Temporal Methods Seminar

1:00 to 5:00 PM
Wednesday April 17th 2013

Seminar Leaders:
Suzanne Pecore  General Mills Inc
Chris Findlay  Compusense Inc
Sarah Kirkmeyer  Givaudan Inc.
There is a temporal component to every sensory experience.

The job of the sensory scientist is to select the most suitable Temporal Method.

It helps to get the question right.
Time is an important factor in the sensory experience. The onset, duration and sequence of sensations evoked by human sensory interaction with products are key properties in product performance and differentiation. To be able to understand these temporal properties we must first be able to measure them. At this time, ASTM has only one document relating to temporal measures, ASTM E1909-11 Standard Guide for Time-Intensity Evaluation of Sensory Attributes.
Analyzing Curve Parameters

STANDARDIZED PARAMETERS FROM T-I CURVES

- **Imax** – maximum intensity
- **Tmax** – time at maximum intensity
- **DUR** – duration
- **AUC** – area under curve
- **Inc. Angle** – increase angle
- **Inc. Area** – increase area
- **Dec. Angle** – decrease angle
- **Dec. Area** – decrease area
A number of newer methods have been developed and are being used by sensory researchers around the world. In the interest of learning more about these methods and considering their inclusion in the ASTM publications, this seminar will focus on three of those methods and provide participants with a “Hands-on” experience with real products and real data collection.
Temporal Methods

• Fixed Time Points
  – Progressive Profiling
  – Sequential Profiling
  – MATI Multiple Attribute T-I

• Continuous Measurement
  – Single Attribute Time-Intensity (T-I)
  – Dual Attribute T-I
  – Temporal Order (TOS)
  – Temporal Dominance (TDS)
The three methods are:

1. Progressive Profiling
   Chris Findlay and Miranda Robb

2. TDS (Temporal Dominance of Sensations)
   Sarah Kirkmeyer and John Castura

3. TOS (Temporal Order of Sensations)
   Suzanne Pecore and Peter Love

Everyone will have an opportunity to rotate through and experience all three methods.
The final part of the seminar will be devoted to analysis, interpretation and evaluation of the strengths, weaknesses and challenges of these temporal methods. Participants will be able to determine the ease of use by panelists, the clarity of results, the skills required for the analyst and finally the potential value to their business.

E18 will be able to consider developing a new document or documents on Temporal Methods.
Schedule:

1:00    Introduction
       Presentation of the problem and logistics
1:30    Hands-on #1
2:10    Hands-on #2
2:50    Hands-on #3
3:30    Break for Participants
       Data Analysis by group leaders
4:00    Presentation of results
4:30    Discussion of the methods and observations
Application of Temporal Methods

*Problem Statement*
Project Objective

• The E18 Snack Bar is being reformulated to improve its health credentials.
• Goal is to match the sensory characteristics of the current E18 Bar as closely as possible.
Descriptive Analysis shows options with similar aromatics to current bar.

Aromatic Profile of Prototype E18 Bars

Bars sharing the same letter do not significantly differ in intensity at the 95% confidence level.
Descriptive Analysis also shows potential issues with the temporal taste profile.

**Option 2, for example, is less sweet in-mouth, but with more lingering sweet taste.**
Temporal Study

• Objective is to understand if the temporal profile has been affected by the reformulation of the E18 bar, and
• To identify a formulation option that more closely matches the Control bar.
## Attributes To Be Evaluated By The Temporal Methods

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Aromatics associated with grains such as oat, wheat, etc. An overall grain aromatic, inclusive of raw, cooked and toasted aspects.</td>
</tr>
<tr>
<td>Caramelized</td>
<td>Aromatic associated with caramelized sucrose or browned sugars</td>
</tr>
<tr>
<td>Dried Fruit</td>
<td>A brown sweet aromatic associated with dried fruits such as raisins and prunes.</td>
</tr>
<tr>
<td>Nutty</td>
<td>Aromatics associated with nut meats such as almonds. An overall nutty aromatic, inclusive of raw and roasted aspects.</td>
</tr>
<tr>
<td>Sweet</td>
<td>Taste on the tongue stimulated by sugars and potent sweeteners; reference is sucrose in water.</td>
</tr>
</tbody>
</table>
Evaluation Protocol

