

Image-Based Profiling for Product Improvement and Optimization

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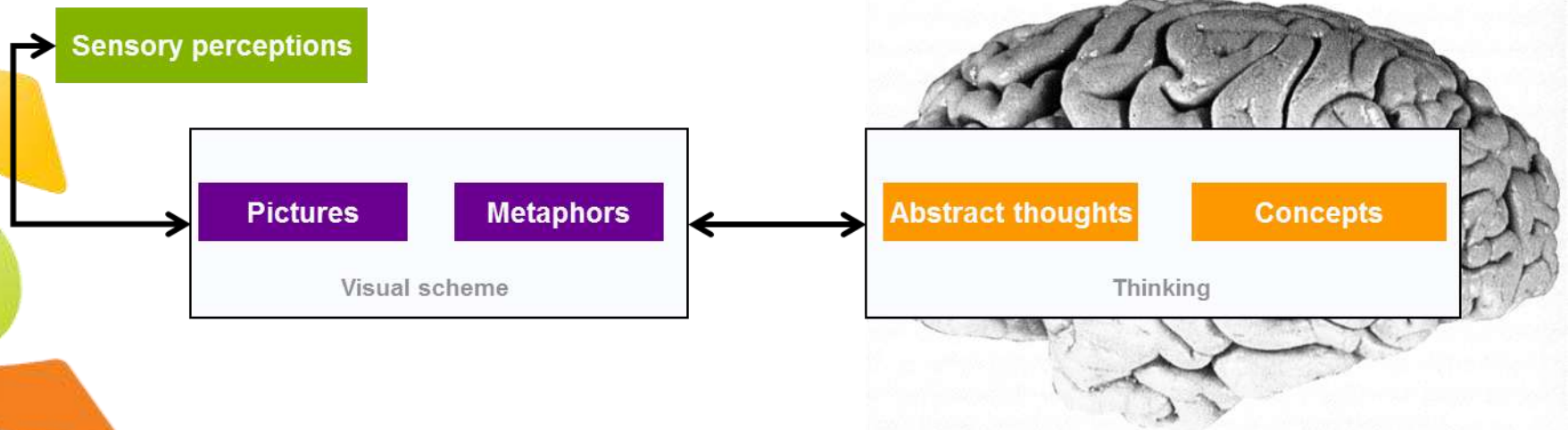
- Flavor/Texture Spider Plots
- Data from Correspondence Analysis and Preference Mapping

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- 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- 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:

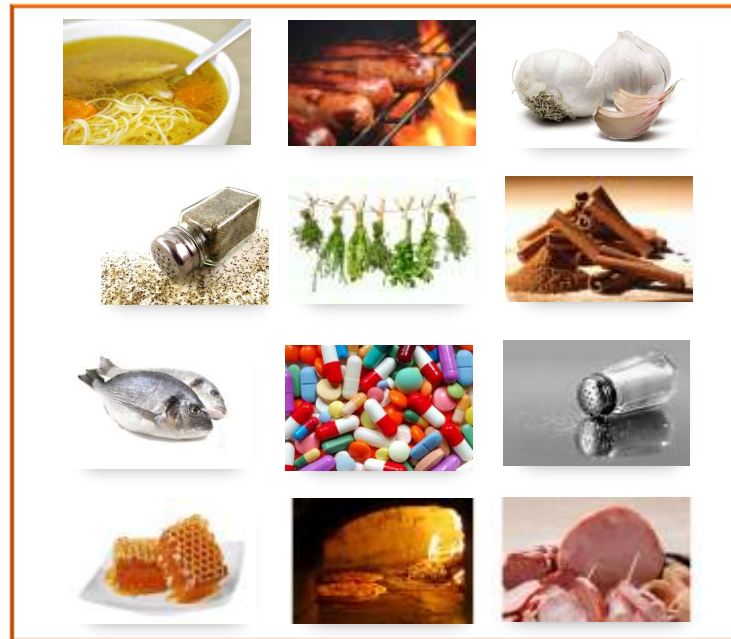


- While other sensory terms have a more direct association with an image...
 - An example of a flavor term:



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.)

