SOCIETY OF SENSORY PROFESSIONALS

Sensory Approaches and New Methods for Developing Grain-Based Products

Symposia · Oglethorpe CC

Monday 26 October 2016

8:40 a.m. 102-S

Perception dynamics of grain-based ready-to-eat cereal products using TCATA

John C. Castura

Compusense®

Eating & drinking

- Many sensations are elicited
  - Visual sensations
  - Aromas
  - Textures
  - Flavors
  - Tastes
  - Sounds
  - Temperature
  - Pain
- Consumer perceptions can be investigated using check-all-that-apply (CATA)

CATA task

Check the words that **describe** **Sample 470** *(check **all** that apply).*

☐ Oats flavor	☐ Corn/corn meal flavor	☐ Cardboard flavor
☐ Chocolate flavor	☐ Bitter taste	☐ Malty flavor
☐ Sweet taste	☐ Peanut butter flavor	☐ Chemical flavor
☐ Sour taste	☐ Crunchy texture	☐ Salty taste
☐ Vanilla flavor	☐ Mouth-pucker (drying)	☐ Tooth-packing texture
☐ Grainy texture	☐ Caramel flavor	☐ Other _____

CATA task

Check the words that **describe** **Sample 470** *(check **all** that apply).*

☐ Oats flavor	☑ Corn/corn meal flavor	☐ Cardboard flavor
☑ Chocolate flavor	☑ Bitter taste	☑ Malty flavor
☑ Sweet taste	☐ Peanut butter flavor	☐ Chemical flavor
☐ Sour taste	☑ Crunchy texture	☐ Salty taste
☐ Vanilla flavor	☑ Mouth-pucker (drying)	☑ Tooth-packing texture
☑ Grainy texture	☐ Caramel flavor	☐ Other _____

When is CATA used?

- Consumers can use CATA to characterize samples
- Consumers can also indicate which samples they like and dislike
- Creates an opportunity to investigate how consumer liking and perception are linked

What is TCATA?

- Temporal check-all-that-apply (TCATA) extends CATA to ***continuously track sensory properties***

- It is a new method (proposed in 2014) that builds on earlier temporal methods that are not focused on attribute intensities

TCATA task

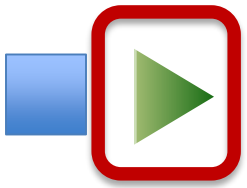
Check and re-check words to track changes in the cereal.

0:00

- ☐ Oats flavor
- ☐ Chocolate flavor
- ☐ Sweet taste
- ☐ Crunchy texture
- ☐ Corn/corn meal flavor
- ☐ Bitter taste
- ☐ Peanut butter flavor
- ☐ Other

TCATA task

Check and re-check words to track changes in the cereal.



0:00

Timer starts when **Start** button is clicked

- ☐ Oats flavor
- ☐ Corn/corn meal flavor
- ☐ Chocolate flavor
- ☐ Bitter taste
- ☐ Sweet taste
- ☐ Peanut butter flavor
- ☐ Crunchy texture
- ☐ Other

TCATA task

Check and re-check words to track changes in the cereal.

Consumers check and re-check attributes to describe the sample

- ☐ Oats flavor
- ☐ Chocolate flavor
- ☐ Sweet taste
- ☐ Crunchy texture
- ☐ Corn/corn meal flavor
- ☐ Bitter taste
- ☐ Peanut butter flavor
- ☐ Other

TCATA task

Check and re-check words to track changes

Swallow the sample now

Instruction prompts appear at specific times

- ☐ Oats flavor
- ☐ Chocolate flavor
- ☐ Sweet taste
- ☐ Crunchy texture
- ☐ Corn/corn meal flavor
- ☐ Bitter taste
- ☐ Peanut butter flavor
- ☐ Other

TCATA task

Check and re-check words to track changes in the cereal.

