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Cracking the Code: Linking Winemakers to Consumers

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What is Sensory & Consumer Science?

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”.

The combined understanding of human behavior, the physiology of the senses, as well as knowledge of experimental design and statistics are essential to obtaining actionable results and developing key recommendations.

Any developments/advances must follow the science

It seems so simple!

Product sensory information is unique; deceptively easy to obtain but can lack validity when the science is misunderstood or not followed.

A consumer agrees to taste a product and answer some questions about the experience.

A consumer participates in a discrimination test.

Consumers will agree to participate especially if you offer them a “financial” reward.



Why do so many products fail?

The sensory professional typically designs a product test using a small consumer population and then makes inferences to a larger population; i.e., predictive relationships.

However, not every “sensory” tests follows basic scientific methodology to understand the underlying patterns of consumer behavior.

A few common errors in sensory testing include . . .

1. The consumer was not qualified as a product user
2. The consumer was not qualified based on sensory skills (analytical testing)
3. The consumer was not representative of the target population



Why do companies support sensory programs?

Usually management needs answers to questions such as:

- Do technological or ingredient changes impact product perception, consumer preference, and purchase?
 - *Grape source, tank, temperature, seasonal ingredients, yeast source, etc.*
- Which sensory characteristics most impact the sensory experience?
 - *Sweetness, color, astringency, aroma, mouthfeel.*
- What physical and chemical measures best represent important sensory measures?
 - *% Alcohol, pH, lactones, esters,*
- Which new wines are best to go into a test market or retail space?

Sensory Resources Required

There are a finite number of resources to help provide valid and reliable research.

1. Subjects/Test Population
2. Methods
3. Facilities/Test Location
4. Gathering sensory information and data processing
5. Professional staff for research design, execution, and interpretation

Subjects Must Be Qualified

Defining the target consumer is necessary to ensure research integrity. Unfortunately, business decisions are often based on results obtained from an erroneous test population.

Anyone can participate in a sensory test by being at the right location at right time.

Buteach individual's sensory skills are unique.

Basic sensitivity can vary by as much as 100+%, among average or heavy/frequent product users.



Sensory Skills Vary Greatly in the Population

Sensory analytical tests are small panel procedures that rely on about 25 or fewer subjects so the qualifying process is critical.

But, about 30% of any population cannot discriminate differences between products at better than chance even among products they regularly consume.

Increasing N does not reduce error or correct for use of unqualified subjects.

Testing unqualified individuals increases risk of incorrect decisions (sometimes referred to as β , beta risk, or type 2 error – stating there is no difference when, in fact, there is).



Best Practices Methodology

To account for variability due to subject's sensitivity used in sensory analytical tests, we:

- Use a panel of qualified subjects
- Qualify subjects based on product use and sensory skill
- Use balanced block serving orders
- Require a response; i.e., tests are forced choice
- Use repeated trials design
- Monitor performance on a subject basis by and across tests

All Products Vary

A few comments about product:

- All products are different from each other; a source of variability.
- Brands and label information are influential. Products usually evaluated blind, without the benefit of brand and imagery to minimize halo/bias effects.
- Some products are innately branded with embossed logos and other characteristics; e.g., chocolates, Oreo's, running shoes, and that limits the types of methods that can be used.

Categories of Sensory Methods

There are two types of sensory methods -- analytical and affective.

- **Analytical methods** include discrimination and descriptive analysis
- **Affective methods** include liking and preference

No method is more sensitive than another !!

Analytical -- Discrimination Testing

Objective is to determine whether the difference between products is perceived at a previously established level of significance.

By convention, we use $\alpha = .05$ or the 95% confidence level.

Tests require a homogeneous population of qualified subjects (must demonstrate discrimination ability). A typical panel size is 25, but more or less can be used (an experimenter choice). Use of repeated trials is recommended.

Only measure whether a difference is perceived (a discrete or categorical judgment).

