Image-Based Profiling for Product Improvement and Optimization

Gaewalin O. Ricklefs
Kraft Foods Inc., North America
**Background**
- What is Image-Based Profiling?
- Why use it?

**Procedures**
- Prior to testing sessions
- At testing sessions

**Results**
- Flavor/Texture Spider Plots
- Data from Correspondence Analysis and Preference Mapping

**Conclusions**
- Implication for your projects
What is Image-Based Profiling?

- Image-Based Profiling is a quantitative tool used to broaden how consumers describe and differentiate products via the use of images.
- This technique was adapted from Image Product Profiling used by Kraft Foods in Munich.
- Visual schemes serve as a bridge between the consumers’ thinking process and sensory perception of products.
Why Image-Based Profiling?

- Previous studies have shown that consumers may have difficulty using words to describe product characteristics.
- Consumer Science wanted to provide direction on flavor and texture improvement in order to help R&D and flavor suppliers with their formulation by
  - understanding how consumers describe flavor and texture attributes of product via the use of Image-Based Profiling.
  - quantifying and characterizing products based on consumer defined descriptors.
  - generating a set of consumer-relevant descriptors for products.

Samples:

- Our current products
- Competitor products
Image-Based Profiling Process: prior to the consumer testing sessions

Select team members
- Product Developers
- Consumer/Sensory Scientists
- Flavor Researcher
- Culinary Research Chef
- (Imaging Lab)
- (Consumer Insights/Marketing)
- (Flavor Supplier)

Product tasting + Brainstorming
- Generate a list of suitable images by keywords
- Go wide, think as the targeted consumer
- Consider similar products
- Avoid images of usage occasions/ target occasions- needs to focus on product + sensory attributes
- Taste varieties of products and select products for CLT

Image pre-selection
- Subscribe to a website and select images based on the created list of keywords (or have Imaging Lab do search)
- On-going tracking of this list will aid tagging and review

Review meetings
- 2 meetings: pre-selection screening + finalization
- About 70 images

Develop online questionnaire
- Download images (if applicable)
- Uniformity of size, quality, and resolution of selected images
- Test out the online questionnaire

Make sure image set covers all possible attribute dimensions, yet keep focus on specific research objectives.
Rule of Thumb: 70 images per study are about maximum; use no fewer than 50
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Image Screening

• It is more difficult to select an image for some sensory terms…
  – An example of a texture term:

• While other sensory terms have a more direct association with an image…
  – An example of a flavor term:
Image-Based Profiling Process: at the consumer testing sessions

Product Tasting + Image Selection

An example of selected images for a sample from one consumer.
Image-Based Profiling Process: at the consumer testing sessions (cont.)

- Descriptive analysis of the same products with sensory panelists
- Data analyses: Correspondence Analysis and Preference Mapping

In the spaces provided, please provide up to three descriptions or associations of what this image means to you!

1:1 Exit Interviews – optional (extra learnings)
Does the picture represent a flavor of this sample?
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Does the picture represent a flavor of this sample?
Does the picture represent a flavor of this sample?
You selected the picture below:

In the spaces provided, please provide up to three descriptions or associations of what this image means to you!

brothy
soup
savory
Results

• 245 terms were used by consumers to describe the flavor and texture of the tested products.

• Correspondence Analysis was used to analyze similarities between consumers’ descriptors based on Euclidean distances.

• 245 terms → 60 flavor terms and 32 texture terms.

• The differences between each pair of the products were determined by t-test.

• The results from consumers were overlaid with the descriptive analysis results to guide product optimization.
Flavor Comparison between Two Tested Samples

* significantly different at $p \leq 0.05$
** directionally different at $0.05 \leq p \leq 0.10$
*** directionally different at $0.10 \leq p \leq 0.20$

in % | n=95
Examples of Pictures used by Consumers to Describe Flavor and Texture of Products

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<thead>
<tr>
<th>Picture</th>
<th>Counts over all samples</th>
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<td><img src="image22.png" alt="Image" /></td>
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</table>
Pictures associated with Flavor Descriptors from Consumers

PC1: 50 % explained variance
PC2: 20 % explained variance

Dos
- flavor 2, flavor 3, flavor 4, flavor 5, flavor 6, flavor 7, flavor 8, flavor 9, flavor 10, flavor 11, flavor 12, flavor 13, flavor 14, flavor 15, flavor 16, flavor 17, flavor 18, flavor 19

