Test type
Discriminative	Difference: paired comparison, duo trio, triangle
Descriptive	Descriptive analysis: Flavor profile, QDA
Affective	Acceptance – preference: nine-point hedonic

Affective tests are used to assess consumer response to products. They are concerned with acceptability of a product or whether one product is preferred over another.

SENSORY EVALUATION PRODUCT ATTITUDE SURVEY

To match your product preferences, usage, and sensory skills to the samples to be evaluated, please complete this questionnaire. All information will be maintained confidential.

PLEASE PRINT

Name _____ Department _____

Telephone Ext. _____ Date _____

General Information

Female _____ Male _____

Under 34yrs. 11 mos _____ 35 to 50 _____ Over 50 _____

Married _____ Single _____

Children 0 _____ 1 _____

2 _____ 3 _____

4 or more _____

1. Please indicate which, if any, of the following foods disagree with you. (allergy, discomfort, etc.)

Cheese (specify) _____ Poultry _____

Chocolate _____ Seafood _____

Eggs _____ Soy _____

Fruits (specify) _____ Spices (specify) _____

Meats (specify) _____ Vegetables (specify) _____

Milk _____

2. Please indicate if you are on a special diet.

Diabetic _____ Low Salt _____

High Calorie _____ No Special Diet _____

Low Calorie _____ Other (specify) _____

The following is a list of products of current, or perhaps of potential interest, arranged in categories. Each product has descriptive terms from *won't eat* or *never tried* to *like extremely* or *dislike extremely*. Using these descriptions as guidelines, please **circle** the number under each phrase that most closely describes your attitude about that particular food.

Categories	Won't Eat	Never Tried	Food Item	Like Extremely	Like Very Much	Like Moderately	Like Slightly	Neither Like nor Dislike	Dislike Slightly	Dislike Moderately	Dislike Very Much	Dislike Extremely
Baked Products & Desserts	11	10	Cakes	9	8	7	6	5	4	3	2	1
	11	10	Cookies	9	8	7	6	5	4	3	2	1
	11	10	Puddings	9	8	7	6	5	4	3	2	1
Breakfast Foods	11	10	Pancakes	9	8	7	6	5	4	3	2	1
	11	10	Toaster Pop-Ups	9	8	7	6	5	4	3	2	1
	11	10	Donuts	9	8	7	6	5	4	3	2	1
Beverages	11	10	Carbonated Soft Drinks	9	8	7	6	5	4	3	2	1
	11	10	Coffee	9	8	7	6	5	4	3	2	1
	11	10	Tea	9	8	7	6	5	4	3	2	1
Juices	11	10	Citrus	9	8	7	6	5	4	3	2	1
	11	10	Non-Citrus	9	8	7	6	5	4	3	2	1
Canned Foods	11	10	Chili	9	8	7	6	5	4	3	2	1
	11	10	Fruit	9	8	7	6	5	4	3	2	1
	11	10	Spaghetti	9	8	7	6	5	4	3	2	1

Response scale should be:

Meaningful to subjects: The words used for questions and/or to scale the responses must be familiar, easily understood, and unambiguous to the subjects. Words must be readily related to the product and the task,

Uncomplicated to use: task and scale must be easy to use.

Relevant: relates to scale validity, the scale should measure that attribute, characteristic, attitude, etc., that it is intended to measure. For example, preference scales should measure preference, and quality scales should measure quality; and it is unwise to infer one from the other.

Sensitive to differences.

Provides for a variety of statistical analyses

Four categories of scales:

1. Nominal scales for use in classification or naming.
2. Ordinal scales for use in ordering or ranking.
3. Interval scales for use in measuring magnitudes, assuming equal distances between points on the scale.
4. Ratio scales for use in measuring magnitudes, assuming equality of ratios between points.

Name _____ Code _____ Date _____

In which location(s) in your home do you most often use air fresheners? Please check as many as necessary.

- Bathroom
- Kitchen
- Bedroom
- Closet
- Hall

- Garage
- Family room
- Dining room
- Living room

Figure 3.1 Example of a scorecard that uses a nominal scale to obtain information about product usage characteristics.

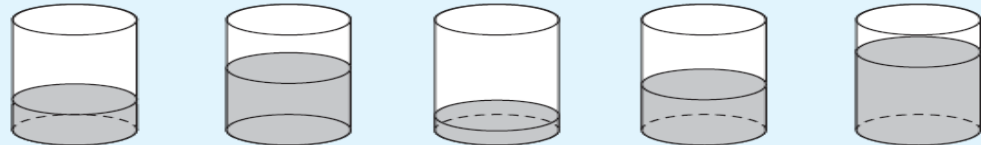
Ordinal Scales

Ordinal scales use either numbers or words organized from “high” to “low,” “most” to “least,” etc.,

Ranking is one of the most commonly used types of ordinal scale.

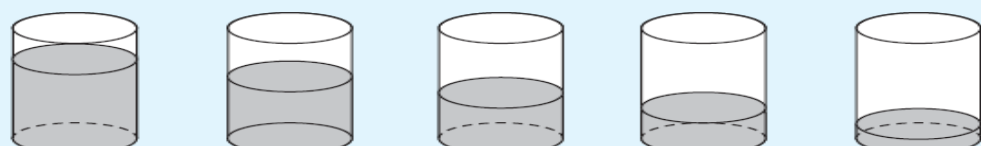
Name _____ Code _____ Date _____

Arrange the coded products from most full to least full



Code: 652 013 921 458 304

A. Rearranging products



Code: 304 013 458 652 921

B. Listing codes

<u>304</u>	Most full
<u>013</u>	
<u>458</u>	
<u>652</u>	
<u>921</u>	Least full

Figure 3.2 Examples of a direct ranking test in which the respondents can (A) rearrange the products or (B) list the codes. In the former procedure, the products are moved; in the latter, the subject records the order and no product movement is required.