1:00

Evaluation ends at a set time

- ☐ Oat flavor
- ☐ Corn/cornmeal flavor
- ☐ Chocolate flavor
- ☐ Bitter taste
- ☐ Sweet taste
- ☐ Peanut butter flavor
- ☐ Crunchy texture
- ☐ Other

Video/sound recording and photography are

strictly prohibited

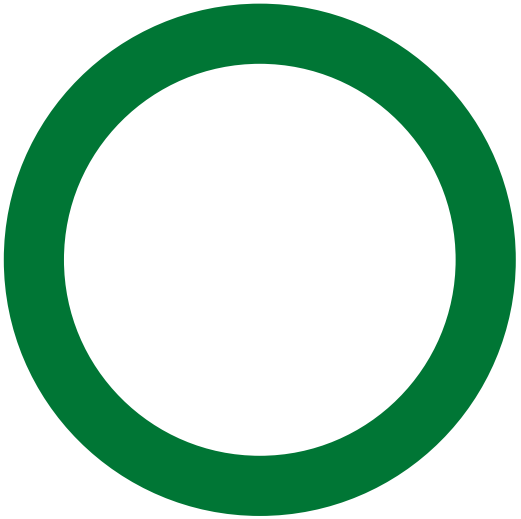
in this portion

of the

presentation.

Temporal Check-All-That-Apply (TCATA)

Delight	Basset horn
Divine	Comic
Bassoon	Oboe
Longing	Clarinet
Rusty Squeezebox	Pulsing