Image + Product Description

You selected the picture below:



1:1 Exit Interviews –
optional
(extra learnings)

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

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

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Does the picture represent a flavor of this sample?



YES

NO

Screen | Image interpretation

You selected the picture below:



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

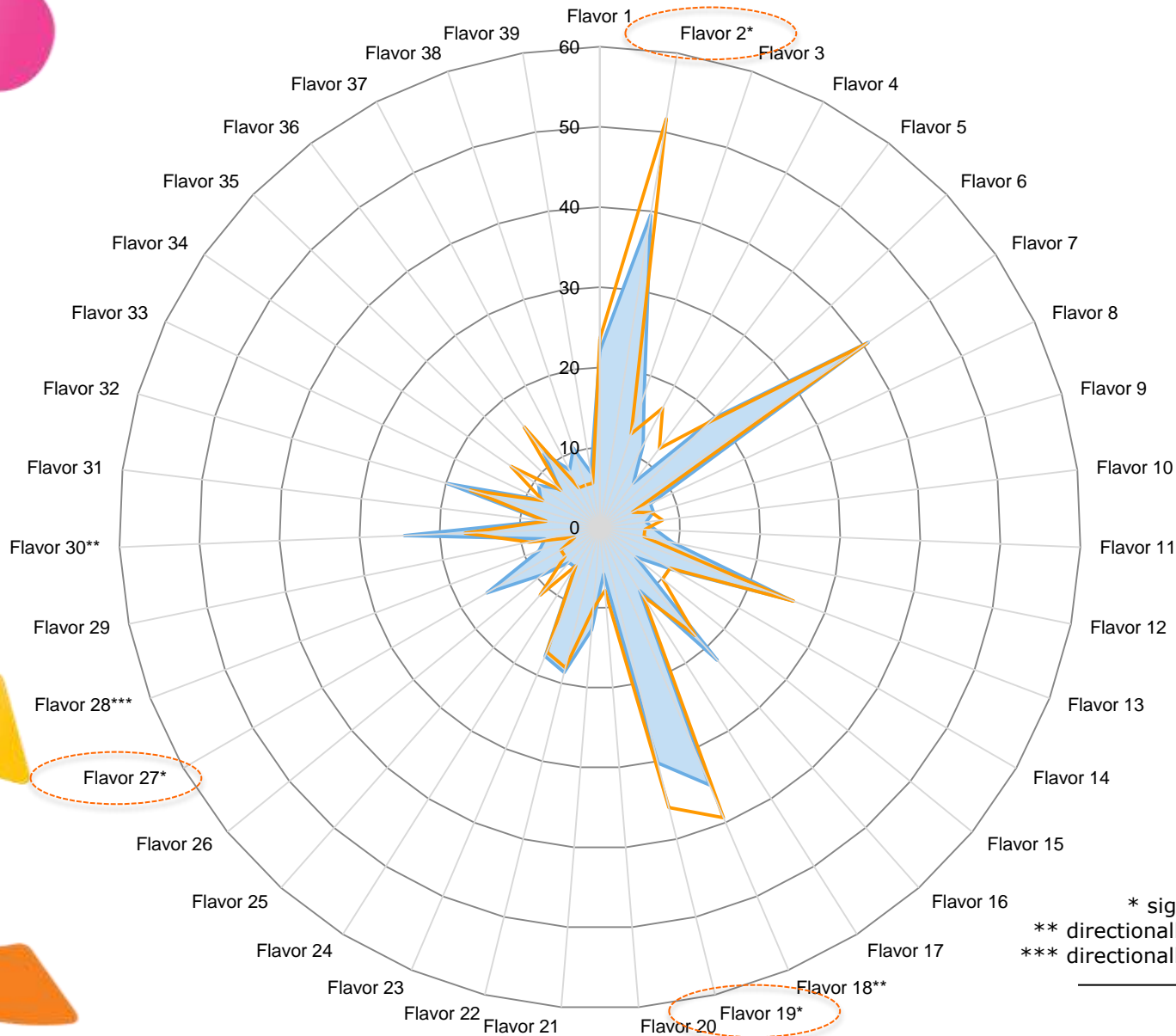
NEXT »