• Bite through the bar with incisors, about ½ inch into bar.
• Try to sample a representative section of bar, i.e., avoid large particulates. (Can break-up bar to reach representative sections.)
• Chew bar with molar teeth.
• Start of timing should coincide with first chew. (Details provided at each station.)
• Expectorating is encouraged!
Logistics

- Three samples: 227, 648, 950
- Evaluated as two pairs:
  - Group 1 (Blue circle): 227 vs. 950
  - Group 2 (Red triangle): 227 vs. 648
- You are assigned to Group 1 or Group 2
- Each Group will evaluate the same pair at each of three stations:
  - Station 1 (A) Room 307: Progressive Profiling
  - Station 2 (B) Room 308: TDS
  - Station 3 (C) Room 309: TOS
- Observations collected at each station
Temporal Methods Seminar

Progressive Profiling

Chris Findlay
Miranda Robb
Compusense Inc
Progressive Profiling

Uses a conventional line-scale ballot presented at specific intervals.

Records an attribute intensity at each time point.

Lends itself to longer time intervals and the entire experience.

May record multiple bites or product exposures.

Intervals can vary in duration.

Analysis can be at specific time points or over the entire time of the test.
## Attributes to be evaluated by the temporal methods

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Aromatics associated with grains such as oat, wheat, etc. An overall grain aromatic, inclusive of raw, cooked and toasted aspects.</td>
</tr>
<tr>
<td>Caramelized</td>
<td>Aromatic associated with caramelized sucrose or browned sugars</td>
</tr>
<tr>
<td>Dried Fruit</td>
<td>A brown sweet aromatic associated with dried fruits such as raisins and prunes.</td>
</tr>
<tr>
<td>Nutty</td>
<td>Aromatics associated with nut meats such as almonds. An overall nutty aromatic, inclusive of raw and roasted aspects.</td>
</tr>
<tr>
<td>Sweet</td>
<td>Taste on the tongue stimulated by sugars and potent sweeteners; reference is sucrose in water.</td>
</tr>
</tbody>
</table>
Progressive Profile Ballot

Please evaluate each of the attributes below and then click ‘Next’.

Grain Flavor

None                                      Very Strong

Caramelized Flavor

None                                      Very Strong

Dried Fruit Flavor

None                                      Very Strong

Nutty

None                                      Very Strong

Sweet

None                                      Very Strong
Progressive Profiling Panelist Instructions

1. Open the test and login using your assigned code.
2. Repeat the code as your password.
3. Start the test.
4. Please read the instructions carefully.
Progressive Profiling Panelist Instructions -2

1. You will be asked to respond to 5 attributes on line scales.
2. Hit the **Next** button as soon as you have scored all attributes.
3. Chew steadily and score whenever the ballot screen appears.
4. You will take 3 bites of each sample.
5. You may chose to spit or swallow.
Progressive Profiling Panelist Instructions - 3

1. You will be asked to respond twice after the first bite.
2. On the 2\textsuperscript{nd} and 3\textsuperscript{rd} bite you will see the ballot once.
3. After the 3\textsuperscript{rd} bite you will be asked to score \textbf{Aftertaste}.
4. In between samples you will have a break and a rinse of water.
Observations

• Thoughts / Insights as you experience this approach?
• Build on comments from prior groups (see flip charts)
LET’S COLLECT SOME DATA
Temporal Order of Sensations

Session Leaders:
Suzanne Pecore
Peter Love

General Mills Inc
Compusense Inc
What is TOS?

- TOS is a technique to measure the order that key attributes appear over the eating experience, i.e., over *several spoonfuls* and into the aftertaste.
Evaluation Protocol

• Bite through the bar with incisors, about ½ inch into bar.
• Try to sample a representative section of bar, i.e., avoid large particulates. (Can break-up bar to reach representative sections.)
• Chew bar with molar teeth.
• Start of timing should coincide with first chew.
• Expectorating is encouraged!
Specifics of E18 Bar Evaluation

• You will see one of two pairs:
  Group 1: 227 vs. 648
  Group 2: 227 vs. 950

• Focus is to identify the appearance, in order, of the first three attributes from a possible six attributes.

