Back to the Future:
What’s in the Future for the Sensory & Consumer Science?

IFST’s Professional Food Sensory Group (PFSG)
Leatherhead Food Research, UK
Monday, June 06, 2011
Sensory Science
At the Intersection between Consumer Expectations, Food Reality and Product Development & Improvement

Annette Bongartz
Food Sensory Science
ZHAW / Wädenswil
annette.bongartz@zhaw.ch
www.lsfm.zhaw.ch / www.degu.zhaw.ch
Outline

› Introduction
› Food Product Development and its Sensory Implications
› Case Study: „ECROPOLIS“
   › PAN-European Approach to Product Improvement on the Organic Market
› Conclusions
› Acknowledgments
Introduction

- In Europe – as well as in the other developed countries - changes in food consumption were observed over the last decades.
- Consumers seek for quality and convenience and are more and more aware about topics such as safety and health.
- Some consumer groups show interest for the organic production of food, for environmental protection and animal welfare. These consumers are described as wealthy, well-educated and concerned about health and product quality.
- Buyers of organic products consider organic food as healthier. Food safety, taste, freshness and overall quality are often mentioned as important attributes explaining consumer preference for organic products.
- Cost is the main reason mentioned for NOT buying organic food.

Introduction

Key players in the organic food field claim superior tastes for their products compared to the non-organic alternatives. However there is still a controversy regarding this claim and therefore additional scientific work is necessary to clarify this statement.

“Since repurchases are dependent on the overall liking of a product, and sensory experiences may have an important impact, knowledge about these dimensions is crucial for producers and marketers of organic food to offer products which meet consumer expectations”.

Food Product Development and its Sensory Implications

- The development of commercially successful products is a very difficult task.
- There is an enormous amount of research work that has been done and still is done in the field of sensory consumer science.
  - Food choice and liking are extremely complex phenomena.
  - Understanding consumers’ behaviour and thus developing successful food products can only be achieved with a multidisciplinary approach.
Food Product Development and its Sensory Implications

- Factors influencing food choice and liking can be assigned to three main categories
  - **The product**
    - intrinsic characteristics (sensory characteristics and ingredients)
    - extrinsic characteristics (price, brand, label, regulatory framework, ...)
  - **The consumers**
    - individuals
    - inconsistent
    - relying on experience and beliefs
  - **The environment**
    - Location, meal context, time
    - cultural and economical factors

www.sglwt.ch/igsensorik
Food Product Development and its Sensory Implications

- Using different approaches focusing on the elements product, consumers and environment should allow for a sounder food product development.

- However, the question on how to integrate the different results remains challenging.
Food Product Development – Future approaches

Diversity in the determinants of food choice: A psychological perspective

E.P. Köster

Centre for Innovative Consumer Studies (CICS), Wageningen University and Research, Bornsesteeg 59, 6708 PD Wageningen, The Netherlands

Received 5 November 2006; received in revised form 8 October 2007; accepted 2 November 2007
Available online 19 November 2007
Essential factors that influence Eating and Drinking Behaviour & Food Choice (Mojet, 2007)
Case Study „ECROPOLIS“

www.ecropolis.eu

PAN-European Approach to Product Improvement on the Organic Market
Project Structure: **ECROPOLIS**

- **Project co-ordination and management**
- **State-of-the-art and regulatory framework**
  - Sensory analysis
  - Market needs and solutions
- **Synthesis, recommendations and testing of OSIS**
  - Workshop with all SME AG/SMEs
  - Case study 1
  - Case study 2
- **Dissemination and training**
  - Fact sheets
  - Meetings
  - Knowledge on sensory quality
  - Training of sales staff; Taste seminars
  - Improvement of service quality
- **OSIS concept and technical implementation**
Case Study „ECROPOLIS“

