SENSORY METHODOLOGICAL DEVELOPMENTS & INDUSTRY PARTNERING

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Society of Sensory Professionals
Transforming Science to Strategy
Napa, October 27-29, 2010
Doing Great?

- Scientific discipline or combination thereof
- Central role in R&D and Marketing
- Integral part of university curricula
- Strong cadre of sensory service providers
- Fast-growing professional associations & well-attended professional meetings
- Established journals and publications
Paradigm Shift

Sensory → Consumer

Product sensory properties

Consumer behavior
A Model for the Study of Consumption Behavior

Product Variables
- Sensory properties
- Functionalities
- Marketing mix
- Brand equity

Consumer Variables
- Demographics
- Psychographics
- Physiology & Genetics

Context Variables
- Physical context
- Convenience/effort
- Societal pressures

Consumption Behavior
- Likes & dislikes, preferences
- Choice
- Purchase/Repeat purchase
- Consumption
- Pleasure/Satiety

Culture

Multivariate
Trends, not cause-effect
Quantitative & qualitative
Dynamic

Guinard, 2008
Sensory Methodological Developments

- Discrimination testing
- Descriptive analysis
- Consumer testing
- Sensometrics
- Marketing
Discrimination Testing

No preference option

Similarity testing, Type I & II Errors and power
Descriptive Analysis

- Fast(er) methods
- Sorting
- Napping
- Sorted napping
- CATA (Check-All-That-Apply)
Napping Minerality in White Wines

Heymann & Collaborators
MFA: Nappe Consensus Map

Heymann & Collaborators
MFA: Nappe and DA comparison

Heymann & Collaborators
Consumer Research

Intangibles:
- Emotions
- Values

Advances in ‘…omics’

Context

Psychographics

Internet
- YouTube
- Skype, iChat

Social networks
Consumer Research

- Ethnography
- Conjoint analysis
- Multivariate statistics
- Holistic approaches
- Combining qualitative & quantitative
- Segmentation
Olive Oil Research at UC Davis

- Sensory properties and consumer acceptance of extra-virgin olive oil (Delgado, 2010)
  - Descriptive analysis
  - Consumer hedonic ratings
  - Expert quality ratings
- Consumer perceptions of olive oil (Santosa, 2010)
  - Focus groups
  - Means end chains analysis
  - Sorting
  - Survey research
Extra Virgin Olive Oils – The Products (CVA)
The Consumers – Focus Group Insights

Most (US) consumers do not know what ‘extra virgin’ means.

- “I just always heard that cold press is absolutely something you have to have in oil. And I guess… is there another press that is hot press? Hahaha… So I guess I don’t know anything…”

- “I feel I don’t know anything about it. […] Initial perception was the better kind, but then, it morphed into… it’s the kinds of less flavor, the less intense flavor. And I really don’t know”.

- “I guess in my mind extra virgin didn’t necessarily mean cold press, that it could be extra virgin and not necessarily cold press. […] I have no idea.”

- “I just thought it had stronger taste. I don’t think less processed, but stronger taste.”

- “I know I read an article about it a couple years ago. I have an impression that extra virgin is what I should get.”
(US) consumers know that olive oil has health benefits but they are usually unaware of the specifics.

- “You have to have some fats in your diets. And you want to be careful about which ones those are. And that’s the nutritious one to have. So it tastes good and you need it. Your body needs it and it’s a good one for you”.

- “Olive oil ... actually was healthier than those oils. And actually had flavor and was interesting to cook with. So I remember thinking, oh... feeling relieved, like, oh okay... here’s a fat that actually is healthy and it has a good flavor”.

Oleic Acid
(US) consumers have a limited vocabulary to describe the sensory properties of olive oil.

Across all four groups, consumers were able to come up with a higher number of descriptors of negative attributes than of positive ones.

Consumers came up with some specific terms (e.g., ‘rancid’ or ‘oxidized’) as well as some ambiguous ones (e.g., ‘smelled good’, ‘pleasant taste’, ‘smooth’, ‘delicious’, ‘very nice’ and ‘smooth’).

‘Fruitiness’ was the only positive attribute to appear in all four groups.

The specific olive oil attributes that most participants viewed negatively were ‘bitter aftertaste’, ‘hotness’, and the burning sensation consumers perceived after tasting the oil...
Consumer preference map (left) and descriptive panel sensory map (right)
Three preference clusters emerged

Cluster 1 N=33
Butter, ripe fruit, grassy, spicy.
Balance group tend to like a broad number of products

Cluster 2 N=48
Negative drivers of liking: bitter, pungent, astringency and spicy.
Attributes liked: butter, winey, fusty, rancid.
Preferred oils: I2, I3, U11

Cluster 3 N=29
Negative drivers of liking: mint, herbs, tropical fruit.
Attributes liked: nutty, tea, ripe fruit
Preferred Oils: C2, U9, U1, U4, I4, I3
The Experts – Quality Ratings vs. Sensory Attributes
Expert Quality Ratings vs. Consumer hedonic ratings
Sensometrics

(Hierarchical) Multifactor Analysis

DISTATIS

Dendrogram for Overall Liking (Actual)
Marketing

Sensory quality

Sensory marketing

Individualized everything
How Does Academia Serve the Needs of Consumer Product Industries?