• Repeated THREE TIMES

• 4th bite is chewed 10-12 times, then most intense aftertaste is selected 10 seconds after expectoration.
## Attributes To Be Evaluated

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Aromatics associated with grains such as oat, wheat, etc. An overall grain aromatic, inclusive of raw, cooked and toasted aspects.</td>
</tr>
<tr>
<td>Caramelized</td>
<td>Aromatic associated with caramelized sucrose or browned sugars</td>
</tr>
<tr>
<td>Dried Fruit</td>
<td>A brown sweet aromatic associated with dried fruits such as raisins and prunes.</td>
</tr>
<tr>
<td>Nutty</td>
<td>Aromatics associated with nut meats such as almonds. An overall nutty aromatic, inclusive of raw and roasted aspects.</td>
</tr>
<tr>
<td>Sweet</td>
<td>Taste on the tongue stimulated by sugars and potent sweeteners; reference is sucrose in water.</td>
</tr>
<tr>
<td>Other</td>
<td>Describe</td>
</tr>
</tbody>
</table>
Read the instructions carefully before you begin.

Please take your FIRST bite of Sample 950.

When you are ready to begin:

- Press the button below and start to chew the product.
- AS YOU CHEW, select which attributes you experience 1st, 2nd and 3rd (the order in which they are perceived) by clicking on the corresponding attribute below. All 3 attributes experienced for your FIRST bite belong here.

- Click on the attribute as you detect it while you chew the product.
- Do NOT give intensity ratings.

0:00

Grain Flavor  Caramelized Flavor  Dried Fruit Flavor
Nutty Flavor  Sweet  OTHER

If you rated OTHER on your 1st bite, please identify here.
Observations

- Thoughts / Insights as you experience this approach?
- Build on comments from prior groups (see flip charts)
Introduction to TDS
Sarah V. Kirkmeyer, Givaudan
John Castura, Compusense
TDS Definition

- The Temporal Dominance of Sensations is a sensory profiling technique.

- The aim of the TDS methodology is to give an overall temporal picture of a product by allowing the panelist to score several descriptors simultaneously (multi-attributes).

- It detects sequence of dominance of different attributes (intensity of the dominant attribute at the time \( t_i \) is recorded).

- At Givaudan, TDS methodology is based on Quantitative Flavor Profiling (QFP) for descriptive part and TI for temporal information.
What kind of information do we obtain?

- The sequence of dominance in the profile
- The time and the duration when each attribute starts to be dominant (until it changes to another one)
- The intensity of each dominant perception *note requires significant additional training
- Is there the dominance of an attribute disappearing and reappearing later? (“Nutty” in the example)

*Pineau, Pessina, Cordelle, Imbert, Rogeaux, Schlich, (7th Sensometrics Meeting, Davis, CA, 2004)*
General Training sessions

- Learning instruments/descriptive attributes
- Recognize instruments/descriptive attributes quickly at the first note/perception
- Learning sequencing
  - Check that sequencing and time dependent is understood
  - Learn sequencing taking into account the intensity
- Defining dominance
  - Sequence then scoring
  - Dominance, NOT intensity
  - Dominance scale is a proportion
The process with food products

- Defining language used
- Defining in mouth and after swallowing profile, protocol of tasting
- Defining temporality flavor beginning/middle/end
- Checking time of shift
- Checking score
Interpreting Results

- Remember Dominance, NOT intensity
- Dominance scale is a proportion
- Significance line keeps the focus on the meaningful output
  - Do not create chances for obsessing over noise
- Highlight the main points/conclusions
- Useful to compare two TDS curves side by side when comparing samples or products
## Attributes To Be Evaluated

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain</td>
<td>Aromatics associated with grains such as oat, wheat, etc. An overall grain aromatic, inclusive of raw, cooked and toasted aspects.</td>
</tr>
<tr>
<td>Caramelized</td>
<td>Aromatic associated with caramelized sucrose or browned sugars</td>
</tr>
<tr>
<td>Dried Fruit</td>
<td>A brown sweet aromatic associated with dried fruits such as raisins and prunes.</td>
</tr>
<tr>
<td>Nutty</td>
<td>Aromatics associated with nut meats such as almonds. An overall nutty aromatic, inclusive of raw and roasted aspects.</td>
</tr>
<tr>
<td>Sweet</td>
<td>Taste on the tongue stimulated by sugars and potent sweeteners; reference is sucrose in water.</td>
</tr>
</tbody>
</table>
What do we ask the panel?