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



■ Sample A
■ Sample B

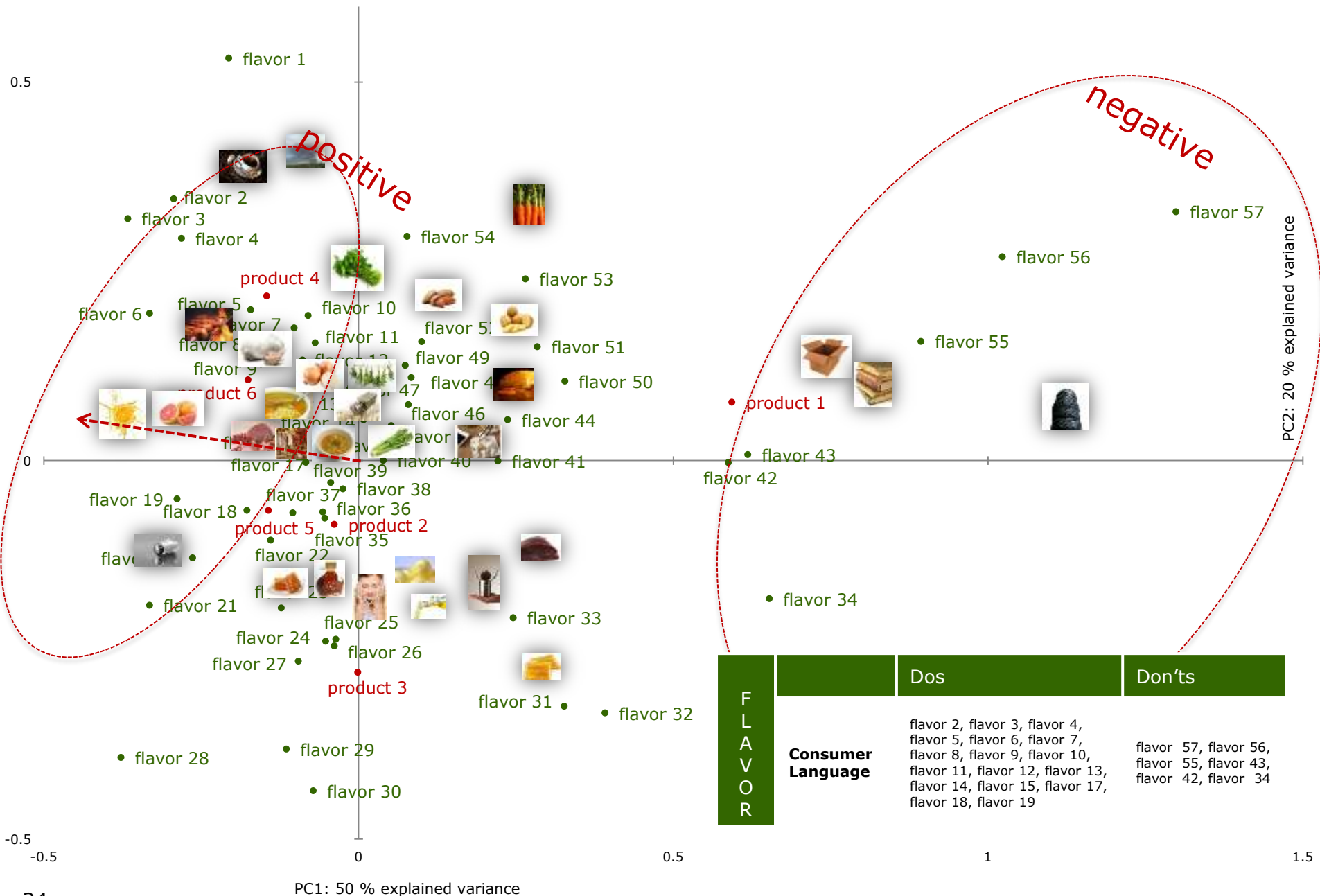
* significantly different at $p \leq 0.05$
 ** directionally different at $0.05 \leq p \leq 0.10$
 *** directionally different at $0.10 \leq p \leq 0.20$