Don’ts
- flavor 26, flavor 27, flavor 28, flavor 29, flavor 30, flavor 31, flavor 32, flavor 33, flavor 34, flavor 35, flavor 36, flavor 37, flavor 38, flavor 39, flavor 40, flavor 41, flavor 42, flavor 43, flavor 44, flavor 45, flavor 46, flavor 47, flavor 48, flavor 49, flavor 50, flavor 51, flavor 52, flavor 53, flavor 54, flavor 55, flavor 56, flavor 57

Consumer Language
- flavor 2, flavor 3, flavor 4, flavor 5, flavor 6, flavor 7, flavor 8, flavor 9, flavor 10, flavor 11, flavor 12, flavor 13, flavor 14, flavor 15, flavor 16, flavor 17, flavor 18, flavor 19, flavor 20, flavor 21, flavor 22, flavor 23, flavor 24, flavor 25, flavor 26, flavor 27, flavor 28, flavor 29, flavor 30, flavor 31, flavor 32, flavor 33, flavor 34, flavor 35, flavor 36, flavor 37, flavor 38, flavor 39, flavor 40, flavor 41, flavor 42, flavor 43, flavor 44, flavor 45, flavor 46, flavor 47, flavor 48, flavor 49, flavor 50, flavor 51, flavor 52, flavor 53, flavor 54, flavor 55, flavor 56, flavor 57
Pictures associated with Flavor Descriptors from Consumers + Descriptive Data from Sensory Panelists

- Descriptive Panel
  - Dos
    - Consumer Language: flavor 2, flavor 3, flavor 4, flavor 5, flavor 6, flavor 7, flavor 8, flavor 9, flavor 10, flavor 11, flavor 12, flavor 13, flavor 14, flavor 15, flavor 17, flavor 18, flavor 19
  - Don’ts
    - flavor 57, flavor 56, flavor 55, flavor 43, flavor 42, flavor 34

- Flavor Descriptors
  - flavor 1, flavor 2, flavor 3, flavor 4, flavor 5, flavor 6, flavor 7, flavor 8, flavor 9, flavor 10, flavor 11, flavor 12, flavor 13, flavor 14, flavor 15, flavor 17, flavor 18, flavor 19, flavor 20, flavor 21, flavor 22, flavor 23, flavor 24, flavor 25, flavor 26, flavor 27, flavor 28, flavor 29, flavor 30, flavor 31, flavor 32, flavor 33, flavor 34, flavor 35, flavor 36, flavor 37, flavor 38, flavor 39, flavor 40, flavor 41, flavor 42, flavor 43, flavor 44, flavor 45, flavor 46, flavor 47, flavor 48, flavor 49, flavor 50, flavor 51, flavor 52, flavor 53, flavor 54, flavor 55, flavor 56, flavor 57

- PC1: 50% explained variance
- PC2: 20% explained variance
Pictures associated with Texture Descriptors from Consumers

- **PC1**: 65% explained variance
- **PC2**: 16% explained variance

**Dos**
- Consumer Language: texture 9, texture 10, texture 11, texture 12, texture 13, texture 14, texture 15, texture 17, texture 18, texture 19

**Don’ts**
- texture 32, texture 27, texture 26, texture 25, texture 24, texture 22, texture 21
Pictures associated with Texture Descriptors from Consumers

+ Descriptive Data from Sensory Panelists

PC1: 65% explained variance
PC2: 16% explained variance

Dos

<table>
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<td>Dos: descriptor 3, descriptor 4, descriptor 5, descriptor 6, descriptor 7, descriptor 9</td>
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Don’ts

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<td></td>
<td>Descriptive Panel</td>
<td>Don’ts: descriptor 9</td>
</tr>
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</table>
Recommendations for the Team

Based on consumer descriptions and sensory intensities to improve the flavor of the product we need to

- attribute 1
- attribute 2
- attribute 3
- attribute 4
- attribute 5
- attribute 6
- attribute 7
- attribute 12
- attribute 13
- attribute 14
- attribute 11