Video/sound recording or photographing is

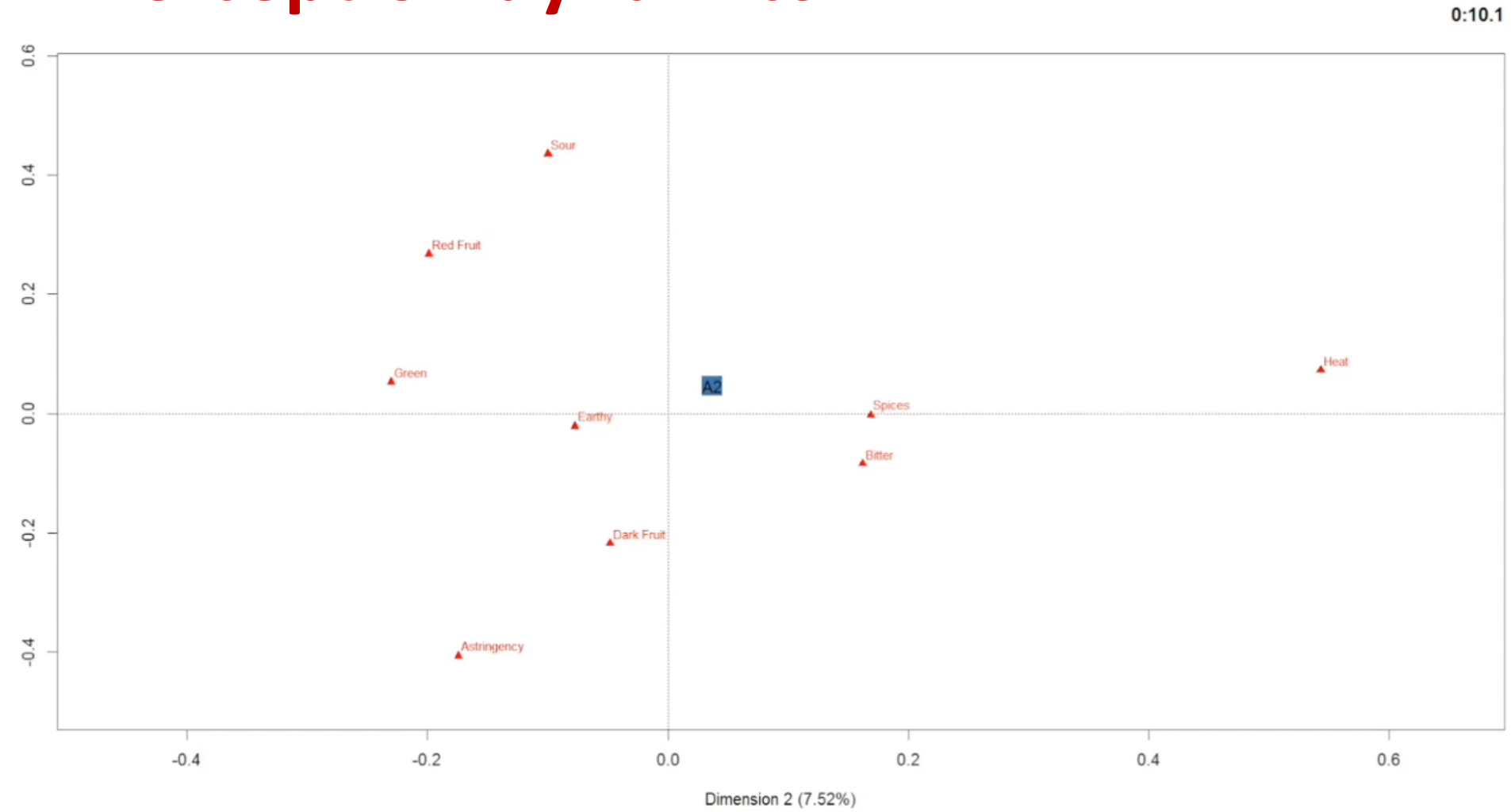
permitted

for the remainder

of the

presentation.

Perception dynamics



Castura, Baker, & Ross (2016; adapted from Video 1).

When is TCATA used?

- Consumers can perform TCATA to characterize how sensations evolve over time
- Again, consumers can indicate which samples they like and dislike
- This creates a *new* opportunity to investigate how consumer liking and perception dynamics are linked