Examples of Pictures used by Consumers to Describe Flavor and Texture of Products

Picture	Counts over all samples
	31
	96
	88
	123
	146
	13
	12
	133
	124
	109
	17
	208

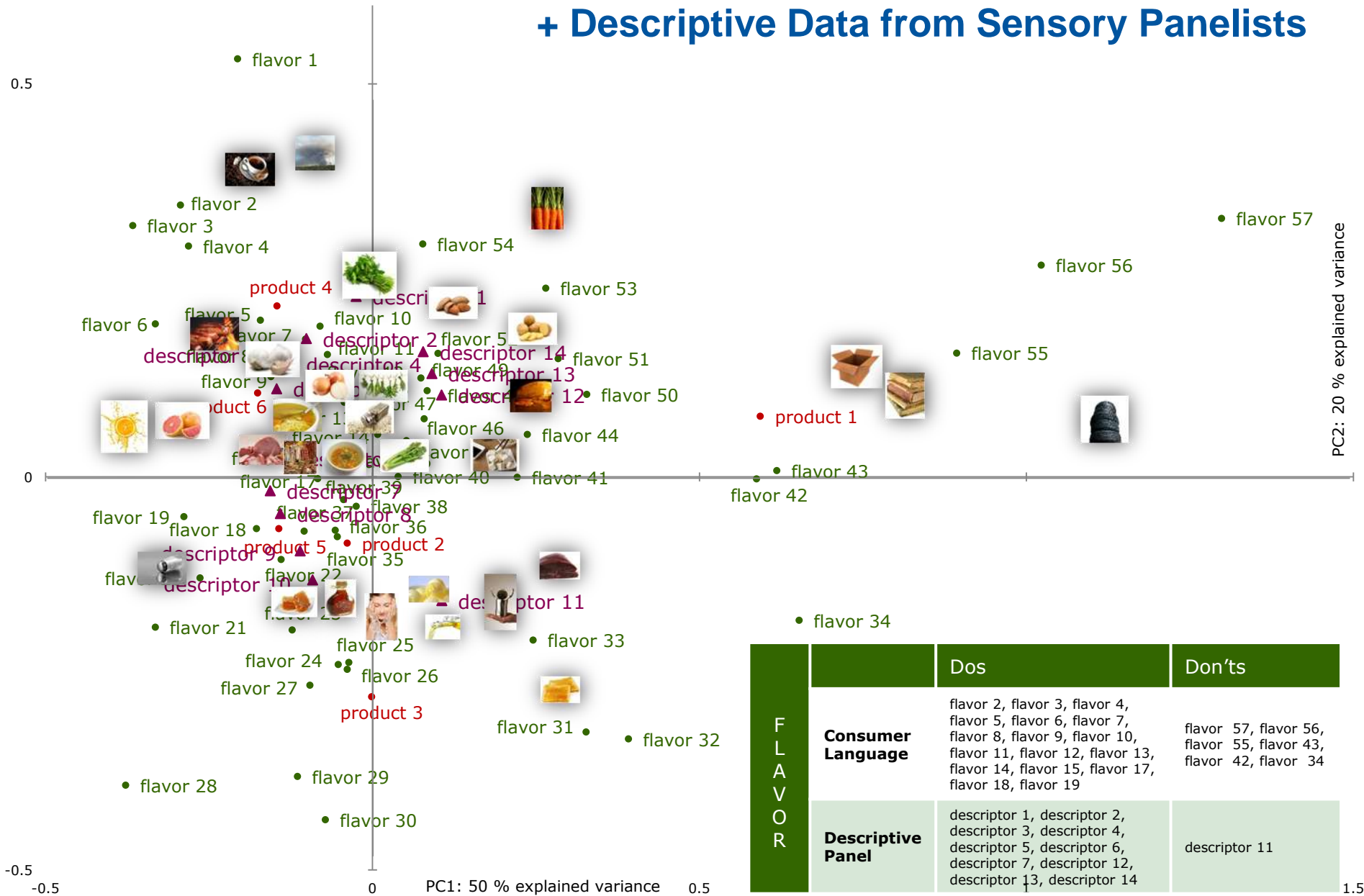
Picture	Counts over all samples
	46
	113
	15
	183
	47
	10
	58
	87
	74
	46