- Regulatory Framework affecting Sensory Properties
## Regulatory Framework

### Affecting Sensory Properties

Table 2.2 Selected regulations and standards in the ECROPOLIS project

<table>
<thead>
<tr>
<th>Level: country/international</th>
<th>Governmental rules (more detailed or even stricter than EC Reg. 834/2007 &amp; EC Reg. 889/2007)</th>
<th>Private Standards</th>
<th>Other private requirements such as Code of Practise and binding guidelines, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>SKAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>Ekoland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>Governmental rules</td>
<td>Bio Suisse (2009)* &lt;br&gt;Demeter Switzerland (2008/2009)*</td>
<td></td>
</tr>
</tbody>
</table>
Regulatory Framework Affecting Sensory Properties of "Yogurt"
Case Study „ECROPOLIS“

- Qualitative Approach to explore Consumer Needs and Expectations
- Focus Group Discussions
Focus Group Discussions
Exploration of Consumer Needs and Expectations

Key Questions

- Which senses are important to you when eating?
- Did you perceive sensory differences to conventional food when eating organic food?
- In which occasions do you prefer organic or conventional products because of their sensory properties?
- Please take a moment to imagine the sensory experience of organic food. What kind of images comes to your mind?
- Basically, do you expect organic products to taste similarly to conventional products, or differently?
- Do you remember situations where your buying decision was influenced by sensory information and how?
Focus Group Discussions

**Results:** Mentioned Senses and their Relevance

Table 3: Overview on mentioned senses and their relevance in case study countries

<table>
<thead>
<tr>
<th></th>
<th>DE</th>
<th>FR</th>
<th>IT</th>
<th>NL</th>
<th>PL</th>
<th>CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Odour</td>
<td>+</td>
<td>+/-</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Appearance</td>
<td>+/-</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>+/-</td>
<td>+/-</td>
</tr>
<tr>
<td>Texture / mouth feeling</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>+/</td>
<td>-</td>
</tr>
<tr>
<td>Sound</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Others</th>
<th>Instinct, good feeling</th>
<th>Changes undergone when cooked</th>
<th>Feeling of satiety</th>
<th>Feeling after eating</th>
<th>Appetite, stomach feeling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Quantification of relevance: ++ = very relevant; + = relevant; + / - = indifferent; - = limited relevance; -- = very limited relevance; nv = not available
Focus Group Discussions
Results: Experiences and Expectations for Organic Food

A rather controversial discussion:

“[…] sincerely, when I ate organic food, I didn’t find any sensory difference in comparison to conventional one. I drank organic milk thinking that it could have better sensory attributes than conventional, but sincerely I did not meet any difference.” (IT.L)

“Organic products have a more typical, authentic taste. Nowadays, conventional strawberries are tasteless.” (FR.H)
Focus Group Discussions

Results: Sensory Attributes of Organic Food should be different from Conventional Food

➤ “ [...] organic food should have a more intense taste. In addition, it should distinguish itself from conventional products!” (IT.L)

➤ “[organic food has to have a particular identity and taste, or] its natural taste, the old taste.” (IT.L)

➤ “Organic dairy products are manufactured with whole, non pasteurised milk. This process gives the final product a more authentic, full taste. Like yogurts or cheese from the farm.” (FR.L)
Focus Group Discussions

Results: Sensory Attributes of Organic Food should not be different from Conventional Food

“[…] at the beginning, a new organic product should be similar to conventional product, because the consumer has to be accustomed to the new product. So, if it will be different from conventional products, consumers may not recognize it and may refuse it.” (IT.H)
Focus Group Discussions

Conclusion: Sensory Characteristics of Organic Food
Case Study „ECROPOLIS“

- Quantitative Approach to explore Sensory Product Properties and Consumer Acceptance
  - Descriptive Sensory Analysis
  - Consumer Testing
Work Plan

Preference Mapping

Influence of organic labelling

Consumer Test

Sensory Profiling
## Descriptive Sensory Analysis

*Exploration of Sensory Product Properties and Consumer Acceptance – in Switzerland*