Paired Sample Test

Duo Trio Test

Triangle Test

Analytical – Descriptive Analysis

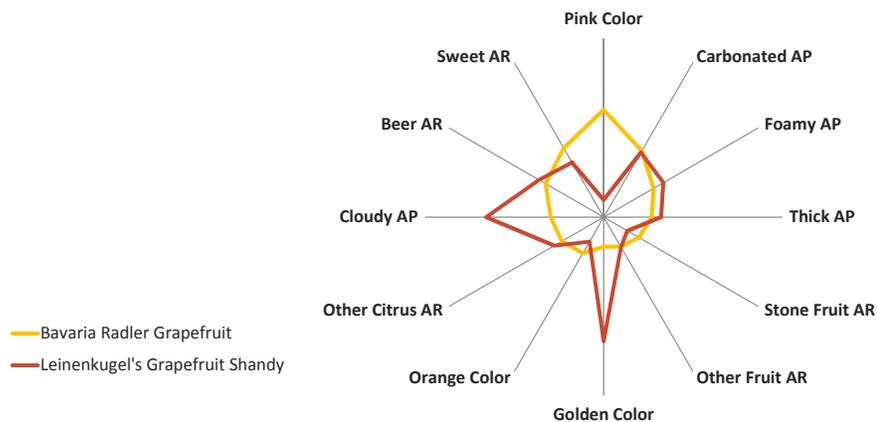
Objective is to describe products using a sensory language and quantify the intensities of the language.

A small panel procedure using ~12 subjects, all of whom are qualified based on their product usage and demonstrated discrimination skills.

The results provide visual displays or maps of products and their spatial relationships.



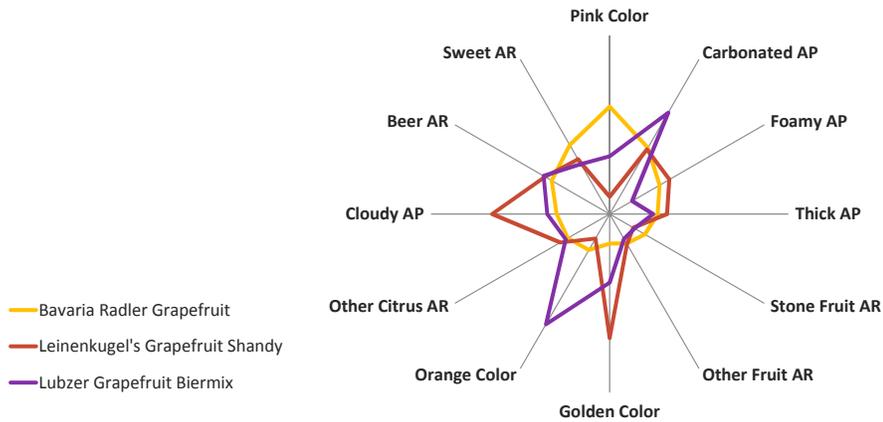
A Sensory Map (QDA Spider Plot)



Intensity is measured from the center to the end line for each attribute for each product.



A Sensory Map (QDA Spider Plot)



Intensity is measured from the center to the end line for each attribute for each product.



Affective -- Preference

Measure preference for one product vs. another.

Uses ~ 50+ consumers meeting test objective and demographic profile.

Consumers do not need to demonstrate discrimination ability, but must be users and likers of the product/category.



Affective – Hedonic

Measures degree of liking for an array of products using a scaling system such as the 9-pt hedonic scale. An indirect measure of preference.

Recommended number of respondents ranges from not less than ~50, but often > 100 qualified consumers (product users, meet related demographic criteria).



Facilities

Most sensory tests use environmentally-controlled space to minimize non-test variables.

A facility will have:

- partitions to minimize visual contact between subjects
- partitions to minimize contact between subject and experimenter
- environmental & lighting controls
- separate prep area
- ease of access into/out of area



Typical Sensory Facility

Each sensory booth is partitioned preventing respondents from interacting with each other during data collection. Data is collected by a computer/direct data entry system and the prep area has ample counter space.