Ready-to-eat (RTE) breakfast cereals

6 chocolate-flavored cereals

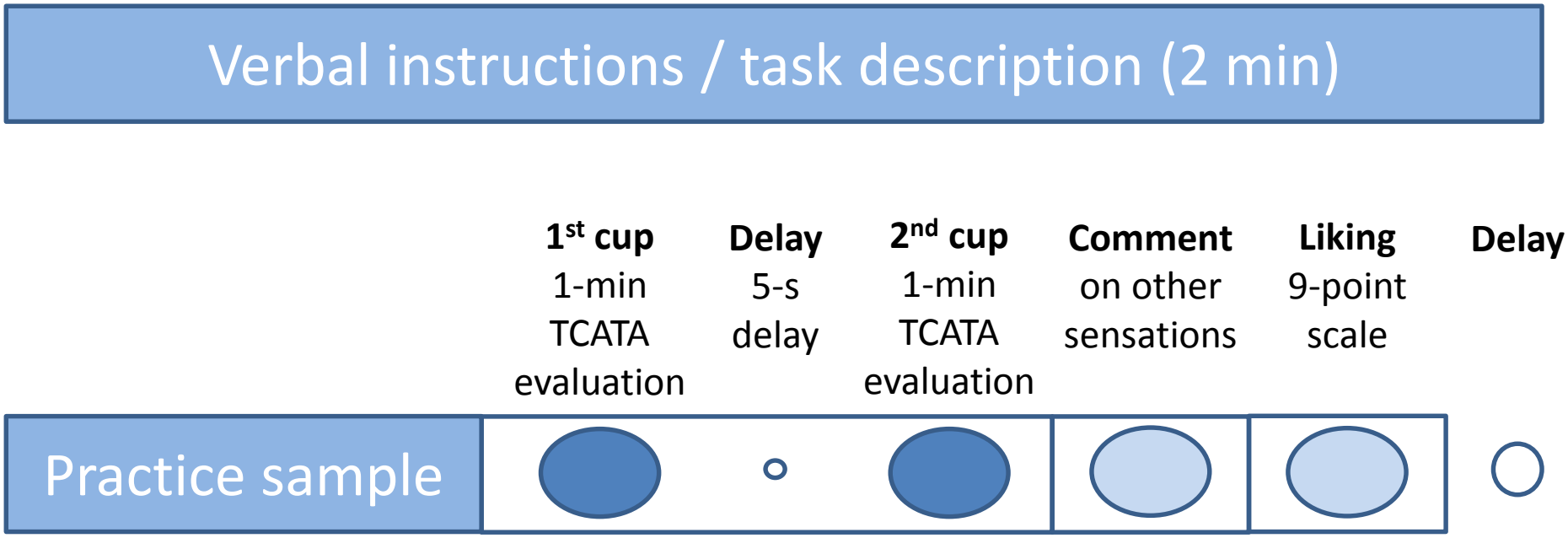
Consumers

76 high-school teenage category consumers

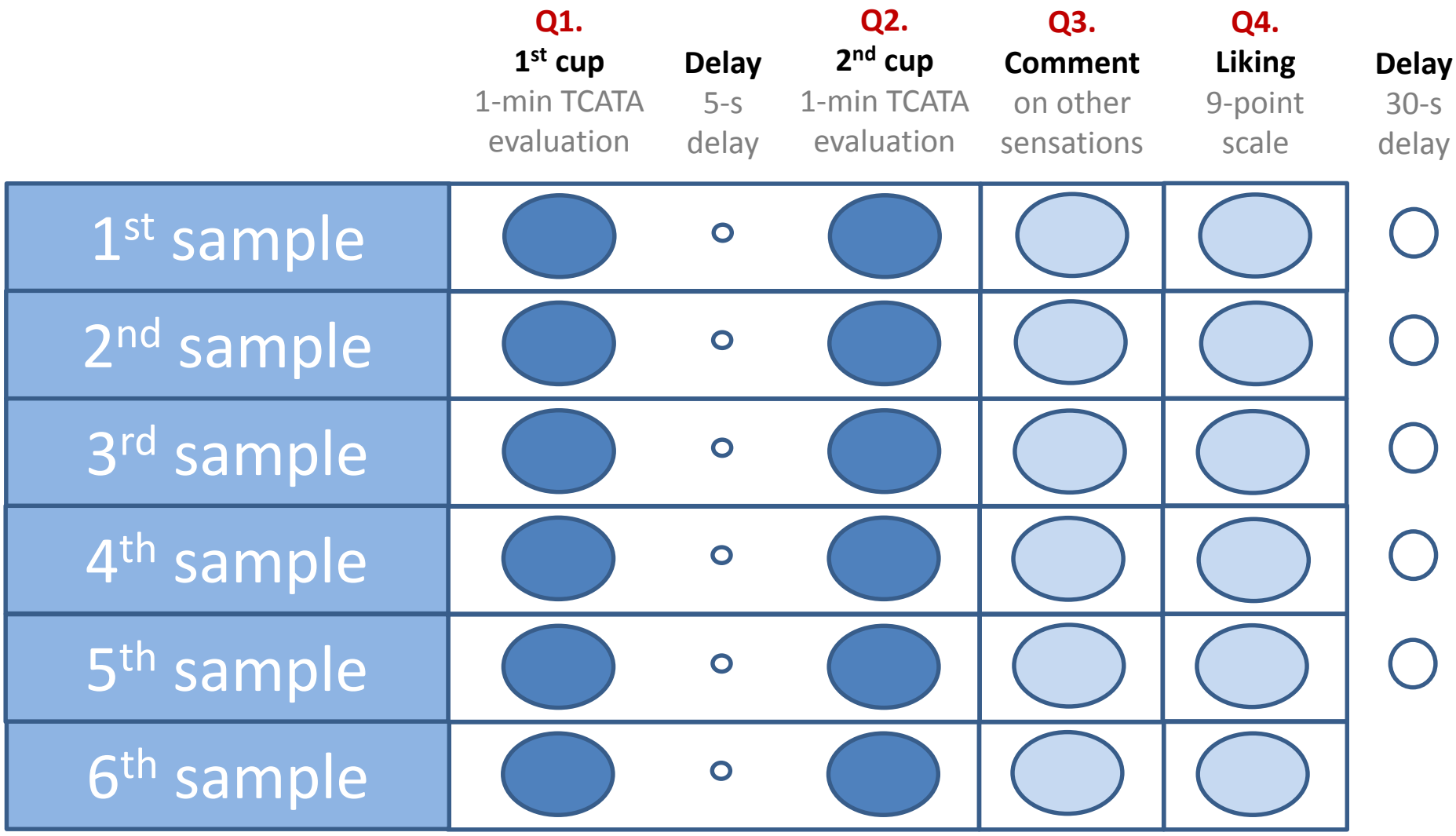
	Grades 9-10	Grades 11-12
Male	20	22
Female	18	16