Read the instructions carefully before you begin.

When you are ready to begin:

- Place Sample 950 in your mouth, press the button below and begin to chew the product.
- Hold the sample in your mouth and manipulate/chew for 20 seconds, then swallow. Evaluate during the manipulation/chew and after the swallow.
- Indicate the dominant attribute as you perceive it by clicking on the attribute below. When a new attribute is perceived as dominant, click on the new attribute.
- After 45 seconds the timer will end. Press 'Next' when it appears.

0:00
Grain Flavor
Caramelized Flavor
Dried Fruit Flavor
Nutty Flavor
Sweet

If you have any comments, please identify here.
Observations

- Thoughts / Insights as you experience this approach?
- Build on comments from prior groups (see flip charts)
Temporal Methods Seminar

Conclusion

4:00 to 5:00 PM

Wednesday April 17th 2013

Break out Groups:

Progressive Profile  Chris Findlay  Compusense
TDS  Sarah Kirkmeyer  Givaudan
TOS  Suzanne Pecore  General Mills
The intent of the final session in the seminar:
Analysis, interpretation and evaluation of the strengths, weaknesses and challenges of these temporal methods, the ease of use by panelists, the clarity of results, the skills required for the analyst and finally the potential value to any business.

The outcome for ASTM:
E18 will be able to commence developing a new document or documents on Temporal Methods.
Data Analysis
Progressive Profile

• Each data point is made up of the 5 well-defined attributes whose intensity has been scored on an unstructured line-scale anchored at 0 and 100

• Timing is achieved by specific pauses between data points. A well-trained and calibrated panel will be recording data at very similar times. Our seminar panelists have been disrupted by connectivity problems, lack of practice and distraction.

• The time points were planned to be as follows
  – Initial point about 10 seconds
  – Point 2 about 30 seconds
  – Point 3 20 seconds after 2nd Bite
  – Point 4 20 seconds after 3rd Bite
  – Aftertaste 30 seconds after swallowing or spitting the 3rd Bite

• Total time elapsed, about 3 minutes

• Exact time stamps may be collected to achieve individual timing of panelists for training and analysis. Analysis has yet to be developed for this data.
# Temporal Methods Seminar
April 2013