- **List of attributes for flavour** *(example)*

<table>
<thead>
<tr>
<th>TERMS</th>
<th>DEFINITION</th>
<th>PROTOCOL</th>
<th>ANCHORING POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>In mouth flavor</td>
<td><em>Acid</em></td>
<td>From the least acid to the most</td>
<td>none - very intensive</td>
</tr>
<tr>
<td></td>
<td>Put a spoon of yogurt in the mouth, swallow it and evaluate the acid taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In mouth flavor</td>
<td><em>Fermented</em></td>
<td>Persisting acid taste</td>
<td>none - very intensive</td>
</tr>
<tr>
<td></td>
<td>Put a spoon of yogurt in the mouth, swallow it and evaluate the yogurt’s acid taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In mouth flavor</td>
<td><em>Fresh</em></td>
<td>From the least fresh to the most</td>
<td>none - very intensive</td>
</tr>
<tr>
<td></td>
<td>Put a spoon of yogurt in the mouth, swallow it and evaluate the yogurt’s freshness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In mouth flavor</td>
<td><em>Persistent taste</em></td>
<td>From the least intense to the most</td>
<td>none - very intensive</td>
</tr>
<tr>
<td></td>
<td>Put a spoon of yogurt in the mouth, swallow it and evaluate the taste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Descriptive Sensory Analysis

Exploration of Sensory Product Properties and Consumer Acceptance – *in Switzerland*

### Chosen Products

<table>
<thead>
<tr>
<th>SAMPLE CODE</th>
<th>INGREDIENTS</th>
<th>MICROORGANISMS</th>
<th>PROCESSING METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Org1 BS Yoghurt CH</td>
<td>milk, skimmed milk powder, fat content 3.5%</td>
<td>no data</td>
<td>pasteurization</td>
</tr>
<tr>
<td>Org2 GO Yoghurt CH</td>
<td>milk, skimmed milk powder, fat content 3.5%</td>
<td>Lactocacillus, B. Bifidum</td>
<td>homogenization; pasteurization</td>
</tr>
<tr>
<td>Conv1 Yoghurt CH</td>
<td>whole milk, skimmed milk powder</td>
<td>Sc Thermophilus, Lb d. s. bulgaricus; Lb helvetikus</td>
<td>homogenization; pasteurization</td>
</tr>
<tr>
<td>Org3 BS Yoghurt CH</td>
<td>whole milk homogenised, milk protein</td>
<td>Lactobacillus; Lb. delbrueckii subsp. bulgaricus</td>
<td>homogenisation; Double Pasteurisation</td>
</tr>
<tr>
<td>Org4 MB Yoghurt CH</td>
<td>whole milk, milk proteins, fat content 4%</td>
<td>no data</td>
<td>no data</td>
</tr>
<tr>
<td>Conv2 Yoghurt CH</td>
<td>milk, milk protein, fat content 3.5%</td>
<td>Lactobacillus; Lb. delbrueckii subsp. bulgaricus</td>
<td>homogenisation; Double Pasteurisation</td>
</tr>
<tr>
<td>Org5 DM Yoghurt CH</td>
<td>whole milk, fat content 3.8%</td>
<td>Lactobacillus, Streptococcus</td>
<td>pasteurization</td>
</tr>
</tbody>
</table>
Descriptive Sensory Analysis
Exploration of Sensory Product Properties and Consumer Acceptance – *in Switzerland*

- Spider Web (example)
Descriptive Sensory Analysis
Exploration of Sensory Product Properties and Consumer Acceptance – *in Switzerland*

▷ Principal Component Analysis
Consumer Testing
Exploration of Sensory Product Properties and Consumer Acceptance – in Switzerland
Consumer Testing

Exploration of Sensory Product Properties and Consumer Acceptance – in Switzerland

Comparison blind and branded consumer test

Results marked with * differ significantly from each other
Consumer Testing

Exploration of Sensory Product Properties and Consumer Acceptance – in Germany
Case Study „ECROPOLIS“

Data Analysis / Synthesis

- Preference Mapping → PAN-European Mosaic

- Product Improvement Potential
Preference Mapping

Acidic taste & smell

Sticky mouthfeel & texture, creamy and smooth appearance, creamy texture

Lactic smell, fermented taste, fatty mouthfeel, appearance of liquid on the surface