Parental/guardian consent was required. Both teens and parents/guardians were financially compensated for their participation.

Task familiarization & practice



Evaluation of samples



Sample 142

Bitter taste
Chocolate flavor
Corn / Corn meal flavor
Crunchy texture
Oat flavor
Off flavor
Other flavor
Peanut Butter flavor
Sweet taste

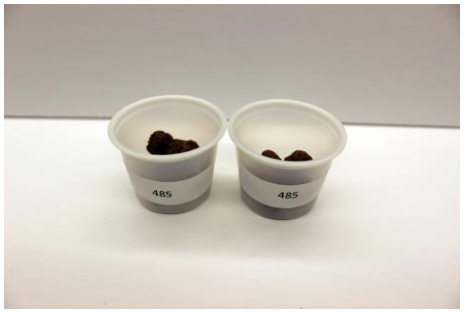
Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

0 5 10 15 20 25 30 35 40 45 50 55 60

Time

Time



Sample 485

Bitter taste
Chocolate flavor ▲
Corn / Corn meal flavor
Crunchy texture
Oat flavor ▼
Off flavor
Other flavor ▲
Peanut Butter flavor ▼
Sweet taste ▲

Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

0 5 10 15 20 25 30 35 40 45 50 55 60

Time

Sample 507

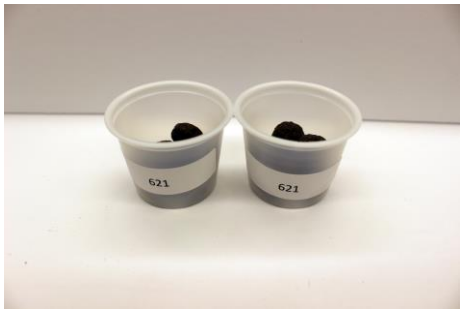
Bitter taste ▼
Chocolate flavor ▲
Corn / Corn meal flavor
Crunchy texture
Oat flavor ▼
Off flavor ▼
Other flavor ▲
Peanut Butter flavor ▼
Sweet taste ▲

Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

0 5 10 15 20 25 30 35 40 45 50 55 60

Time



Sample 621

Bitter taste ▲
Chocolate flavor ▲
Corn / Corn meal flavor ▲
Crunchy texture ▼
Oat flavor ▼
Off flavor ▲
Other flavor ▲
Peanut Butter flavor ▼
Sweet taste ▼

Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

0 5 10 15 20 25 30 35 40 45 50 55 60

Time

Sample 713

Bitter taste ▲
Chocolate flavor ▼
Corn / Corn meal flavor ▼
Crunchy texture
Oat flavor ▼
Off flavor ▼
Other flavor ▼
Peanut Butter flavor ▲
Sweet taste ▲

Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

0 5 10 15 20 25 30 35 40 45 50 55 60

Time

Sample 974

Bitter taste
Chocolate flavor ▲
Corn / Corn meal flavor ▲
Crunchy texture
Oat flavor ▼
Off flavor ▼
Other flavor ▼
Peanut Butter flavor ▼
Sweet taste