Pictures associated with Flavor Descriptors from Consumers



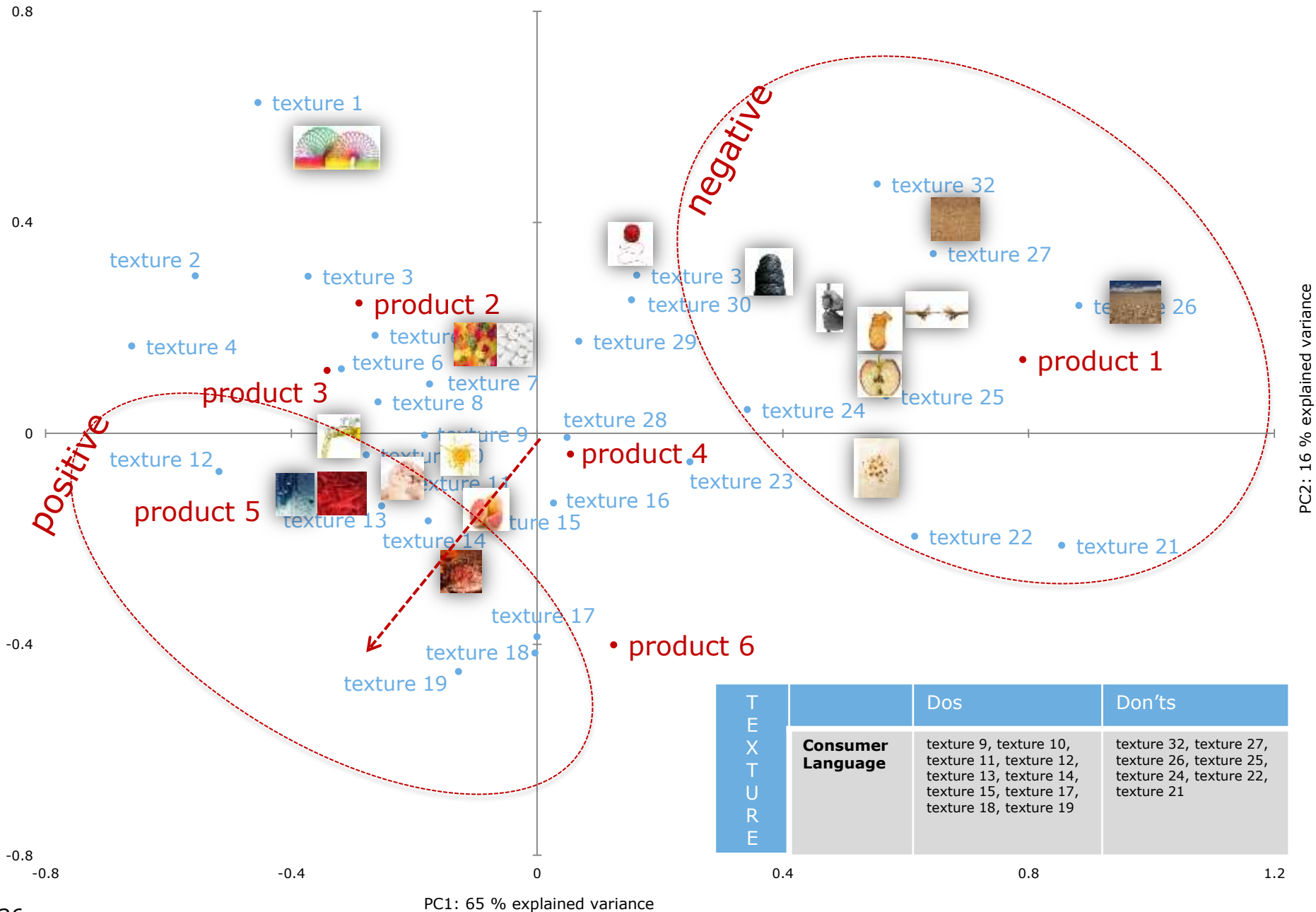
Pictures associated with Flavor Descriptors from Consumers