Photos courtesy of Tragon Corporation, Redwood City, CA

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Data Collection & Processing

Electronic capture systems (direct data entry) provide rapid and accurate response capture.

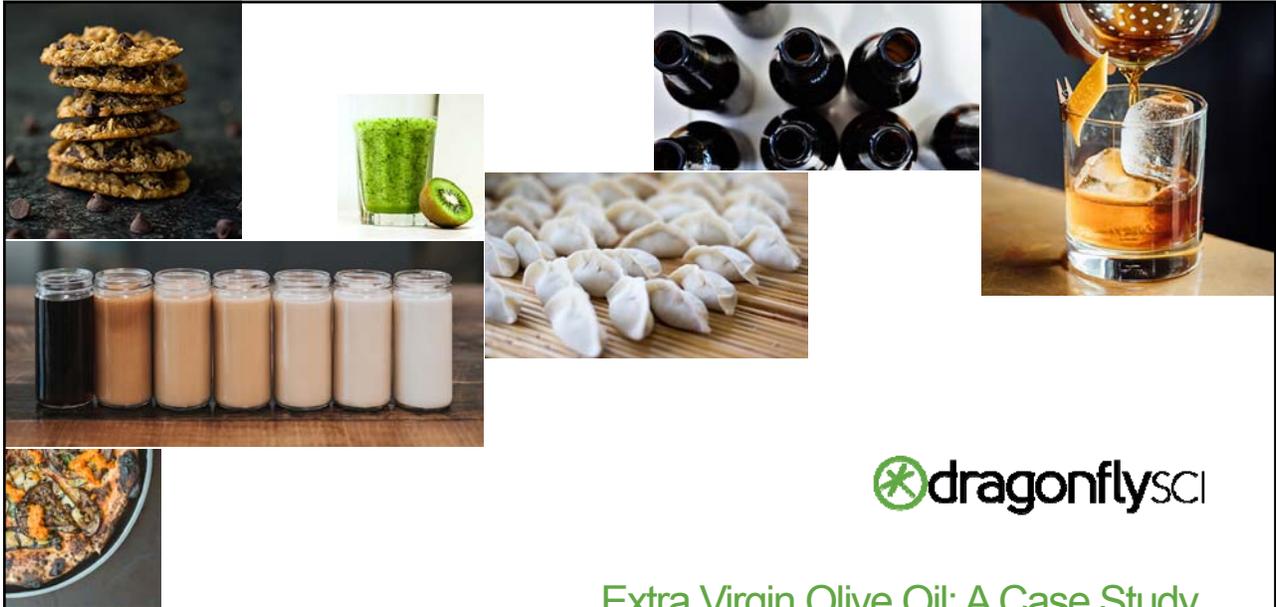
Real time analyses (cloud) and reporting; access to subject and product performance records.

Numerous systems available to best serve your needs and your budget.

Summary

Developing a sensory and consumer research program requires resources, qualified personnel, an operating strategy, and interaction with technology, innovation, quality controls, and marketing.

Successful programs develop actionable product knowledge that is easily understood by management and accepted as credible.



Extra Virgin Olive Oil: A Case Study

Extra Virgin Olive Oils

A Case Study Conducted for:

**Beyond Extra Virgin - EVOO
Conference**



Opportunities for the Olive Oil Industry in China and USA

USA consumers use 80 million gallons of olive oil annually, making it the largest market outside of the European Community. We only produce 2% and import 98%!

In India, imports of olive oil have increased about 20% each year for the past 3 years.

Consumption has increase 73% globally in past 25 years.

- o USA – 250% increase
- o UK – 763% increase
- o China – 75% increase
- o India – 20% increase in past year

Business Issues

India has a tremendous opportunity to increase market share, especially within EVOO.