---

## Progressive Profile

### Summary Analysis of Variance
Produced immediately after data collection

**Test Name:** Progressive Profiling  
**# of Evaluations:** 46 Per Group  
23 Combined from Both Groups

### Summary Results

Multiple Comparison Test Used: Tukey's HSD 0.05

<table>
<thead>
<tr>
<th>Attribute Title</th>
<th>time</th>
<th>p value</th>
<th>HSD value</th>
<th>950</th>
<th>227</th>
<th>648</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Flavor</td>
<td>1</td>
<td>0.06</td>
<td>9.96</td>
<td>50.78 a</td>
<td>41.15 a</td>
<td>41.91 a</td>
</tr>
<tr>
<td>Caramelized Flavor</td>
<td>1</td>
<td>0.07</td>
<td>10.51</td>
<td>36.87 a</td>
<td>33.46 ab</td>
<td>25.43 b</td>
</tr>
<tr>
<td>Dried Fruit Flavor</td>
<td>1</td>
<td>0.11</td>
<td>12.36</td>
<td>47.7 a</td>
<td>37.67 a</td>
<td>36.78 a</td>
</tr>
<tr>
<td>Nutty</td>
<td>1</td>
<td>0.1</td>
<td>11.23</td>
<td>52.39 a</td>
<td>42.13 a</td>
<td>45.26 a</td>
</tr>
<tr>
<td>Sweet</td>
<td>1</td>
<td>0.05</td>
<td>9.42</td>
<td>56.91 a</td>
<td>47.13 b</td>
<td>49.26 ab</td>
</tr>
<tr>
<td>Grain Flavor</td>
<td>2</td>
<td>0.45</td>
<td>11.97</td>
<td>47.65 a</td>
<td>44.63 a</td>
<td>40.43 a</td>
</tr>
<tr>
<td>Caramelized Flavor</td>
<td>2</td>
<td>0.17</td>
<td>8.45</td>
<td>32.61 a</td>
<td>32.54 a</td>
<td>26.22 a</td>
</tr>
<tr>
<td>Dried Fruit Flavor</td>
<td>2</td>
<td>0.39</td>
<td>14.49</td>
<td>40.65 a</td>
<td>38.11 a</td>
<td>31.52 a</td>
</tr>
<tr>
<td>Nutty</td>
<td>2</td>
<td>0.38</td>
<td>12.28</td>
<td>48.57 a</td>
<td>41.43 a</td>
<td>43.83 a</td>
</tr>
<tr>
<td>Sweet</td>
<td>2</td>
<td>0.1</td>
<td>9.02</td>
<td>49 a</td>
<td>43.72 ab</td>
<td>39.65 b</td>
</tr>
<tr>
<td>Grain Flavor</td>
<td>3</td>
<td>0.41</td>
<td>8.12</td>
<td>44.78 a</td>
<td>45.54 a</td>
<td>41.09 a</td>
</tr>
<tr>
<td>Caramelized Flavor</td>
<td>3</td>
<td>0</td>
<td>7.62</td>
<td>43.96 a</td>
<td>27.2 b</td>
<td>28.78 b</td>
</tr>
<tr>
<td>Dried Fruit Flavor</td>
<td>3</td>
<td>0.01</td>
<td>10.5</td>
<td>47.83 a</td>
<td>37.3 b</td>
<td>30.91 b</td>
</tr>
<tr>
<td>Nutty</td>
<td>3</td>
<td>0.2</td>
<td>8.3</td>
<td>45.57 a</td>
<td>44.43 a</td>
<td>39 a</td>
</tr>
<tr>
<td>Sweet</td>
<td>3</td>
<td>0</td>
<td>6.34</td>
<td>57.04 a</td>
<td>47.48 b</td>
<td>36.57 c</td>
</tr>
<tr>
<td>Grain Flavor</td>
<td>4</td>
<td>0.02</td>
<td>8.14</td>
<td>50.39 a</td>
<td>43.04 ab</td>
<td>39.35 b</td>
</tr>
<tr>
<td>Caramelized Flavor</td>
<td>4</td>
<td>0.01</td>
<td>8.23</td>
<td>39.09 a</td>
<td>32.17 ab</td>
<td>25.74 b</td>
</tr>
<tr>
<td>Dried Fruit Flavor</td>
<td>4</td>
<td>0.04</td>
<td>12.32</td>
<td>47.65 a</td>
<td>35.09 b</td>
<td>35.65 ab</td>
</tr>
<tr>
<td>Nutty</td>
<td>4</td>
<td>0.02</td>
<td>9.71</td>
<td>44.22 a</td>
<td>45.09 a</td>
<td>33.83 b</td>
</tr>
<tr>
<td>Sweet</td>
<td>4</td>
<td>0.01</td>
<td>12.32</td>
<td>47.65 a</td>
<td>43.39 ab</td>
<td>40.04 b</td>
</tr>
<tr>
<td>Grain Flavor</td>
<td>5</td>
<td>0.57</td>
<td>8.21</td>
<td>50.39 a</td>
<td>42.04 a</td>
<td>38.57 a</td>
</tr>
<tr>
<td>Caramelized Flavor</td>
<td>5</td>
<td>0.04</td>
<td>8.69</td>
<td>32.43 a</td>
<td>25.83 ab</td>
<td>21.91 b</td>
</tr>
<tr>
<td>Dried Fruit Flavor</td>
<td>5</td>
<td>0.02</td>
<td>11.27</td>
<td>33.43 a</td>
<td>20.7 b</td>
<td>20.91 b</td>
</tr>
<tr>
<td>Nutty</td>
<td>5</td>
<td>0.42</td>
<td>11.53</td>
<td>35.91 a</td>
<td>35.46 a</td>
<td>29.7 a</td>
</tr>
<tr>
<td>Sweet</td>
<td>5</td>
<td>0.01</td>
<td>10.58</td>
<td>41.52 a</td>
<td>36.26 ab</td>
<td>25.96 b</td>
</tr>
</tbody>
</table>
# Progressive Profile