Name _____ Code _____ Date _____

Check one of the boxes that represents your opinion about the taste intensity of the product you are evaluating.

Intensity of taste		Product	
		487	924
		Taste	Taste
None	10		
	9		
Slight	8		
	7		
Moderate	6		
	5		
Strong	4		
	3		
Extreme	2		
	1		

A

Name _____ Code _____ Date _____

Check the box that represents the relative intensity for that characteristic you are evaluating.

Characteristic A

Light Dark

Characteristic B

Weak Strong

B

Figure 3.3 Two examples of ordinal-type rating scales that have been used in sensory evaluation. The first (A) represents a structured scale that contains both numerical and word categories, some of which have been weighted. The second (B) is a less complicated scale with no numerical values and only two word anchors.

Interval Scales

An interval scale is one in which the interval or distance between points on the scale is assumed to be equal and the scale has an arbitrary zero point. Interval scales may be constructed from paired-comparison, rank, or rating scale procedures, or by the method of bisection, equal sense distances, and equal-appearing categories.

The two interval scales with which most sensory professionals should be familiar are the nine-point hedonic scale and the graphic rating scale.

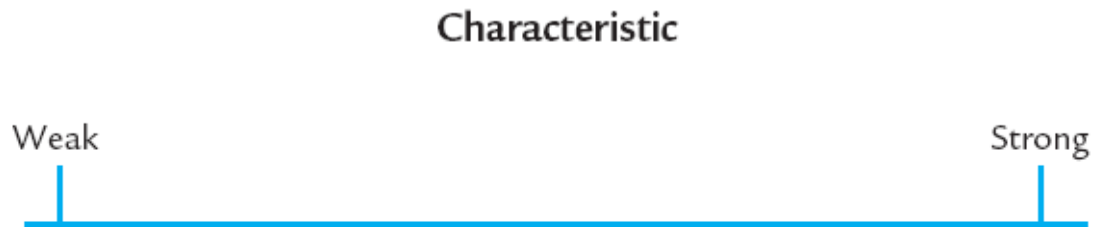


Figure 3.4 An example of a line scale – graphic rating scale. The subject places a vertical line across the horizontal line at that place that best reflects the intensity of that characteristic. Typically the two anchors reflect a continuum from weak to strong intensity.

Ratio Scales

Ratio-scale data exhibit the same properties as interval-scale data, and in addition, there is a constant ratio between points and an absolute zero.

Selected Measurement Techniques

A. Hedonic Scale

Of all scales and tests methods, the nine-point hedonic scale occupies a unique niche in terms of its general applicability to the measurement of product acceptance– preference.

Please circle the term that best reflects your attitude about the product whose code matches the code on this scorecard.

Like extremely

Like very much

Like moderately

Like slightly

Neither like or dislike

Dislike slightly

Dislike moderately

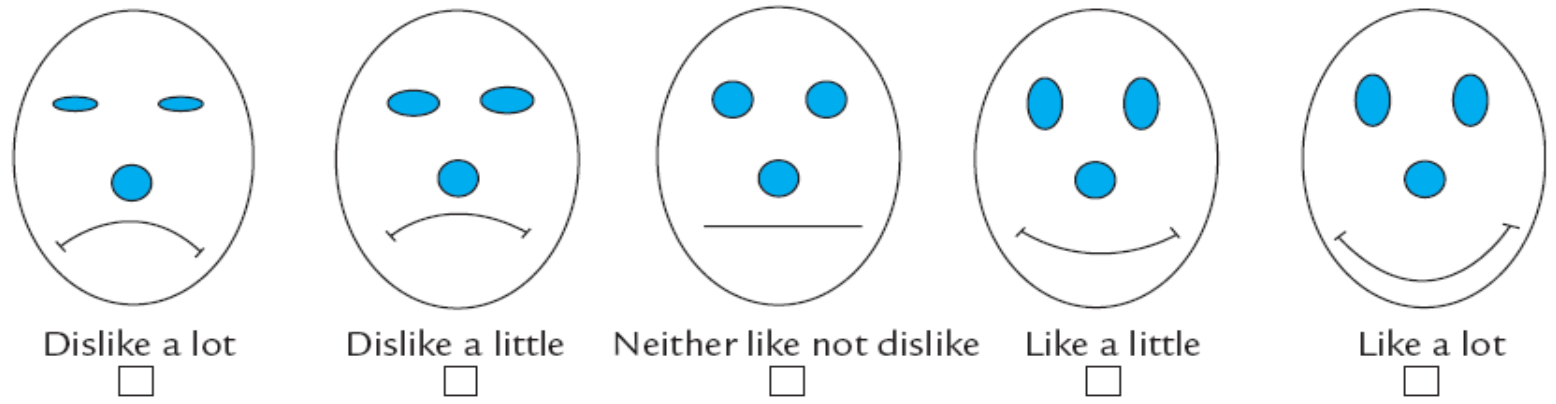
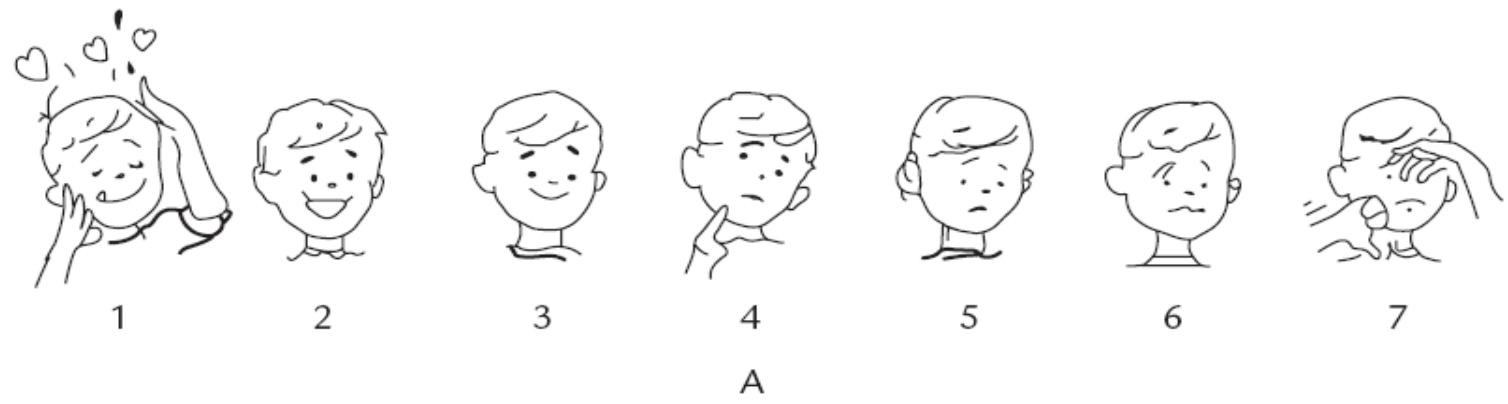
Dislike very much