Dense mouthfeel

www.sglwt.ch/igsensorik
Preference Mapping

→ PAN European Mosaic

- 17 attributes
- Most liked samples marked by solid line squares
- Least liked samples marked by dotted line squares
Product Improvement Potential

www.sglwt.ch/igsensorik
## Product Improvement Potential

### Drivers of Liking

<table>
<thead>
<tr>
<th>Variables</th>
<th>Overall Liking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance Creamy</td>
<td>0.835</td>
</tr>
<tr>
<td>Appearance Smooth</td>
<td>0.820</td>
</tr>
<tr>
<td>Appearance Presence of liquid on the surface</td>
<td>-0.582</td>
</tr>
<tr>
<td>Odour Fermented</td>
<td>0.031</td>
</tr>
<tr>
<td>Odour Lactic</td>
<td>-0.133</td>
</tr>
<tr>
<td>Texture (Spoon) Firm</td>
<td>0.704</td>
</tr>
<tr>
<td>Texture (Spoon) Sticky</td>
<td>0.879</td>
</tr>
<tr>
<td>Texture (Spoon) Creamy</td>
<td>0.842</td>
</tr>
<tr>
<td>Taste Acid</td>
<td>-0.081</td>
</tr>
<tr>
<td>Taste Fermented</td>
<td>-0.006</td>
</tr>
<tr>
<td>Taste Persistant Taste</td>
<td>-0.023</td>
</tr>
<tr>
<td>Mouthfeel Sticky</td>
<td>0.901</td>
</tr>
<tr>
<td>Mouthfeel Dense</td>
<td>0.882</td>
</tr>
<tr>
<td>Mouthfeel Flows in the Mouth</td>
<td>-0.427</td>
</tr>
<tr>
<td>Mouthfeel Fatty</td>
<td>-0.097</td>
</tr>
<tr>
<td>Overall Liking</td>
<td>1</td>
</tr>
</tbody>
</table>
## Product Improvement Potential

### Drivers of Liking

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Conv1 Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Conv2 Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Org1 GO Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Org2 BS Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Org3 BS Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Org4 MB Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Org5 DM Yoghurt CH (Mean Value from Sensory Profiling)</th>
<th>Correlation Overall-Liking with Sensory Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance Creamy</td>
<td>80.9</td>
<td>13.3</td>
<td>63.7</td>
<td>66.9</td>
<td>79.7</td>
<td>77.7</td>
<td>7.2</td>
<td>0.835</td>
</tr>
<tr>
<td>Appearance Smooth</td>
<td>85.9</td>
<td>12.7</td>
<td>58.5</td>
<td>80.3</td>
<td>81.6</td>
<td>74.6</td>
<td>5.7</td>
<td>0.820</td>
</tr>
<tr>
<td>Appearance Presence of liquid on the surface</td>
<td>34.0</td>
<td>86.2</td>
<td>34.9</td>
<td>32.3</td>
<td>47.8</td>
<td>43.9</td>
<td>83.9</td>
<td>-0.582</td>
</tr>
<tr>
<td>Odour Fermented</td>
<td>55.4</td>
<td>77.2</td>
<td>48.8</td>
<td>58.1</td>
<td>39.9</td>
<td>37.6</td>
<td>19.7</td>
<td>0.031</td>
</tr>
<tr>
<td>Odour Lactic</td>
<td>36.4</td>
<td>21.5</td>
<td>42.3</td>
<td>34.8</td>
<td>52.6</td>
<td>54.7</td>
<td>77.5</td>
<td>-0.133</td>
</tr>
<tr>
<td>Texture (Spoon) Firm</td>
<td>69.3</td>
<td>77.4</td>
<td>41.7</td>
<td>48.7</td>
<td>79.2</td>
<td>77.4</td>
<td>34.6</td>
<td>0.704</td>
</tr>
<tr>
<td>Texture (Spoon) Sticky</td>
<td>81.1</td>
<td>28.1</td>
<td>56.5</td>
<td>62.9</td>
<td>77.4</td>
<td>78.8</td>
<td>8.6</td>
<td>0.879</td>
</tr>
<tr>
<td>Texture (Spoon) Creamy</td>
<td>78.3</td>
<td>18.7</td>
<td>57.4</td>
<td>66.5</td>
<td>74.3</td>
<td>75.6</td>
<td>8.4</td>
<td>0.842</td>
</tr>
<tr>
<td>Taste Acid</td>
<td>66.2</td>
<td>76.0</td>
<td>52.9</td>
<td>70.6</td>
<td>23.4</td>
<td>32.3</td>
<td>12.2</td>
<td>-0.081</td>
</tr>
<tr>
<td>Taste Fermented</td>
<td>23.4</td>
<td>23.7</td>
<td>47.9</td>
<td>23.7</td>
<td>71.0</td>
<td>57.8</td>
<td>83.2</td>
<td>-0.006</td>
</tr>
<tr>
<td>Taste Persistent Taste</td>
<td>54.8</td>
<td>58.2</td>
<td>51.2</td>
<td>63.0</td>
<td>37.7</td>
<td>41.7</td>
<td>30.6</td>
<td>-0.023</td>
</tr>
<tr>
<td>Mouthfeel Sticky</td>
<td>62.2</td>
<td>37.4</td>
<td>49.7</td>
<td>55.7</td>
<td>66.4</td>
<td>69.2</td>
<td>16.9</td>
<td>0.901</td>
</tr>
<tr>
<td>Mouthfeel Dense</td>
<td>56.6</td>
<td>49.9</td>
<td>40.8</td>
<td>50.9</td>
<td>66.3</td>
<td>70.3</td>
<td>37.3</td>
<td>0.882</td>
</tr>
<tr>
<td>Mouthfeel Flows in the Mouth</td>
<td>43.0</td>
<td>46.6</td>
<td>57.1</td>
<td>63.7</td>
<td>36.8</td>
<td>36.5</td>
<td>43.9</td>
<td>-0.427</td>
</tr>
<tr>
<td>Mouthfeel Fatty</td>
<td>46.5</td>
<td>39.6</td>
<td>51.7</td>
<td>39.3</td>
<td>58.8</td>
<td>57.9</td>
<td>71.7</td>
<td>-0.097</td>
</tr>
<tr>
<td>Overall Liking</td>
<td>6.0</td>
<td>5.3</td>
<td>5.4</td>
<td>5.7</td>
<td>6.8</td>
<td>6.1</td>
<td>4.8</td>
<td>1</td>
</tr>
</tbody>
</table>
Product Improvement Potential