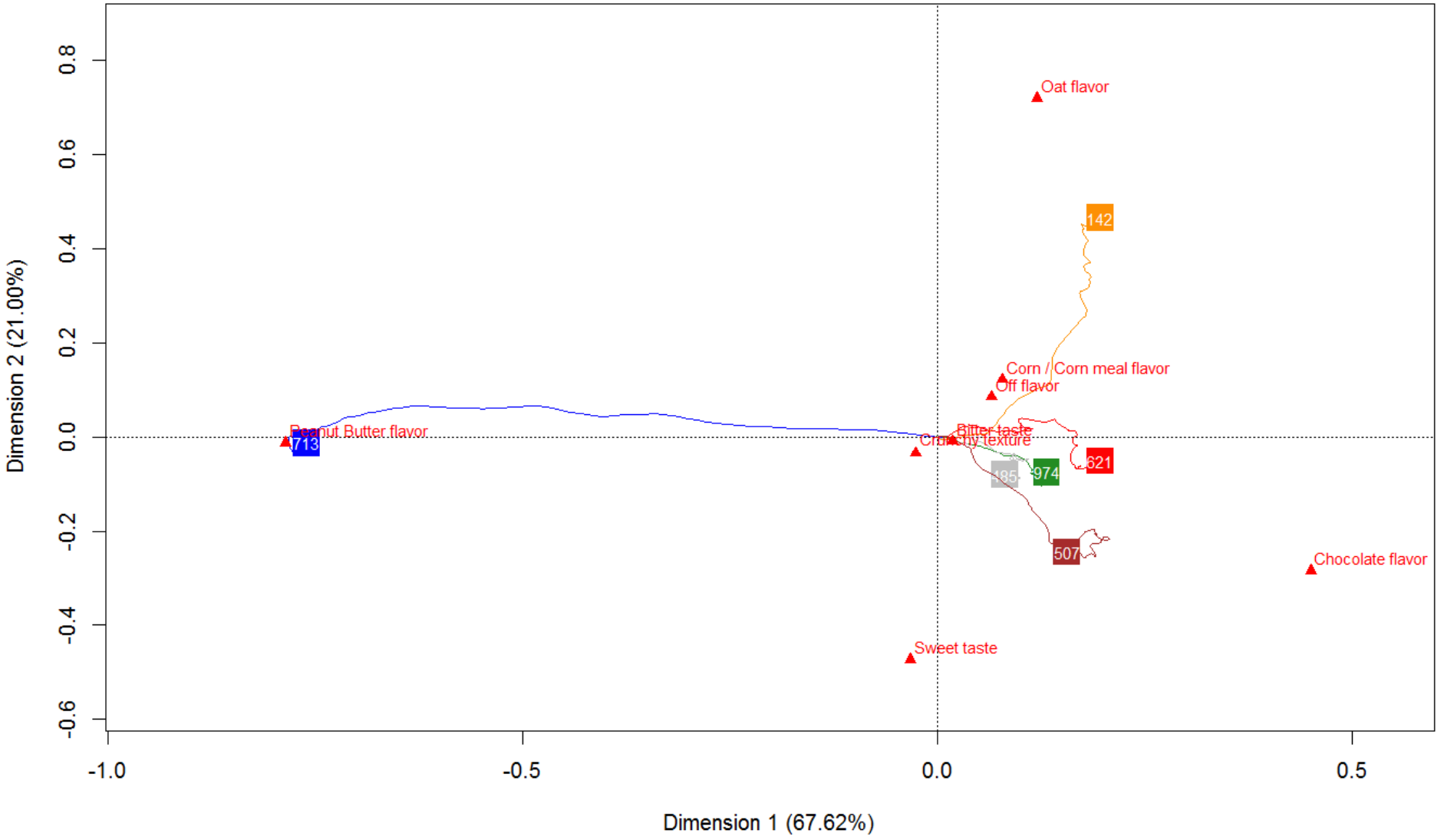
Citation proportion

0.0 0.2 0.4 0.6 0.8 1.0