+ Descriptive Data from Sensory Panelists



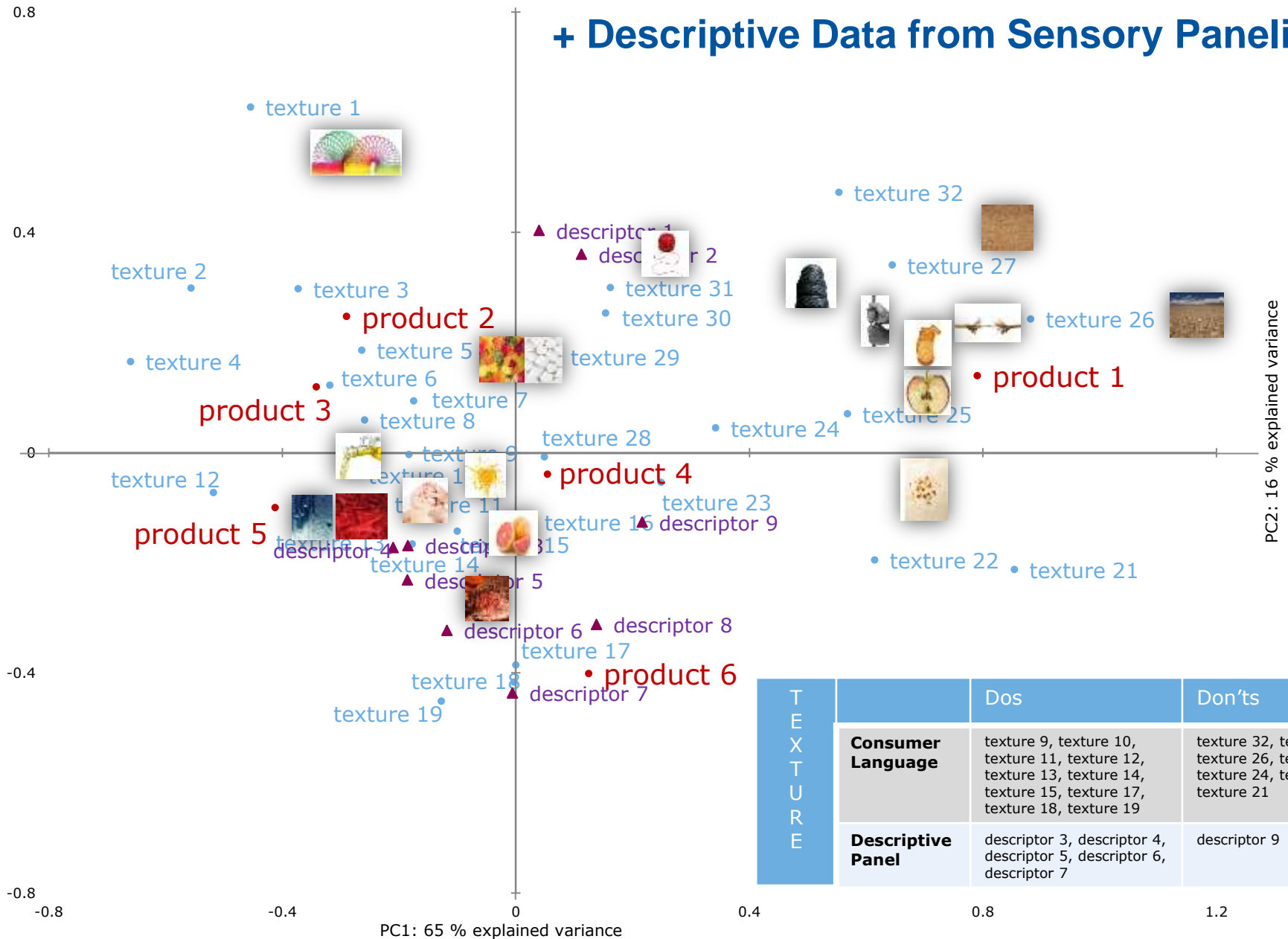
FLAVOR		Dos	Don'ts
	Consumer Language		flavor 2, flavor 3, flavor 4, flavor 5, flavor 6, flavor 7, flavor 8, flavor 9, flavor 10, flavor 11, flavor 12, flavor 13, flavor 14, flavor 15, flavor 17, flavor 18, flavor 19
Descriptive Panel		descriptor 1, descriptor 2, descriptor 3, descriptor 4, descriptor 5, descriptor 6, descriptor 7, descriptor 12, descriptor 13, descriptor 14	descriptor 11