Dislike extremely

Figure 3.5 An example of the nine-point hedonic scale. The subject's task is to circle the term that best represents their attitude about the product. Boxes adjacent to the terms could also be used. The responses are converted to numerical values for computational purposes: like extremely, 9; dislike extremely, 1.

B. Face Scales

These scales were primarily intended for use with children and those with limited reading and/or comprehension skills. They can be described as a series of line drawings of facial expressions ordered in a sequence from a smile to a frown,



Please check the box under the figure which best describes how you feel about this product.

B

Figure 3.7 Two examples of face scales that can be found in the literature and appear to have been used for measuring children's responses to products.

C. Just-About-Right Scale

The just-about-right (or jar) scale is one of the most frequently encountered in larger scale consumer testing.

Make a mark in the box that represents your reaction to the product.

Aroma

- Too strong
- Just about right
- Too weak

Sweetness

- Much too strong
- Strong
- Just about right
- Weak
- Much too weak

Figure 3.8 Two examples of just-about-right scales. Both types of scales would not be placed on the same scorecard. They are presented here for illustrative purposes.

Discrimination Testing

paired-comparison and triangle tests; well known
dual-standard not well known

Here are two products; which one has the stronger flavor?" or "Here are three products, which one is different from the other two?"

Methods:

Paired comparison,
duo-trio,
triangle

Paired-comparison test

Name _____ Code _____ Date _____

In front of you are two samples; starting with the sample on the left, evaluate each and circle the sample which is most sweet. You must make a choice, even if it is only a guess. You may retaste as often as you wish. Thank you.

Duo-trio test

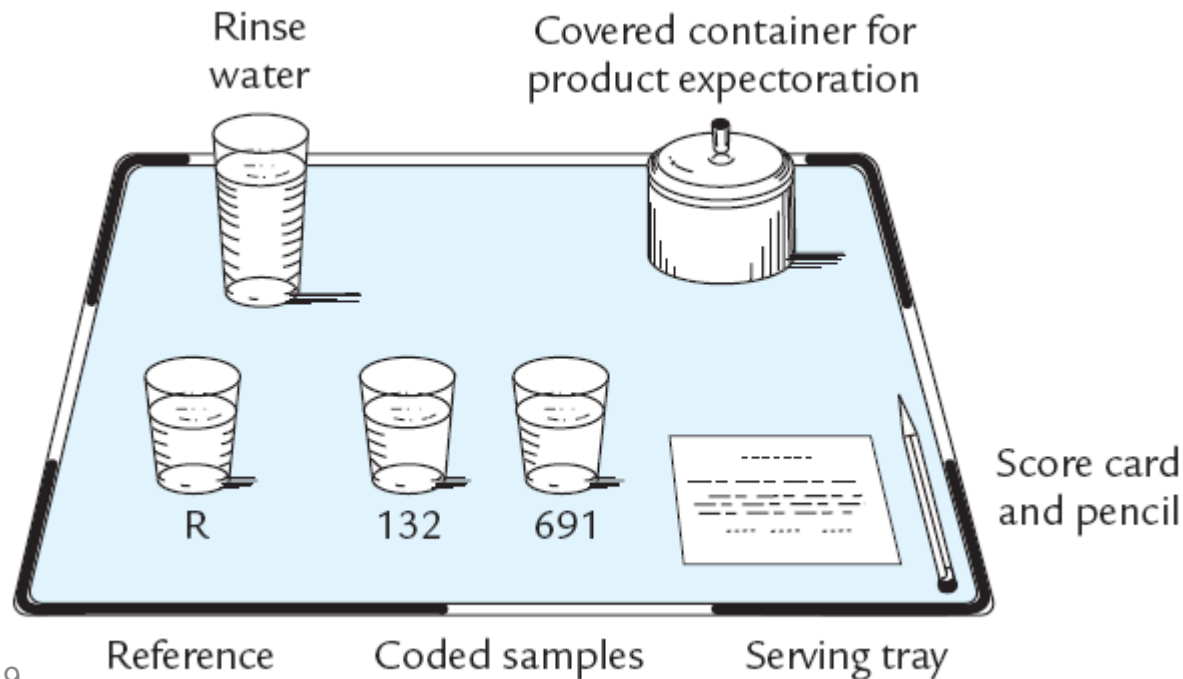
Name _____ Code _____ Date _____

In front of you are three samples, one marked **R** and the other two, coded; evaluate the samples starting from left to right, first **R** and then the other two. Circle the code of the sample different from **R**. You may retaste the samples. You must make a choice. Thank you.