The Blue Group (950 vs 227) and the Red Group (648 vs 227)

<table>
<thead>
<tr>
<th>BLUE</th>
<th>Only evaluated 950 and 227</th>
<th>RED</th>
<th>Only evaluated 648 and 227</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attribute Title</td>
<td>950</td>
<td>227</td>
</tr>
<tr>
<td>1 Grain Flavor</td>
<td>50.78</td>
<td>41.15</td>
<td>0.43</td>
</tr>
<tr>
<td>1 Caramelized Flavor</td>
<td>36.87</td>
<td>33.46</td>
<td>0.80</td>
</tr>
<tr>
<td>1 Dried Fruit Flavor</td>
<td>47.7</td>
<td>37.67</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>1 Nutty</td>
<td>52.39</td>
<td>42.13</td>
</tr>
<tr>
<td></td>
<td>1 Sweet</td>
<td>56.91</td>
<td>47.13</td>
</tr>
<tr>
<td>2 Grain Flavor</td>
<td>47.65</td>
<td>44.63</td>
<td>0.82</td>
</tr>
<tr>
<td>2 Caramelized Flavor</td>
<td>32.61</td>
<td>32.54</td>
<td>0.22</td>
</tr>
<tr>
<td>2 Dried Fruit Flavor</td>
<td>40.65</td>
<td>38.11</td>
<td>0.88</td>
</tr>
<tr>
<td>2 Nutty</td>
<td>48.57</td>
<td>41.43</td>
<td>0.13</td>
</tr>
<tr>
<td>2 Sweet</td>
<td>49</td>
<td>43.72</td>
<td>0.79</td>
</tr>
<tr>
<td>3 Grain Flavor</td>
<td>44.78</td>
<td>45.54</td>
<td>0.20</td>
</tr>
<tr>
<td>3 Caramelized Flavor</td>
<td>43.96</td>
<td>27.2</td>
<td>0.00</td>
</tr>
<tr>
<td>3 Dried Fruit Flavor</td>
<td>47.83</td>
<td>37.3</td>
<td>0.04</td>
</tr>
<tr>
<td>3 Nutty</td>
<td>45.57</td>
<td>44.43</td>
<td>0.89</td>
</tr>
<tr>
<td>3 Sweet</td>
<td>57.04</td>
<td>47.48</td>
<td>0.54</td>
</tr>
<tr>
<td>4 Grain Flavor</td>
<td>50.39</td>
<td>43.04</td>
<td>0.24</td>
</tr>
<tr>
<td>4 Caramelized Flavor</td>
<td>39.09</td>
<td>32.17</td>
<td>0.81</td>
</tr>
<tr>
<td>4 Dried Fruit Flavor</td>
<td>47.65</td>
<td>35.09</td>
<td>0.11</td>
</tr>
<tr>
<td>4 Nutty</td>
<td>44.22</td>
<td>45.09</td>
<td>0.72</td>
</tr>
<tr>
<td>4 Sweet</td>
<td>50.3</td>
<td>43.39</td>
<td>0.08</td>
</tr>
<tr>
<td>5 Grain Flavor</td>
<td>39.91</td>
<td>42.04</td>
<td>0.23</td>
</tr>
<tr>
<td>5 Caramelized Flavor</td>
<td>32.43</td>
<td>25.83</td>
<td>0.18</td>
</tr>
<tr>
<td>5 Dried Fruit Flavor</td>
<td>33.43</td>
<td>20.7</td>
<td>0.18</td>
</tr>
<tr>
<td>5 Nutty</td>
<td>35.91</td>
<td>35.46</td>
<td>0.71</td>
</tr>
<tr>
<td>5 Sweet</td>
<td>41.52</td>
<td>36.26</td>
<td>0.82</td>
</tr>
</tbody>
</table>
Progressive Profile

BLUE

Nutty Flavor

RED

Nutty Flavor

E18 on Sensory Evaluation of Materials and Products

Temporal Methods Seminar
April 2013
Two Controls (227) plotted together.
Preliminary Conclusions

• Both options, 950 and 648, show significant differences from sample 227.