Pictures associated with Texture Descriptors from Consumers



Pictures associated with Texture Descriptors from Consumers

+ Descriptive Data from Sensory Panelists



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 and attribute 14

↓ attribute 11

Descriptive Data from Kraft's Sensory Panel

	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5	Attribute 6	Attribute 7	Attribute 12	Attribute 13	Attribute 14	Attribute 11
Competitive Product 1	3.1	1.2	1.1	1.9	4.0	4.2	2.7	0.6	0.2	0.0	0.9
Competitive Product 2	3.5	2.0	2.3	3.3	3.5	3.7	3.0	0.3	0.1	0.1	0.9
Our Product	2.8	1.9	1.1	1.6	3.3	1.3	3.7	1.2	0.0	0.1	0.9
Competitive Product 3	2.4	1.5	0.3	1.4	2.5	1.0	3.5	1.0	0.0	0.1	1.7
Our Product	1.8 ↑	0.8 ↑	0.2 ↑	0.6 ↑	2.1 ↑	1.3 ↑	3.3 ↑	1.1 ↑	0.1 ↑	0.0 ↑	1.7 ↓
Competitive Product 4	1.5	0.5	1.1	0.6	4.6	6.2	1.2	0.1	0.0	0.0	1.6

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



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Comparison of Flavor Terms/Descriptors used by 3 Different Panels

Image-Based Profiling			Kraft Descriptive Panel	Central Location Testing Questionnaire
Consumer Flavor 1	Consumer Flavor 27	Consumer Flavor 53	Descriptive 1	CLT 1
Consumer Flavor 2	Consumer Flavor 28	Consumer Flavor 54	Descriptive 2	CLT 2
Consumer Flavor 3	Consumer Flavor 29	Consumer Flavor 55	Descriptive 3	CLT 3
Consumer Flavor 4	Consumer Flavor 30	Consumer Flavor 56	Descriptive 4	CLT 4
Consumer Flavor 5	Consumer Flavor 31	Consumer Flavor 57	Descriptive 5	CLT 5
Consumer Flavor 6	Consumer Flavor 32	Consumer Flavor 58	Descriptive 6	CLT 6
Consumer Flavor 7	Consumer Flavor 33	Consumer Flavor 59	Descriptive 7	CLT 7
Consumer Flavor 8	Consumer Flavor 34	Consumer Flavor 60	Descriptive 8	CLT 8
Consumer Flavor 9	Consumer Flavor 35		Descriptive 9	CLT 9
Consumer Flavor 10	Consumer Flavor 36		Descriptive 10	CLT 10
Consumer Flavor 11	Consumer Flavor 37		Descriptive 11	CLT 11
Consumer Flavor 12	Consumer Flavor 38		Descriptive 12	CLT 12
Consumer Flavor 13	Consumer Flavor 39		Descriptive 13	CLT 13
Consumer Flavor 14	Consumer Flavor 40		Descriptive 14	CLT 14
Consumer Flavor 15	Consumer Flavor 41		Descriptive 15	CLT 15
Consumer Flavor 16	Consumer Flavor 42		Descriptive 16	CLT 16
Consumer Flavor 17	Consumer Flavor 43		Descriptive 17	CLT 17
Consumer Flavor 18	Consumer Flavor 44		Descriptive 18	CLT 18
Consumer Flavor 19	Consumer Flavor 45		Descriptive 19	CLT 19
Consumer Flavor 20	Consumer Flavor 46		Descriptive 20	CLT 20
Consumer Flavor 21	Consumer Flavor 47		Descriptive 21	CLT 21
Consumer Flavor 22	Consumer Flavor 48		Descriptive 22	
Consumer Flavor 23	Consumer Flavor 49		Descriptive 23	
Consumer Flavor 24	Consumer Flavor 50		Descriptive 24	
Consumer Flavor 25	Consumer Flavor 51		Descriptive 25	
Consumer Flavor 26	Consumer Flavor 52		Descriptive 26	