R

132

691



C. Triangle Test

The triangle test is the most well-known of the three methods. It has been used to a much greater extent because it was mistakenly believed to be more sensitive than other methods (i.e. based on the probability of).

Triangle test

Name _____ Code _____ Date _____

In front of you are three coded samples, two are the same and one is different; starting from the left evaluate the samples and circle the code that is different from the other two. You may reevaluate the samples. You must make a choice. Thank you.

624

801

199

Components of discrimination Test

- A. Organization and Test Management
- B. Test Requests
- C. Test Objectives
- D. Test Procedures
- E. Data Analysis and Interpretation
- F. The Just-Noticeable Difference

Table 5.2 Example of a discrimination test request form^a

To be completed by the requestor

Experimenter:

Test objective:

Product:

Sample location, description, and history (storage, etc.):

If storage, withdrawal date:

Sample amounts and availability:

People to be excluded from testing:

Report distribution:

Date:

Priority:

Project number:

To be completed by sensory evaluation

Receipt date:

Type of test method:

Suggested test date:

Design:

Number and type of subject:

Methods of sample presentation:

Number of replications:

Experimenter comments:

Serving conditions:

Sample quantity:

Sample temperature:

Carrier:

Serving container:

Lighting conditions:

Other:

Experimental design for discrimination tests

Table 5.4 A serving order for the directional paired-comparison test^a

Subject	Serving order	
	First set	Second set
1	AB	BA
2	BA	BA
3	BA	AB
4	AB	AB
5	BA	AB
6	AB	BA
7	AB	AB
8	BA	BA
9	BA	AB
10	BA	BA
11	AB	AB
12	AB	BA
13	AB	BA
14	BA	AB
15	AB	AB
16	BA	BA
17	AB	AB
18	BA	BA
19	BA	AB
20	AB	BA

^a One replication per subject.

Table 5.6 A serving order for the duo-trio test, balanced reference^a

Subject	Serving order	
	First set	Second set
1	R _A AB	R _B BA
2	R _B BA	R _A BA
3	R _A BA	R _A BA
4	R _B BA	R _A AB
5	R _B BA	R _B AB
6	R _B AB	R _B BA
7	R _A AB	R _A BA
8	R _A AB	R _B AB
9	R _A AB	R _A AB
10	R _A BA	R _B BA
11	R _B AB	R _A BA
12	R _B AB	R _B AB
13	R _A BA	R _A AB
14	R _B BA	R _B BA
15	R _B AB	R _A AB
16	R _A BA	R _B AB

^a One replication per subject.

Table 5.8 A serving order for the triangle test, balanced order^a

Subject	Serving order	
	First set	Second set
1	ABB	ABA
2	BAB	AAB
3	BBA	BAA
4	AAB	BAB
5	BBA	ABA
6	ABB	AAB
7	BAA	BAB
8	ABA	BBA
9	AAB	ABB
10	BAA	BBA
11	ABA	ABB
12	BAB	BAA
13	AAB	BBA
14	BBA	AAB
15	BAA	ABB
16	ABB	BAA
17	ABA	BAB
18	BAB	ABA

^a One replication per subject.

Table 5.9 Minimum numbers of correct judgments to establish significance at various probability levels for paired-difference and duo-trio tests (one-tailed, $p = \frac{1}{2}$)^a

Number of trials (n)	Probability levels						
	0.05	0.04	0.03	0.02	0.01	0.005	0.001
7	7	7	7	7	7		
8	7	7	8	8	8	8	
9	8	8	8	8	9	9	
10	9	9	9	9	10	10	10
11	9	9	10	10	10	11	11
12	10	10	10	10	11	11	12
13	10	11	11	11	12	12	13
14	11	11	11	12	12	13	13
15	12	12	12	12	13	13	14
16	12	12	13	13	14	14	15
17	13	13	13	14	14	15	16
18	13	14	14	14	15	15	16
19	14	14	15	15	15	16	17
20	15	15	15	16	16	17	18
21	15	15	16	16	17	17	18
22	16	16	16	17	17	18	19
23	16	17	17	17	18	19	20
24	17	17	18	18	19	19	20
25	18	18	18	19	19	20	21
26	18	18	19	19	20	20	22
27	19	19	19	20	20	21	22
28	19	20	20	20	21	22	23
29	20	20	21	21	22	22	24
30	20	21	21	22	22	23	24
31	21	21	22	22	23	24	25
32	22	22	22	23	24	24	26
33	22	23	23	23	24	25	26
34	23	23	23	24	25	25	27
35	23	24	24	25	25	26	27
36	24	24	25	25	26	27	28
37	24	25	25	26	26	27	29
38	25	25	26	26	27	28	29
39	26	26	26	27	28	28	30
40	26	27	27	27	28	29	30
41	27	27	27	28	29	30	31
42	27	28	28	29	29	30	32
43	28	28	29	29	30	31	32
44	28	29	29	30	31	31	33
45	29	29	30	30	31	32	34
46	30	30	30	31	32	33	34
47	30	30	31	31	32	33	35
48	31	31	31	32	33	34	36
49	31	32	32	33	34	34	36
50	32	32	33	33	34	35	37
60	37	38	38	39	40	41	43
70	43	43	44	45	46	47	49
80	48	49	49	50	51	52	55
90	54	54	55	56	57	58	61
100	59	60	60	61	63	64	66

^a Values (X) not appearing in table may be derived from $X = (z\sqrt{n} + n + 1) / 2$. See text. Reprinted from *J. Food Sci.* **43**, pp. 940–947, 1978. Copyright © by Institute of Food Technologists.