• Sample 227 in both Red and Blue groups show great similarity in all attributes at all time points.

• Sample 648 appears to be the closer option given that the only significantly different attribute was Nutty at time point 4.
TDS - Temporal Dominance

TDS Conclusions

Sarah Kirkmeyer  
John Castura  

Givaudan Flavors  
Compusense
Objectives of TDS Evaluation

• To understand if the temporal profile has been affected by the reformulation of the E18 bar, and
• To identify a formulation option that more closely matches the Control bar. That is, among the two pairs, does one sample more closely match 227?
  – Group 1: 227 vs. 648
  – Group 2: 227 vs. 950
TDS - Temporal Dominance

Raw TDS Responses - Product 950

Time (seconds)

0 10 20 30 40 50

Nutty Flavor
Caramelized Flavor
Grain Flavor
Dried Fruit Flavor
Sweet
Grain Flavor

b04b (1)
b01x (1)
a08e (1)
a07r (1)
a06t (1)
a05y (1)
a04u (1)
a03i (1)
a02k (1)
a01p (1)
Training Conclusions

• Focus on:
  – Panelists indicating first attribute of dominance immediately upon perception
  – Chewing/swallowing procedure and evaluating dominance at the same time
  – Clarity between attributes – nutty vs. grainy and sweet vs. caramelized especially as they may overlap
  – Agreement among panelists regarding changes in dominant attribute – how many is expected
TDS – Temporal Dominance

TDS Panel Average (smoothed data) - Product 950

- Caramelized Flavor
- Dried Fruit Flavor
- Grain Flavor
- Nutty Flavor
- Sweet

Time (seconds)
Dominance (rate)
Chance
Significance

Temporal Methods Seminar
April 2013
TDS Blue Group Results

• During 20 second chew:
  – 227 showed dominance progression of Grain → Nutty → Caramelized
  – 950 not clear for Grain initially, co-dominant with Sweet then → Caramelized → Nutty

• After swallow at 20 sec, 950 dominant for dried fruit and might consider lack of training or effect of heterogeneous product for 227 not showing dominance for Dried Fruit versus Sweet

• 227 showed Sweet and Grain linger, 950 showed Caramelized and Grain linger
TDS Red Group Results

• Chewing occurred for 20 Seconds, during that time:
  – Both samples initially showed significance for Grain followed by Nutty
  – 648 dominance for Nutty closer to the swallow at 20 sec.
• After swallow, both samples dominant for dried fruit
  – Then 648 dominant changed quickly in dominance Grain ➔ Sweet ➔ Nutty however 227 dominant for Grain ➔ Nutty
• Both samples lingered with significant Grain
Preliminary Conclusions

• Both 648 and 950 show differences in TDS dominance profile versus 227
• Due to lack of training and replicate evaluations, data might not be stable enough to draw firm conclusions
Temporal Order of Sensations

Session Leaders:
Suzanne Pecore
Peter Love

General Mills Inc
Compusense Inc
Objectives of TOS Study

• To understand if the temporal profile has been affected by the reformulation of the E18 bar, and
• To identify a formulation option that more closely matches the Control bar. That is, among the two pairs, does one sample more closely match 227?
  – Group 1: 227 vs. 648
  – Group 2: 227 vs. 950
Proportion Appearing First

- This plot helps to quickly see if differences were observed in the up-front attribute.
- Further data analyses can be focused among those attributes appearing above chance.
Proportion Appearing First

**Group 1: 227 vs. 648**

- Grain flavor appears first across the eating experience in both bars.
- 227 shows some Sweet and Nutty appearing first for a few panelists.
- 648 shows Nutty appearing first in the 2\textsuperscript{nd} bite, and Dried Fruit in aftertaste for some panelists.

*Note: Data from untrained panelists attending seminar.*
Proportion Appearing First

Group 2: 227 vs. 950

- 950 shows more Caramelized in first two bites, and a strong hit of Grain flavor by the 3rd bite. 227 shows some Sweet in 2nd bite.
- Nutty is other attribute appearing above chance in both bars.