Sensory and consumer research can ensure that consumer expectations are met, help businesses provide meaningful segmentation rather than 'me too', and help increase repeat purchase.

Major challenges for any product category include:

- Market strategy – customer target, communication, positioning, pricing
- Product strategy – source, processing, packaging, and sensory experience

Business and Research Objectives

To understand consumer behavior, it is important to determine:

- When, how, and why consumers select/use EVOO
- Which EVOOs are well liked by consumers and why
- If unique preference segments exist
- Sensory similarities and differences
- Which sensory differences predict acceptance
- Influence of package on quality and price

How do we measure perception?

Quantitative Descriptive Analysis (QDA) was used to measure sensory similarities and differences. This is a sensory trained panel procedure in which about 12 panelists with demonstrated sensory acuity describe and quantify their product perceptions using common everyday language.

This quantitative data set is analyzed with consumer preferences and physical/chemical measures to help understand “why” consumers like what they do.

Results are used to discover renovation and innovation opportunities, they provide strategic insight into market potential, and more importantly, repeat purchase.



Over 50 EVOO's were benchtop screened for testing



Extra virgin olive oils selected for testing

A subset of products was selected from an array of over 50 EVOOs readily available in the marketplace.

This array represents the full sensory experience of the marketplace screening. Five countries of origin are represented.

Country of Origin	Product Description
California-1	Organic Estate Grown
California-2	Unrefined
California-3	Mission
California-4	Ascolano
Italy-1	EVOO
Italy-2	EVOO
Italy-3	EVOO
Italy-4	EVOO
Spain-1	First Cold Press
Spain-2	100% Spanish
Spain-3	100% Spanish
Greece-1	First Cold Pressed
Greece-2	EVOO
Turkey-1	Delightfully Turkish

Consumer Liking

Product Research Design

Do consumers like some EVOO's more than others?



Product Testing with Target Consumers

Over 150 consumers from San Francisco and Chicago metropolitan areas qualified to participate based on the following criteria:

- Gender: 30% males, 70% females;
- Ages 25-64;
- Attended or graduated from college;
- Primary grocery shopper (>50%);
- Purchased and eaten Extra Virgin Olive Oil in past month;
- Use Extra Virgin Olive Oils in cooking, in salads, and for dipping;
- Standard employment, allergies, and past participation screen.



Product Scorecard (LAM)

1. Please indicate, and then describe, the extent of your agreement with each of the statements below. (77) respondents for the first survey.

Scale Value=100

— GREATEST DISAGREEMENT- DISLIKE

— DISLIKE EXTREMELY

— DISLIKE VERY MUCH

— DISLIKE MODERATELY

— DISLIKE SLIGHTLY

— NEITHER LIKE NOR DISLIKE
— DISLIKE SLIGHTLY

— DISLIKE MODERATELY

— DISLIKE VERY MUCH

— DISLIKE EXTREMELY

Scale Value=0

— GREATEST DISAGREEMENT- DISLIKE

2. How likely would you be to purchase this or a similar product in comparison to other brands on a regular basis given your current usage?

Very Likely
Would Not Purchase



Probably
Would Purchase



Maybe
Not Purchase



Probably
Would Not Purchase



Definitely
Would Purchase



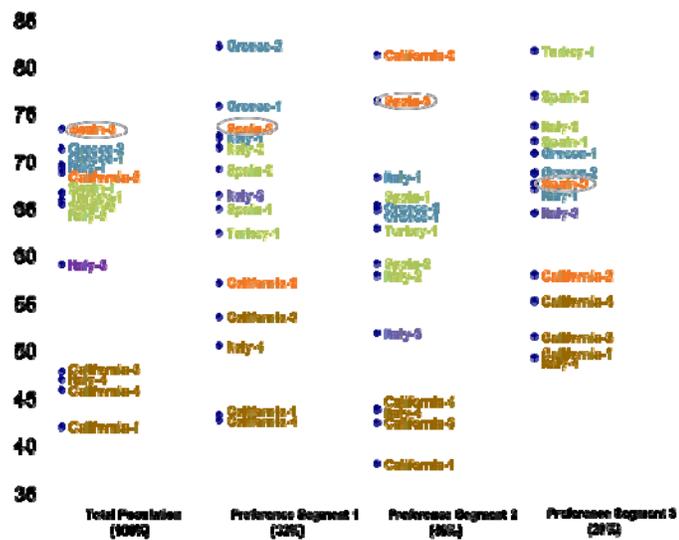
Consumers clearly like some EVOO's more than others.