Penalty Analysis (JAR Scales) → Org 5

The amount of the total penalties shows in relation to all considered attributes the one which shows the greatest influence on overall-liking when rated outside of the area «just about right»
Product Improvement Potential

Penalty Analysis (JAR Scales) → Org 5
Synthesis
Sensory Analysis ↔ Consumer Research

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com

WOOF DOG FOOD

TESTING LAB

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com

THE OPINIONS EXPRESSED
BY MRS. LATIMORE ARE
HER OWN, AND DO NOT
NECESSARILY REFLECT
THOSE OF MR. LATIMORE.

“A and C are a bit on the gritty side... B seems to have a bitter aftertaste... C has a good taste but a bit too mushy...”
Conclusions

„STRESS-FIELD between ...

➢ Consumer Expectations
➢ Official Requirements / Standards
➢ State-of-the-art in Food Processing
➢ Food Reality / Sensory Properties of Food
➢ Overall-Liking / Consumer Acceptance
Acknowledgments

Patrizia Piccinali, Co-Coordinator of IG Sensorik (SGLWT),

Food Sensory Science
Agroscope ALP / Bern
patrizia.piccinali@alp.admin.ch
www.agroscope.admin.ch

All colleagues (SME’s and RTD’s) out of the EU Project
Thank You very much for your Attention !!!

... any Questions?

Annette Bongartz
Food Sensory Science
ZHAW / Wädenswil
annette.bongartz@zhaw.ch
www.lsfm.zhaw.ch / www.degu.zhaw.ch
Bibliography

- **Cardello (1995)**, Food Quality: Relativity, Context and Consumer Expectations, Food Quality and Preference 6, p. 163-170
- **Murray, Delahunty, Baxter (2001)**, Descriptive Sensory analysys: past, present and future, Food Research International 34, P. 461-471
- **Peri (2006)**, The universe of food quality, Food Quality and Preference 17, p. 3-8

- ECROPOLIS Project Reporting, 7FP (not yet published)