Table 5.10 Minimum numbers of correct judgments to establish significance at various probability levels for the triangle test (one-tailed, $p = \frac{1}{3}$)^a

Number of trials (n)	Probability levels						
	0.05	0.04	0.03	0.02	0.01	0.005	0.001
5	4	5	5	5	5	5	
6	5	5	5	5	6	6	
7	5	6	6	6	6	7	7
8	6	6	6	6	7	7	8
9	6	7	7	7	7	8	8
10	7	7	7	7	8	8	9
11	7	7	8	8	8	9	10
12	8	8	8	8	9	9	10
13	8	8	9	9	9	10	11
14	9	9	9	9	10	10	11
15	9	9	10	10	10	11	12
16	9	10	10	10	11	11	12
17	10	10	10	11	11	12	13
18	10	11	11	11	12	12	13
19	11	11	11	12	12	13	14
20	11	11	12	12	13	13	14
21	12	12	12	13	13	14	15
22	12	12	13	13	14	14	15
23	12	13	13	13	14	15	16
24	13	13	13	14	15	15	16
25	13	14	14	14	15	16	17
26	14	14	14	15	15	16	17
27	14	14	15	15	16	17	18
28	15	15	15	16	16	17	18
29	15	15	16	16	17	17	19
30	15	16	16	16	17	18	19
31	16	16	16	17	18	18	20
32	16	16	17	17	18	19	20
33	17	17	17	18	18	19	21
34	17	17	18	18	19	20	21
35	17	18	18	19	19	20	22
36	18	18	18	19	20	20	22
37	18	18	19	19	20	21	22
38	19	19	19	20	21	21	23
39	19	19	20	20	21	22	23
40	19	20	20	21	21	22	24
41	20	20	20	21	22	23	24
42	20	20	21	21	22	23	25
43	20	21	21	22	23	24	25
44	21	21	22	22	23	24	26
45	21	22	22	23	24	24	26
46	22	22	22	23	24	25	27
47	22	22	23	23	24	25	27
48	22	23	23	24	25	26	27
49	23	23	24	24	25	26	28
50	23	24	24	25	26	26	28
60	27	27	28	29	30	31	33
70	31	31	32	33	34	35	37
80	35	35	36	36	38	39	41
90	38	39	40	40	42	43	45
100	42	43	43	44	45	47	49

^aValues (X) not appearing in table may be derived from $X = 0.4714z \sqrt{n} + [(2n + 3)/6]$. See text.
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Descriptive Analysis

Descriptive analysis is a sensory methodology that provides quantitative descriptions of products, based on the perceptions from a group of qualified subjects. It is a total sensory description, taking into account all sensations that are perceived – visual, auditory, olfactory, kinesthetic, etc. – when the product is evaluated. The word “product” is used here in the figurative sense; the products may be an idea or concept, an ingredient, or a finished product as purchased and used by the consumer. The evaluation also can be total, for example, as in the evaluation of a shaving cream before, during, and after use. Alternatively, the evaluation can focus on only one aspect, such as use. The evaluation is defined in part by the product characteristics as determined by the subjects, and in part by the nature of the problem.

Table 6.1 Classification of descriptive analysis methods	
Qualitative	Quantitative
Flavor Profile ^a Product experts (perfumer, flavorist, brewmaster, etc.)	Texture Profile ^b QDA ^c Spectrum analysis ^d Free-Choice profiling ^e Diagnostic descriptive analysis ^f
^a Cairncross and Sjöstrom (1950), Caul (1957). ^b Brandt <i>et al.</i> (1963), Szczesniak <i>et al.</i> (1963). ^c Stone <i>et al.</i> (1974, 1980). ^d Meilgaard <i>et al.</i> (1991). ^e Williams and Langron (1984). ^f Cross <i>et al.</i> (1978), Larson-Powers and Pangborn (1978), Lyons (1987).	

MEMO TO: Project Manager - Canned Soups

FROM: Flavor Profile Panel Leader

SUBJECT: Flavor Profile Report of Tomato Soups

INTRODUCTION:

Samples of canned condensed Alpha Tomato Soup and Beta Tomato Soup were profiled during five panel sessions. The objective was to characterize the two market leaders in order to provide sensory data for management to select a flavor target for a new store brand soup line. For the study, a sufficient number of identically coded samples of each brand were purchased locally. Expiration dates for the two brands were similar. Samples were evaluated for aroma, flavor and aftertaste. Differences in appearance and texture were also noted. Tabular profiles are attached.

SUMMARY OF CONCLUSIONS:

- In aroma and flavor both tomato soup brands exhibited early tomato identity with the Alpha brand having a more intense fresh tomato identity and the Beta brand described as burnt or scorched tomato.
- The development of the tomato identity in Alpha's product was supported by other vegetable and spice notes to produce a moderately full and blended soup. Beta brand was more disjointed in the flavor with the tomato aromatic suppressed by the starchy character of the soup.
- In Alpha brand the salivating mouthfeel with a slight MSG character contributed to a quick washout of flavor and a shorter aftertaste. In Beta the pepper burn lingered into the aftertaste along with a drying mouthfeel.
- Both soups had very slight off-characteristics; metallic in Alpha soup and bitter and musty in the Beta product.
- The appearance and texture of the two soups were different. Alpha soup was dark red in color with dispersed oil and slightly pulpy. The Beta brand was thick and particulate with a burnt red-orange color. The Beta brand was also difficult to heat as it had a tendency to burn.