Consumers clearly like different EVOO's

Three unique product opportunities were identified.

Spain 3 was generally well liked across all preference segments.



Understanding “Why” Consumers Like What They Do

RELATING QDA TO CONSUMER PREFERENCE SEGMENTS



Three Unique Consumer Targets

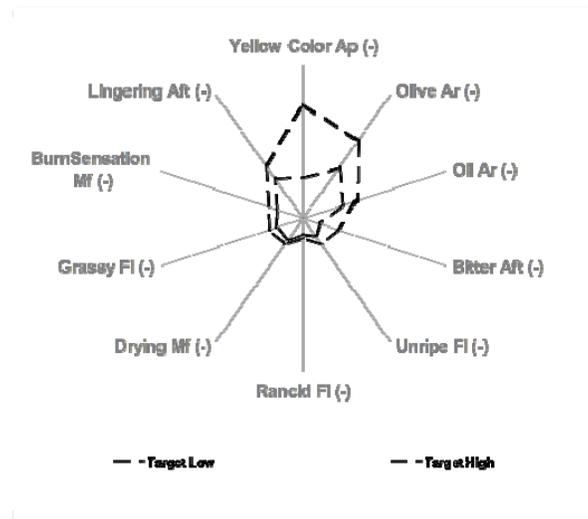
An example of single correlations with each preference segment.

Total Population 1750		Heavy & Sweet Segment 550		Light & Mild Segment 590		Balanced & Flavored Segment 560	
Sweet A1	0.61	Sweet 100 A2	0.71	Apple A1	0.67	Orange A1	0.70
Custard A1	-0.51	Custard A2	0.70	Cherry M1	0.66	GI A1	0.70
Cream F1	-0.51	Yellow Odor A1	0.67	Straw A1	0.65	Apple A1	0.70
Overall A1	-0.50	Glue F1	0.66	Custard A1	-0.54	Overall A1	0.70
Unusual A1	-0.50	Straw A1	0.66	Peaches A1	-0.54	Apple A1	0.70
Orbit M1	-0.52	Water F1	0.61	Apple A1	-0.58	Apple A1	0.67
Unico A1	-0.52	Clear A1	-0.59	Apple F1	-0.59	Glue A1	0.67
Bliss F1	-0.54			Pancho A1	-0.59	Orange F1	0.66
Bliss A1	-0.55			Custard M1	-0.57	Straw A1	0.67
Peaching M1	-0.55			Pancho F1	-0.57	Glue F1	0.66
Unico F1	-0.55			Apple A1	-0.59	Glue A1	0.67
Strawberry A1	-0.72			Apple A1	-0.59	Blender A1	0.67
Strawberry M1	-0.74			Cherry M1	-0.59	Yellow Color A1	0.60
				Orange A1	-0.70	Apple A1	-0.69
				Yellow Color A1	-0.70		
				Glue A1	-0.71		
				Unusual A1	-0.70		
				Glue F1	-0.70		
				Straw A1	-0.70		
				Strawberry M1	-0.70		
				Peaching M1	-0.70		
				Strawberry A1	-0.70		
				Bliss F1	-0.70		
				Bliss A1	-0.61		
				Overall A1	-0.68		
				Orange F1	-0.69		
				Unico A1	-0.69		
				Glue A1	-0.64		
				GI A1	-0.67		
				Unico F1	-0.69		
				Overall A1	-0.69		