Note: Data from untrained panelists attending seminar.
Weighted Order of Occurrence

• This plot shows calculated score for each bite, with higher rating indicating earlier appearance for that attribute.
  – For each panelist and each bite, the attribute appearing 1st is assigned a ‘3’ in value, the attribute appearing 2nd = a ‘2’, and the attribute appearing 3rd = a ‘1’.
  – For each attribute at each bite, these values are averaged to create the Weighted Order of Occurrence score.

• This weighted score can also be subjected to standard statistical analyses used with descriptive panel data, such as analysis of variance.
Weighted Order of Occurrence

Group 1: 227 vs. 648

- Grain and Nutty appear early in both products across bites.
- Key differences are appearance of Sweet in 227 bar (*significant sample effect in ANOVA*), and Dried Fruit in 648 at 3rd Bite.

*Note: Data from *untrained* panelists attending seminar.*
Sweet TOS Plot

*Group 1: 227 vs. 648*

- Plot illustrates the earlier appearance of Sweet Taste in 227 across all three bites and greater intensity in the aftertaste.

*Note: Data from untrained panelists attending seminar.*
Weighted Order of Occurrence

**Group 2: 227 vs. 950**

- Similar to other pair, Grain and Nutty appear early in both products.
- Key difference is appearance of Caramelized in 950 bar (*significant sample effect in ANOVA*).

**Note:** Data from *untrained* panelists attending seminar.
Caramelized TOS Plot

**Group 2: 227 vs. 950**

- Plot illustrates the earlier appearance of Caramelized in 950 across all three bites and greater intensity in the aftertaste.

*Note: Data from untrained panelists attending seminar.*
Preliminary Conclusions

• Both options, 648 and 950, show TOS differences from sample 227.
• Due to lack of training among these panelists, data might not be stable enough to draw firm conclusions.
Project Objective

• The E18 Snack Bar is being reformulated to improve its health credentials.

• Goal is to match the sensory characteristics of the current E18 Bar as closely as possible.

• How well did the each of the methods answer the question?

• Please draw your own conclusions.
Observations

• All temporal methods require training and practice to deliver optimal results.

• Each method provided unique temporal information that demonstrated difference amongst the products.

• The data collected in this seminar represent examples for illustrative purposes and do not represent data obtained from well-trained and experienced panelists.
Flip Charts for the Breakout Rooms

Please note, these are transposed verbatim and would probably benefit from discussion and clear attribution. I cannot be certain which method is being referred to in all cases.

1. Progressive Profiling
   a. Needed spot for “Other”; plastic note in 227
   b. A bit of delay in loading data. Love you can go back and change rating
   c. During one Eval the screen froze, so invalid data (since while waiting expectorated etc.)
   d. Yes. Where is “Other” – cardboard
   e. Slow screen transition time could lead to faulty conclusions
   f. Due to quick dissolution, technique may not fit to product form.
   g. Bars very similar in taste & texture, so differentiation not apparent during the test
   h. Memory may affect the rating
   i. The accumulating may lead to a different 1<sup>st</sup> and 2<sup>nd</sup> bite.
   j. Be very careful if want to use with untrained/consumers. Need to learn protocol.
   k. Hard to have part left to expectorate because eval time longer.
   l. Time transitions were too long – product disintegrated
   m. Clearer instructions
   n. Found additional flavors- Not able to express fully descriptive experience.

2. T OS
   a. Expectorate/swallow need discussion (per objective)
   b. No rinsing between smp (unused to)
   c. Influenced by visual cues (nut=nutty;sticky=sweet)
   d. Pre-portioning helpful/important
   e. Lag time from perception to recording
   f. Frustrated – not able to show intensity diffs (even tho doing D.A. separately)
   g. 2 Aftertastes – couldn’t show
   h. Aftertaste timing by computer good.

3. TDS
   a. Can’t capture 2 simultaneously
   b. Time between clips good to capture
   c. Reps and panelists with such variable products
   d. Profiling and clock captures it all
   e. Rapid – no time to think
   f. Need to consume more in TOS
   g. Can see bite-to-bite diffs
   h. Other is not consistent among panelists ➔ thus, NSD
   i. Aftertaste dependent on the 4<sup>th</sup> bite
   j. Does it work with very dominant flavor?