- Educating students – undergraduate, graduate and lifelong learners
- Conducting fundamental and translational research
- Implementing technology transfer
- Resource to government agencies
- State-of-the-art programs and facilities
- Strategic partnerships with companies
You build from a strong foundation and you adapt to market dynamics

- Foundation and tradition of academic excellence
  - Sensory science and consumer research at UC Davis – pioneering work of Rose Marie Pangborn, Maynard Amerine, Edward Roessler, Ann Noble and Howard Schutz
  - Critical mass of faculty and programs
  - Comprehensive research university context
- Multidisciplinary approach
- Land Grant mission
- Local and global bridges with other academic institutions, government agencies and Industry
Applied Sensory Science and Consumer Testing Certificate Program

- Distance learning certificate
- Launched in 2002; over 250 alumni
- Weekly lessons, assignments, quizzes
- Interactive forum
- Year long; 4 modules
  - Foundations of Sensory Science
  - Sensory Evaluation Methods
  - Consumer Testing Methods
  - Applications of Sensory Science and Consumer Testing Principles

http://extension.ucdavis.edu/unit/agriculture_and_food_science/certificate/applied_sensory_science_and_consumer_testing/
Multidisciplinary Approach to Research

- UC Davis Foods for Health Institute

Objectives
The objectives of the FFHI are to guide multidisciplinary research programs drawing on the complementary strengths of the University of California, Davis and its partners to: (1) develop assessment technologies that accurately measure health; (2) discover the molecular targets of health that are modifiable by food and lifestyle; and (3) translate the discoveries at the molecular level to personalized food and lifestyle solutions.
Collaborations with USDA and CIA

- USDA funded research
- Joint research with USDA Laboratories
- Training of USDA inspectors

- Joint World of Flavors workshops
- Joint sensory and consumer research
- Joint outreach
Wine, Beer and now Olive Oil

- UC Davis has had a unique impact on the American wine and beer industries; those industries have given back and invested in UC Davis’ future
- Robert Mondavi Institute for Wine and Food Science
  - Wine and beer industry endowed chairs and professorships
  - First LEED Platinum winery, brewery and food processing facility – 100% private funds
Certification

The UC Davis Olive Oil Taste Panel

Certification of extra virgin olive oils following International Olive Council regulations and protocols
The UC Davis Olive Oil Taste Panel

- Serves three purposes
  - IOC certification
  - Full descriptive profile to producers
  - Research tool

- Scorecard components
  - IOC attributes – 10-cm scale
  - Full descriptive profile (44 attributes) – 0-10 numerical scale
  - Integrative attributes
  - Comments
## UC Davis Olive Oil Taste Panel Scorecard – IOC Attributes

### Intensity of perception of defects:
- Fusty/muddy sediment
- Musty-humid-earthy
- Winey-vinegary-acid-sour
- Metallic
- Rancid
- Others (specify)

### Intensity of perception of positive attributes:
- Fruity
- Ripe fruit
- Green fruit
- Bitter
- Pungent

10-cm scale
<table>
<thead>
<tr>
<th>Ripe fruit</th>
<th>Ripe banana</th>
<th>Ripe apple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ripe olive</td>
<td>Nutty</td>
<td>Buttery</td>
</tr>
<tr>
<td>Floral</td>
<td>Tropical-pineapple</td>
<td>Apricot/peach</td>
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<tr>
<td>Avocado</td>
<td></td>
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<table>
<thead>
<tr>
<th>Green fruit</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Green grass/freshly cut grass</td>
<td>Green apple</td>
<td></td>
</tr>
<tr>
<td>Green banana</td>
<td>Green olive</td>
<td>Tomato leaf</td>
</tr>
<tr>
<td>Artichoke</td>
<td>Green tea</td>
<td>Herbaceous/stemmy</td>
</tr>
<tr>
<td>Minty/eucalyptus</td>
<td>Pine</td>
<td>(Fresh) green vegetables</td>
</tr>
<tr>
<td>Bitter greens/nettle</td>
<td>Green almond</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Others</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>Peppery (black pepper)</td>
<td>Spicy</td>
</tr>
<tr>
<td>Hay/straw</td>
<td>Woody/olive pit</td>
<td>Black walnut</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>Burnt</td>
<td>Cucumber</td>
</tr>
<tr>
<td>Paint/solvent/petroleum/machine oil</td>
<td>Candle wax/paraffin/play dough</td>
<td></td>
</tr>
<tr>
<td>Cardboard</td>
<td>Wet wood</td>
<td>Canned/brined olives</td>
</tr>
<tr>
<td>Taste</td>
<td>Sweetness</td>
<td>Sourness/acidity (bitterness)</td>
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<tr>
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<td>-------------------------------</td>
</tr>
<tr>
<td>Mouthfeel</td>
<td>Viscosity/thickness</td>
<td>Astringent</td>
</tr>
<tr>
<td>Integrative measures</td>
<td>Total aroma intensity</td>
<td>Total flavor intensity</td>
</tr>
</tbody>
</table>

Circle one: Mild Medium Robust

Comments:
Strategic Partnerships

- UC Davis
- Mars
- Agilent Technologies
- Chevron
Action Items

- Visit campuses; meet with faculty, students and administrators
- Take advantage of professional development opportunities at universities
- Participate in university advisory boards
- Provide internships for undergraduate students; open your laboratories for graduate students to conduct research
- Participate in thesis and dissertation committees
- Keep track of the technical literature in your field(s) and beyond
Action Items

- Hire faculty as consultants, board members, researchers
- Teach in university programs – undergraduate, graduate, lifelong learning
- Conduct joint research
- Be active in your alumni associations
- Monitor university patents and startups
- Engage your company in strategic partnerships with universities