Sensory Experience that Appeal to Segment 2

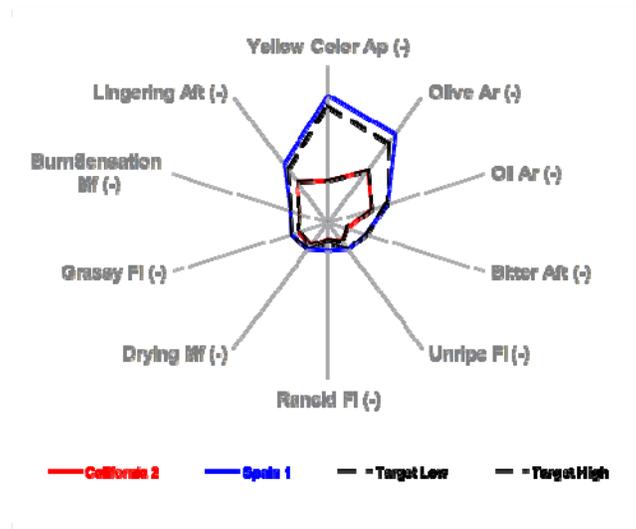
Segment 2 wants a very mild olive oil; one that is not bitter, unripe, burning, or grassy. All attribute are negatively related to acceptance.

This segment has many sensory detractors.



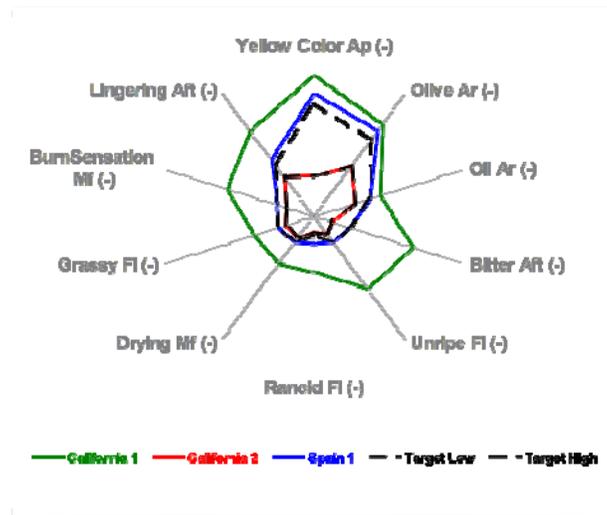
Spain 1 and California 2 Appeal to Segment 2

Spain 1 and California 2 are well liked by the Light & Mild segment.



Spain 1, California 1 & 2 do not appeal to Segment 2

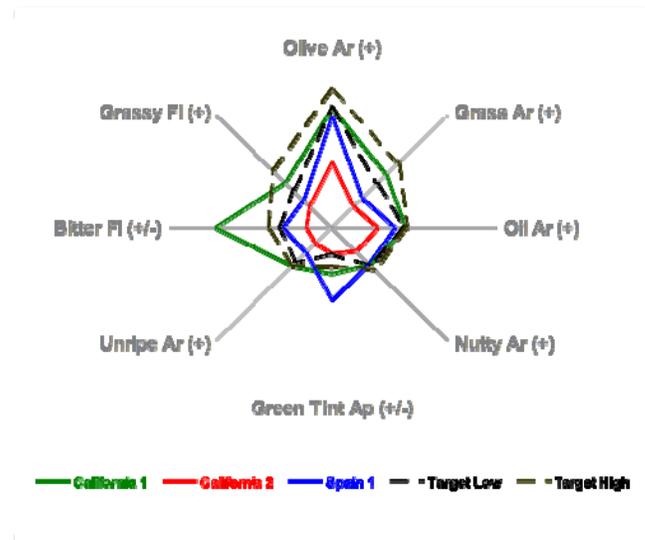
California 1 is disliked by the Light & Mild segment. It is too high in bitter, unripe, rancid, grassy, and burning sensations.