Descriptive Data from Kraft’s Sensory Panel

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<tr>
<th></th>
<th>Attribute 1</th>
<th>Attribute 2</th>
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<tr>
<td>Competitive Product 1</td>
<td>3.1</td>
<td>1.2</td>
<td>1.1</td>
<td>1.9</td>
<td>4.0</td>
<td>4.2</td>
<td>2.7</td>
<td>0.6</td>
<td>0.2</td>
<td>0.0</td>
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<tr>
<td>Competitive Product 2</td>
<td>3.5</td>
<td>2.0</td>
<td>2.3</td>
<td>3.3</td>
<td>3.5</td>
<td>3.7</td>
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<tr>
<td>Competitive Product 3</td>
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<td>2.5</td>
<td>1.0</td>
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<td>1.6</td>
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How to beat the competitor!
Increase all these flavor attributes in our products

Attribute 1

Attribute 2

Attribute 3

Attribute 4

Attribute 5

Attribute 6

Attribute 7

Attribute 12

Attribute 13

Attribute 14
Why Image-Based Profiling?

- Previous studies have shown that consumers may have difficulty using words to describe products characteristics.

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Consumer Texture 3 and Descriptive 7 have never been asked in CLT questionnaires.
Conclusions

• Image-Based Profiling provides more specific direction for product improvement and optimization compared to typical quantitative and qualitative consumer studies by expanding consumers’ ability to describe flavor and texture attributes of products.

• Results from this study were shared with R&D and flavor suppliers to guide flavor development in product optimization.
Special Thanks

- Toshiba Traynham-Jackson
- Deborah Barber
- Whitney Snow
- Keith Forneck
- Linda Finger
- Lori Rothman
- Cathy Kermarrec
- Heike Schmidtke-Reifer
- Karima Moussaouï
- Dariah Lutsch from isi GmbH & Co.
Thank you.

For questions: 

gaewalin.ricklefs@kraftfoods.com

+1 (608) 285-4099
## Descriptors used for Flavor Description

<table>
<thead>
<tr>
<th>Final Code</th>
<th>Consumer Language</th>
</tr>
</thead>
<tbody>
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<td>F: brothy</td>
<td>brothy, soup, savory, broth, broth like flavor</td>
</tr>
<tr>
<td>F: burnt/scorched</td>
<td>burnt, scorched, ash, bacon, earthy flavor, hot dog, burning, open flame</td>
</tr>
<tr>
<td>F: charred/grilled</td>
<td>wood fire taste, grilled, barbecue, summer time, open flamed, grilling, grill</td>
</tr>
<tr>
<td>F: fresh</td>
<td>citrus flavored, salad, refreshing, lemon, garden, grapefruit, fresh, tastes fresh, freshness, freshly made, fruit, orange</td>
</tr>
<tr>
<td>F: metallic</td>
<td>bronze, out of the can, iron, tinny, tin flavor, metallic taste, taste like out of a tin/can, canned, copper</td>
</tr>
<tr>
<td>F: old/aged</td>
<td>musty, old, aged, left over, expire</td>
</tr>
<tr>
<td>F: sweet</td>
<td>maple, syrup, honey, caramel, brown sugar, sugar, sweet maple flavor, sweet taste/sweet flavor</td>
</tr>
<tr>
<td>F: variety</td>
<td>variety, many different flavors</td>
</tr>
<tr>
<td>F: vegetables</td>
<td>celery, carrot, veggies, vegetable flavor, tomato</td>
</tr>
</tbody>
</table>
### Descriptors used for Texture Description

<table>
<thead>
<tr>
<th>Final Code</th>
<th>Consumer Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>T: natural</td>
<td>real, natural, organic, pure</td>
</tr>
<tr>
<td>T: nice/good</td>
<td>good, good texture, good quality, pleasant, loveable, fine, perfect, enjoyable, appealing</td>
</tr>
<tr>
<td>T: raw</td>
<td>raw, medium rare</td>
</tr>
<tr>
<td>T: sandy/gritty</td>
<td>gritty, sandy, dusty, crumbly, stony</td>
</tr>
<tr>
<td>T: slimy</td>
<td>mushy, slimy</td>
</tr>
<tr>
<td>T: smooth/silky</td>
<td>sleek, smooth, silky, not tough, melts in mouth, satiny</td>
</tr>
<tr>
<td>T: springy/rubbery</td>
<td>rubbery, gummy, springy</td>
</tr>
<tr>
<td>T: wet</td>
<td>waterish, liquid, wet, fluid</td>
</tr>
</tbody>
</table>