**FLAVOR PROFILES OF CONDENSED TOMATO SOUPS
RECONSTITUTED WITH SPRING WATER**

ALPHA
CODE: 23567APR92

BETA
CODE: 54K8JUN92

AROMA (160°F - 150°F)

Amplitude 2

Tomato, cooked fresh 2
Cooked vegetables 1 1/2
Sour, citrus-like 1
Briny 1
Spice Complex, 1
Black pepper

Other: Starchy, Non-fat
dry milk

Amplitude 1 1/2

Tomato puree, scorched 1 1/2
Starchy, cooked pasta 1 1/2
Briny 1
Sour, fatty acid, cheesy 1/2
Cooked vegetables 1/2

Other: Spice complex, musty

FLAVOR (150°F - 140°F)

Amplitude 2

Tomato, cooked fresh, 2
slight green
Sweet 1/2
Cooked vegetables 1 1/2
Sour 1 1/2
Salty 1 1/2
Spice Complex, 1
Black pepper
Salivating 1
Metallic 1/2
Pepper bite 1/2
MSG 1

Other: Starchy, oily
plus mouthfeel

Amplitude 1

Starchy, cooked pasta 2
Tomato, stewed, 1
burnt paste
Starchy mouthfeel 1
Sweet 1/2
Salty 1 1/2
Cheesy, fatty acid sour 1/2
Sour 1 1/2
Bitter 1/2
Pepper bite and burn 1 1/2
Musty 1/2

Other: Spice complex, oily
plus mouthfeel

AFTERTASTE

Tomato, sour

Sour, pepper burn, drying,
starchy, tomato

COLOR

Dark red, oily sheen
some pulp and skin pieces

Burnt red-orange

TEXTURE

Thin, smooth,
slight pulpy

Thick, particulate,
slight tacky

Table 6.2 Relationship between textual parameters and popular nomenclature^a

<i>Mechanical characteristics</i>		
<i>Primary parameters</i>	<i>Secondary parameters</i>	<i>Popular terms</i>
Hardness		Soft, firm, hard
Cohesiveness	Brittleness	Crumbly, Crunchy, brittle
	Chewiness	Tender, chewy, tough
	Gumminess	Short, mealy, pasty, gummy
Viscosity		Thin, viscous
Elasticity		Plastic, elastic
Adhesiveness		Sticky, tacky, gooey
<i>Geometrical characteristics</i>		
<i>Class</i>	<i>Examples</i>	
Particle size and shape	Gritty, grainy, coarse, etc.	
Particle shape and orientation	Fibrous, cellular, crystalline, etc.	
<i>Other characteristics</i>		
<i>Primary parameters</i>	<i>Secondary parameters</i>	<i>Popular terms</i>
Moisture content		Dry, moist, wet, watery
Fat content	Oiliness	Oily
	Greasiness	Greasy

^a Reprinted from *J. Food Sci.*, 28(4), (1963), 388. Copyright © by Institute of Food Technologists. See text for further explanation.

TABLE 5—*Standard hardness scale.*^a

Scale Value	Product	Type/Brand	Manufacturer/ Distributor	Sample Size	Temperature
1.0	cream cheese	Philadelphia	Kraft	½-in. cube	40 to 45°F
2.5	egg white	hard-cooked, 5 min	. . .	¼-in. cube	room
4.5	American cheese	yellow, pasteurized	Land O' Lakes	½-in. cube	40 to 45°F
6.0	olive	stuffed, spanish type, pimento removed	Goya Foods	1 piece	room
7.0	frankfurter	beef franks, cooked 5 min in boiling water	Hebrew National Kosher Foods	½-in. slice	room
9.5	peanut	Planter, cocktail type in vacuum tin	Nabisco Brands	1 piece	room
. . .	carrot [7]	uncooked, fresh, unpeeled	. . .	½-in. slice	room
11.0	almond	Planter, shelled	Nabisco Brands	1 piece	room
14.5	hard candy	Life Savers	Nabisco Brands	1 piece	room

^a Printed with permission. See Ref 7.

NOTE: 1 in. = 25.4 mm. 1°F = -17.2°C.

TABLE 6—*Definitions and evaluation procedures for the evaluation of the texture characteristics of caramels.*

I. First Chew

Place sample between molar teeth, bite and evaluate for:

1. **Hardness:** Force required to bite through sample.
2. **Adhesiveness:** Degree sample sticks to teeth.
3. **Cohesiveness:** Degree to which sample deforms rather than ruptures.
4. **Smoothness:** Degree to which sample is free of grits and/or grains.

II. Chewdown

Place sample between molar teeth, chew and evaluate for:

1. **Chewiness:** Number of chews necessary to prepare sample for swallowing.
2. **Gumminess:** Amount of energy required to disintegrate sample to a state ready for swallowing.
3. **Adhesiveness:** Degree to which sample sticks to (a or b) during chewing.
 - a. Roof of Mouth (10–15 chews)
 - b. Teeth
4. **Cohesiveness of mass:** Degree to which sample holds together.
5. **Denseness:** Compactness of sample.
6. **Moisture Absorption:** Degree to which sample absorbs saliva.
 - a. Rate
 - b. Amount
7. **Crystalline:** Degree to which sample is granular.

III. Breakdown

Description of breakdown: Describe changes occurring during breakdown.