Segment 3 likes robust EVOO's

These products are close to the sensory targets but none are ideal for this segment.

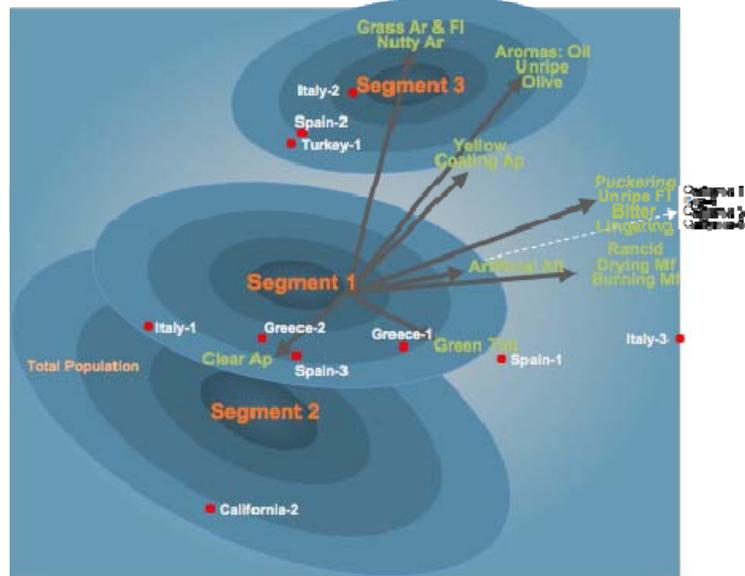
California 1 is too bitter, even for consumers that like some bitterness.



Product Dimensions & Segments

The landscape map shows the sensory measures that relate to the individual products and overall acceptance.

Products within and closest to each acceptance sphere best met segments acceptance and sensor profiles.



What judgments do consumers make simply based on the packaging?

Packaging Impressions

Packaging Research Design

- 4 Unique EVOO packages
- 150 consumers
- 2 test markets



Packaging Examples

To understand the impact of bottle shape, size, and color on consumer perception, four unbranded EVOO packages were shown to consumers.

Consumers were asked to rate expected price, quality, country of origin, and type of olive oil.



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Packaging Results



	180	343	286	269
Type	Pure	Pure/EVOO	EVOO	EVOO
Price	Less than \$10	Up to \$15	Up to \$20	\$25
Country of Origin	California	Italy	Italy	Italy
Quality Level	Value	Mainstream	Premium	Specialty

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Successful Brand Strategy in the Marketplace

They understand what drives consumer behavior.

Statement from August 2017.

Thanks to the support of our customers we have grown faster than we ever dreamed possible!



How Might this Help Wine & Craft Industries?

UNDERSTAND HOW TO APPLY SENSORY SCIENCE PRINCIPLES IN YOUR WORK.

“To Teach” or “To Learn”?

Do you want to teach consumers?

or . . .

Do you want to learn from them?

Marketers are concerned with how consumers learn because they are interested in teaching them about products, product attributes, and their potential benefits.

They are also interested in how effectively they have taught consumers to prefer their brands and to differentiate their products from competitive offerings.



Where to start?

Knowing what to measure and how to measure it is key!

Who is your consumer?

What do your consumers do?

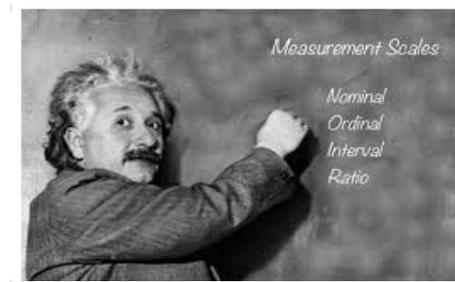
Why, when, and how often?

Be curious!

Make your research team curious.

What are the business issues?

What is the size of the opportunity?



Business Objectives

What sensory research will be most valuable to you?