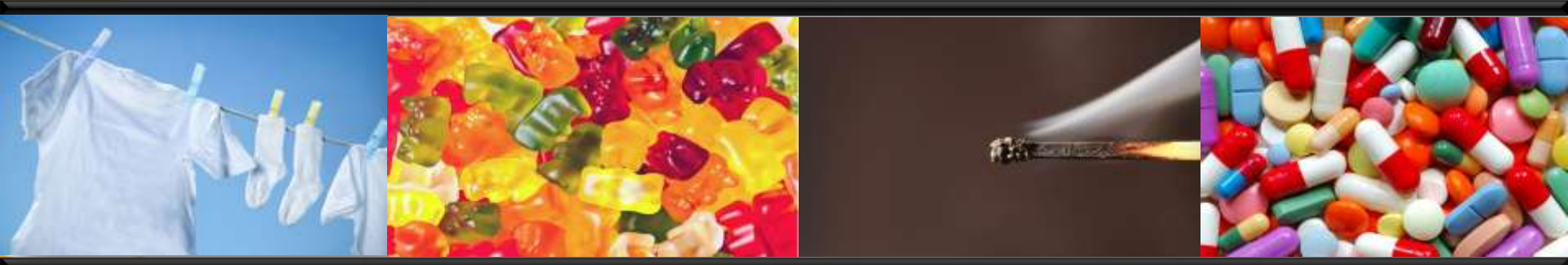
Comparison of Texture Terms/Descriptors used by 3 Different Panels

Image-Based Profiling		Kraft Descriptive Panel	Central Location Testing Questionnaire
Consumer Texture 1	Consumer Texture 17	Descriptive 1	CLT 1
Consumer Texture 2	Consumer Texture 18	Descriptive 2	CLT 2
Consumer Texture 3	Consumer Texture 19	Descriptive 3	CLT 3
Consumer Texture 4	Consumer Texture 20	Descriptive 4	CLT 4
Consumer Texture 5	Consumer Texture 21	Descriptive 5	CLT 5
Consumer Texture 6	Consumer Texture 22	Descriptive 6	CLT 6
Consumer Texture 7	Consumer Texture 23	Descriptive 7	CLT 7
Consumer Texture 8	Consumer Texture 24	Descriptive 8	CLT 8
Consumer Texture 9	Consumer Texture 25	Descriptive 9	CLT 9
Consumer Texture 10	Consumer Texture 26	Descriptive 10	
Consumer Texture 11	Consumer Texture 27	Descriptive 11	
Consumer Texture 12	Consumer Texture 28	Descriptive 12	
Consumer Texture 13	Consumer Texture 29		
Consumer Texture 14	Consumer Texture 30		
Consumer Texture 15	Consumer Texture 31		
Consumer Texture 16	Consumer Texture 32		

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

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Thank you.

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Descriptors used for Flavor Description

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

Descriptors used for Texture Description

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