IV. Residual

After swallowing sample evaluate for:

1. **Ease:** Degree to which prepared sample is readily swallowed.
 2. **Chalkiness:** Degree to which mouth feels dry or chalky after all of sample has been swallowed.
 3. **Grittiness:** Degree to which mouth contains small particles after all of sample has been swallowed.
 4. **Toothpacking:** Degree to which sample remains in teeth.
-

The development of the method evolved from a number of considerations (QDA), including:

- responsive to all the sensory properties of a product;
- reliance on a limited number of subjects for each test;
- subjects qualified before participation;
- able to evaluate multiple products in individual booths;
- use a language development process free from leader influence;
- be quantitative and use a repeated trials design;
- have a useful data analysis system.

NAME: _____ DATE: _____ CODE: _____

R

P

S

APPEARANCE

PURPLE COLOR

light

dark

AROMA

BERRY SMELL

weak

strong

FRUITY SMELL

weak

strong

FLAVOR

BERRY

weak

strong

FRUITY

weak

strong

TART

weak

strong

ACIDIC

weak

strong

SWEET

weak

strong

FIG. 1—Scorecard and line scale for fruit-based juice product.

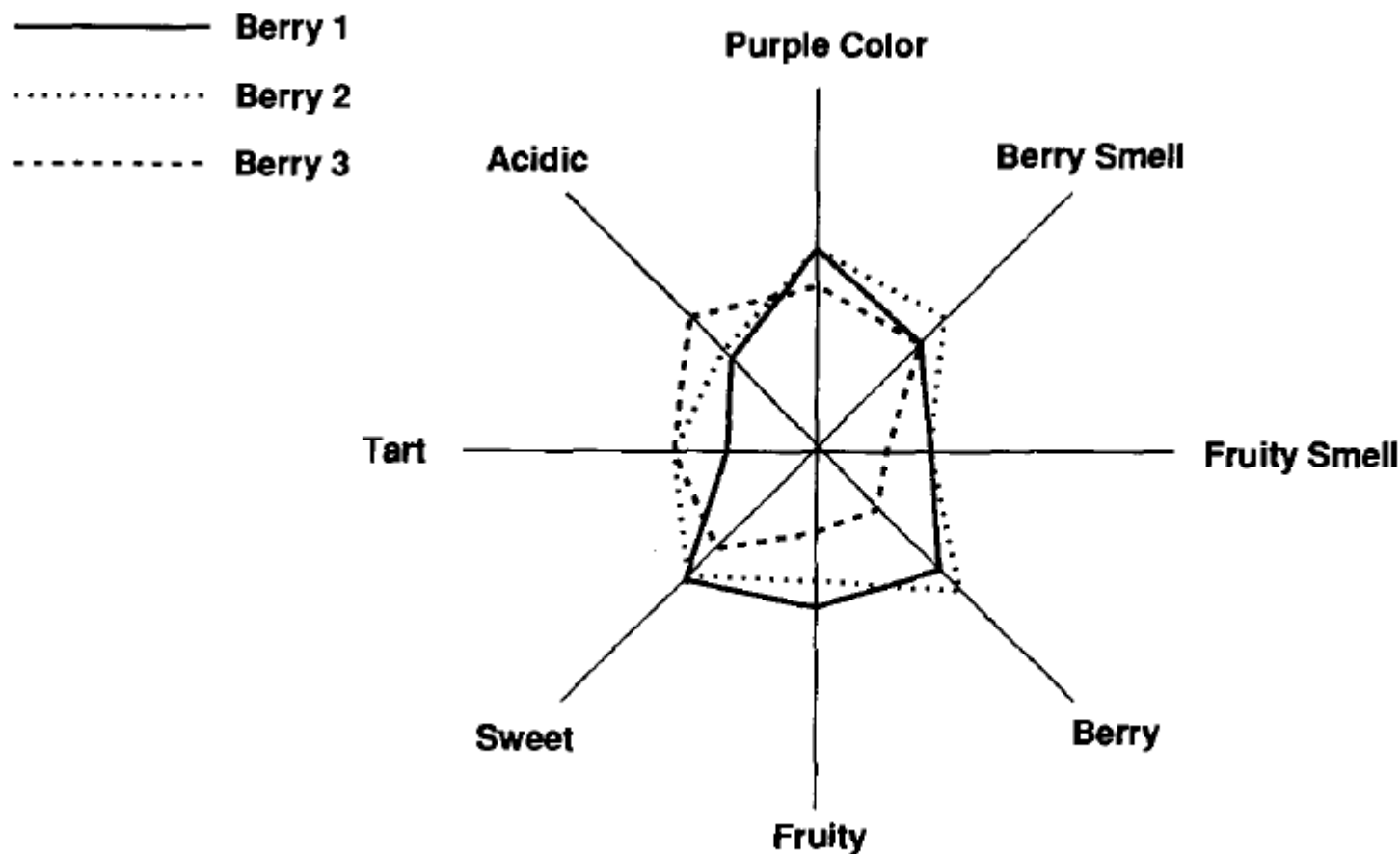


FIG. 2—Aroma and flavor characteristics for fruit-based products. Graphical representation of the results shown in Table 1. Measuring from the center point along the line is the mean intensity value for that attribute.