- What are you trying to achieve?
- How do you measure success?
- How might you change what you are doing if you had sensory data?

What do you know?

(Versus what you think you know)

About the category?

About the consumer?

- Demographics, psychographics, segments, markets

Products

- Usage, frequency, new developments, trends, pricing tiers, distribution, etc.

Gather all available knowledge from key sources

Why Consumer Sensory?

Sensory, product development, quality, and brand groups bring unique and valuable skills to the organization.

Sensory is focused on the product, whereas marketing manages the portfolio and promotes the brand.

When groups work together, they create a synergy that allows for an in-depth exploration of products and consumers.

Sensory professionals can help bridge the gap between the science of discovery and implementation.



UC Davis Sensory & Consumer Insights

Want to learn more?

Web-based opportunities via UCD
Extension



Sensory is an Applied Science

Sensory evaluation has been taught in universities for 70+ years, in food science.

Most professionals discover sensory science after they leave college.

Sensory science is much broader than food science.

University and short courses vary greatly in how they define sensory evaluation.

Sensory is an applied science with important business implications.

Many university programs have limited business applications experience.

Sensory science should be taught in business school, to leadership teams, entrepreneurs, marketers, and product developers, among others.



Now in our 17th year!

UCDE Applied Sensory & Consumer Science Certificate Program

1. Foundations of Sensory Science
2. Sensory Evaluation Methods
3. Consumer Testing Methods
4. Applications of Sensory & Consumer Science Principles



Name: _____ Date: _____

DUO-TRIO TEST

Please taste each product in front of you, starting with the R on the left and then the two coded samples. Circle the number of the sample that is SIMILAR to the Reference 'R'. You must make a choice, even if it is only a guess. If you have any questions, please ask.

REFERENCE

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Name: _____ Date: _____

PREFERENCE TEST

Please taste each product in front of you, one at a time. Circle the number of the sample that you Prefer. You must make a choice. If you have any questions, please ask. Thank you.

657

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Directions: Write down sensory terms to describe observations for the following.

What does the product look like?

What does it smell like?

What does it taste like/flavors?

How does it feel in the mouth?

What flavors/sensations remain about 30 seconds after you swallow?

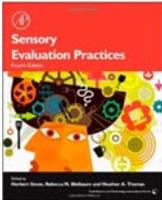


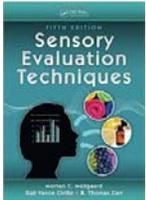
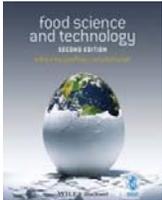
Name: _____ ID: _____ Date: _____

OVERALL OPINION	OVERALL OPINION	OVERALL OPINION	OVERALL OPINION
Like Extremely	Like Extremely	Like Extremely	Like Extremely
Like Very Much	Like Very Much	Like Very Much	Like Very Much
Like Moderately	Like Moderately	Like Moderately	Like Moderately
Like Slightly	Like Slightly	Like Slightly	Like Slightly
Neither Like Nor Dislike			
Dislike Slightly	Dislike Slightly	Dislike Slightly	Dislike Slightly
Dislike Moderately	Dislike Moderately	Dislike Moderately	Dislike Moderately
Dislike Very Much	Dislike Very Much	Dislike Very Much	Dislike Very Much
Dislike Extremely	Dislike Extremely	Dislike Extremely	Dislike Extremely

Sensory Description	Sensory Description	Sensory Description	Sensory Description

Selected References





Sensory Evaluation Practices, 4th Edition, 2012. Stone, H., Bleibaum, R.N., and Thomas. Elsevier/Academic Press

Sensory Evaluation of Food, 2nd Edition, 2010. Lawless, H., and Heymann, H. Springer.

ASTM E-18 Library - Standards & Guides

Discrimination Testing, Descriptive Analysis, Sensory Claims Substantiation, etc.

Thank you!

www.dragonflysci.net

Do you have any burning questions?