Applications for Descriptive Analysis

- 1. Monitor competition.** *It is especially important to know in what ways competitive products differ; such information can be used to anticipate changes and to identify product weaknesses. Without such information, it is relatively easy to initiate product reformulation efforts based on circumstantial evidence that a change in market share reflects a changed competitive product. The descriptive information provides a primary basis and more precise direction for any proposed changes.*
- 2. Storage testing.** *In a storage test in which product changes occur over time, descriptive analysis at the start of the test provides a basis on which changes can be compared. A major problem in all storage tests is the availability of control product throughout the study. A product placed in some type of controlled environment, for example, a freezer, does not prevent change, and providing fresh product for comparison with the stored product introduces other sources of variability.*

3. **Product development.** *Descriptive analysis is used to delineate a target product, determine whether experimental formulations match that target, and provide precise sensory information about the finished product. This latter function could be used to support advertising as well as be of value in setting quality control specifications. It also can be used in evaluating the usefulness of a new ingredient.*

4. **Quality control.** *Descriptive analysis could be used to identify the sensory limits for a product.*

5. **Physical/chemical-sensory relationships.** *Descriptive analysis is especially helpful in identifying specific product differences that can be related to differences in various instrument and chemical measures. Once identified, these differences can be explored in more detail, again using the descriptive model.*

TABLE 1—*Differences among four descriptive analysis methods.*

Method	Panel Leader	Number of Panelists	Facilities	Screening	Time Required Training/Test
Flavor profile	Selected from the trained panel. Results are included in final consensus flavor profile if leader also acts as panelist.	min of 4	Quite, well-lit, odor-free panel room; round table suggested to facilitate discussion.	Basic taste, odors, ranking, and integrative discrimination skills plus a personal interview to determine interest and availability.	For training, ~6 months with daily practice. For product, 1 to 3 sessions. For testing, ~15 min/sample
QDA ^a	Sensory professional functions as panel administrator and discussion coordinator, but is not a subject.	10–12; however, some tests may use as few as 8 or as many as 15	Language development/training done in conference-style room with appropriate lighting and environmental controls. Data collection in sensory test booths.	Product/product category users/likers; discrimination testing with products, progressively more difficult (20 to 30 trials maximum).	Total: 2 weeks, 8 to 10 h, 3 to 5 min/product
Spectrum method	Sensory professional trained in descriptive analysis and as a panelist. Or, a skilled panelist trained as a panel leader.	12 to 15	Booths for evaluation. Room with round table for discussion. Quiet, controlled atmosphere and appropriate lighting.	Prescreening, acuity screening, and interview to screen for availability, interest, good health, acuity in sensory dimension, scaling, and positive attitude.	One modality (for example, flavor) 3 to 4 months total (60 to 80 h). Testing 5 to 15 min/product.
Texture profile	Sensory professional trained as a texture profilist with necessary skills to schedule and conduct panels.	6 to 10	Quiet room with appropriate lighting. Round table for discussion and evaluation.	Tests to discriminate textural attributes and an interview.	4 to 6 months (90 to 100 h). Testing 5 to 15 min/product.

^a QDA is quantitative descriptive analysis.

Name _____ Code _____ Date _____

Option A

Evaluate both products starting from the left. Check the box for the product you prefer. You must make a choice.

347 602

Option B

Evaluate both products starting from the left. Check the box for the product you prefer. You must make a choice.

347 602 No preference

Option C

Evaluate both products starting from the left. Check the box for the product you prefer. You must make a choice.

347
602
Like both equally
Dislike both equally

Example of the scorecard for the paired-preference test, showing Option A, which limits the subjects to two choices; Option B, which includes a no-preference choice for the subject; and Option C, which includes two additional choices.

Table 5.11 Minimum numbers of agreeing judgments necessary to establish significance at various probability levels for the paired-preference test (two-tailed, $p = \frac{1}{2}$)^a

Number of trials (<i>n</i>)	Probability levels						
	0.05	0.04	0.03	0.02	0.01	0.005	0.001
7	7	7	7	7			
8	8	8	8	8	8		
9	8	8	9	9	9	9	
10	9	9	9	10	10	10	
11	10	10	10	10	11	11	11
12	10	10	11	11	11	12	12
13	11	11	11	12	12	12	13
14	12	12	12	12	13	13	14
15	12	12	13	13	13	14	14
16	13	13	13	14	14	14	15
17	13	14	14	14	15	15	16
18	14	14	15	15	15	16	17
19	15	15	15	15	16	16	17
20	15	16	16	16	17	17	18
21	16	16	16	17	17	18	19
22	17	17	17	17	18	18	19
23	17	17	18	18	19	19	20
24	18	18	18	19	19	20	21
25	18	19	19	19	20	20	21
26	19	19	19	20	20	21	22
27	20	20	20	20	21	22	23
28	20	20	21	21	22	22	23
29	21	21	21	22	22	23	24
30	21	22	22	22	23	24	25
31	22	22	22	23	24	24	25
32	23	23	23	23	24	25	26
33	23	23	24	24	25	25	27
34	24	24	24	25	25	26	27
35	24	25	25	25	26	27	28
36	25	25	25	26	27	27	29
37	25	26	26	26	27	28	29
38	26	26	27	27	28	29	30
39	27	27	27	28	28	29	31
40	27	27	28	28	29	30	31
41	28	28	28	29	30	30	32
42	28	29	29	29	30	31	32
43	29	29	30	30	31	32	33
44	29	30	30	30	31	32	34
45	30	30	31	31	32	33	34
46	31	31	31	32	33	33	35
47	31	31	32	32	33	34	36
48	32	32	32	33	34	35	36
49	32	33	33	34	34	35	37
50	33	33	34	34	35	36	37
60	39	39	39	40	41	42	44
70	44	45	45	46	47	48	50
80	50	50	51	51	52	53	56
90	55	56	56	57	58	59	61
100	61	61	62	63	64	65	67

^a Values (*X*) not appearing in table may be derived from $X = (z\sqrt{n} + n + 1)/2$. See text. Reprinted from *J. Food Sci.* **43**, pp. 940-947, 1978. Copyright © by Institute of Food Technologists.