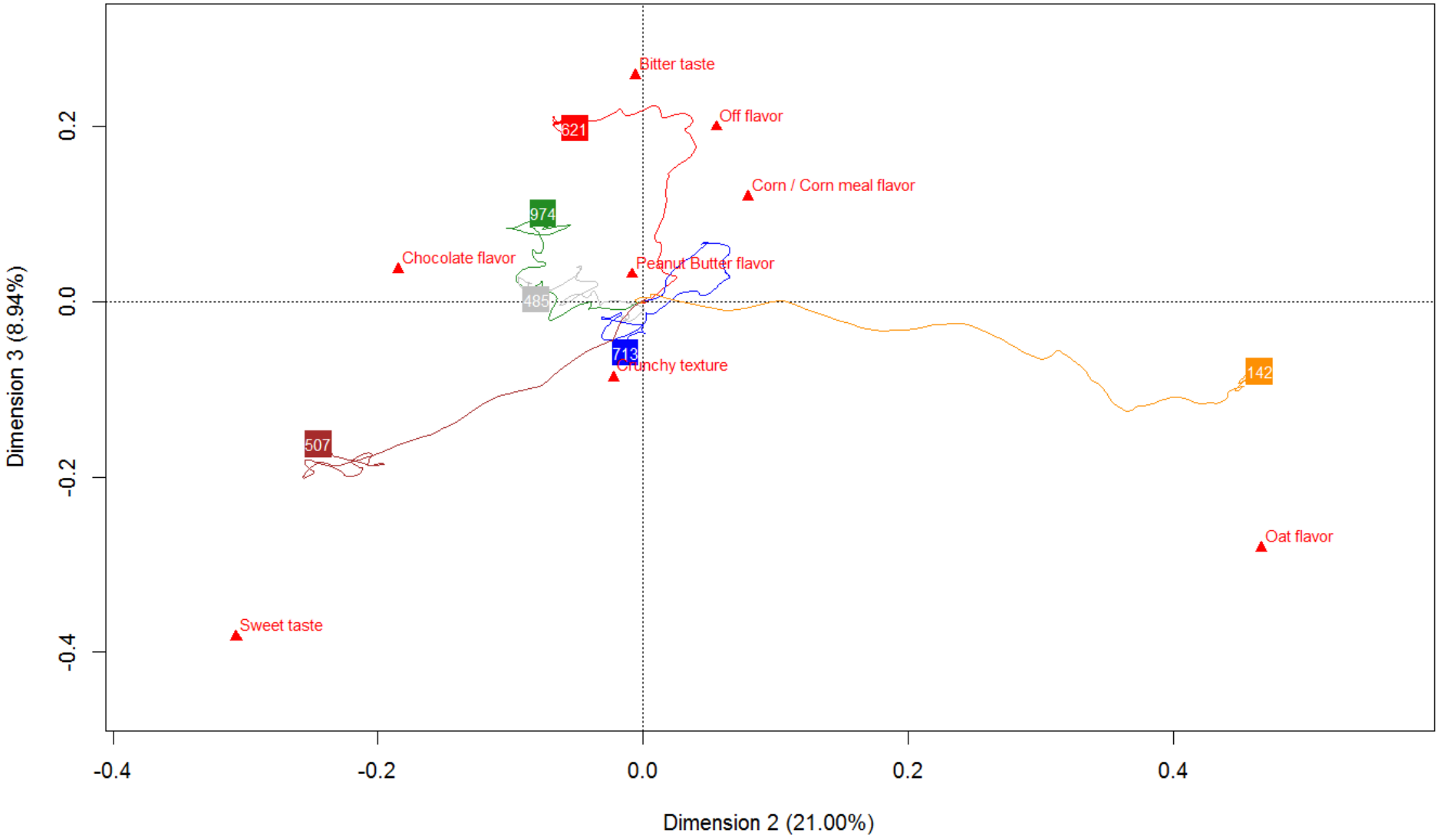
0 5 10 15 20 25 30 35 40 45 50 55 60

Time

First sensory impressions (up to 20 s)



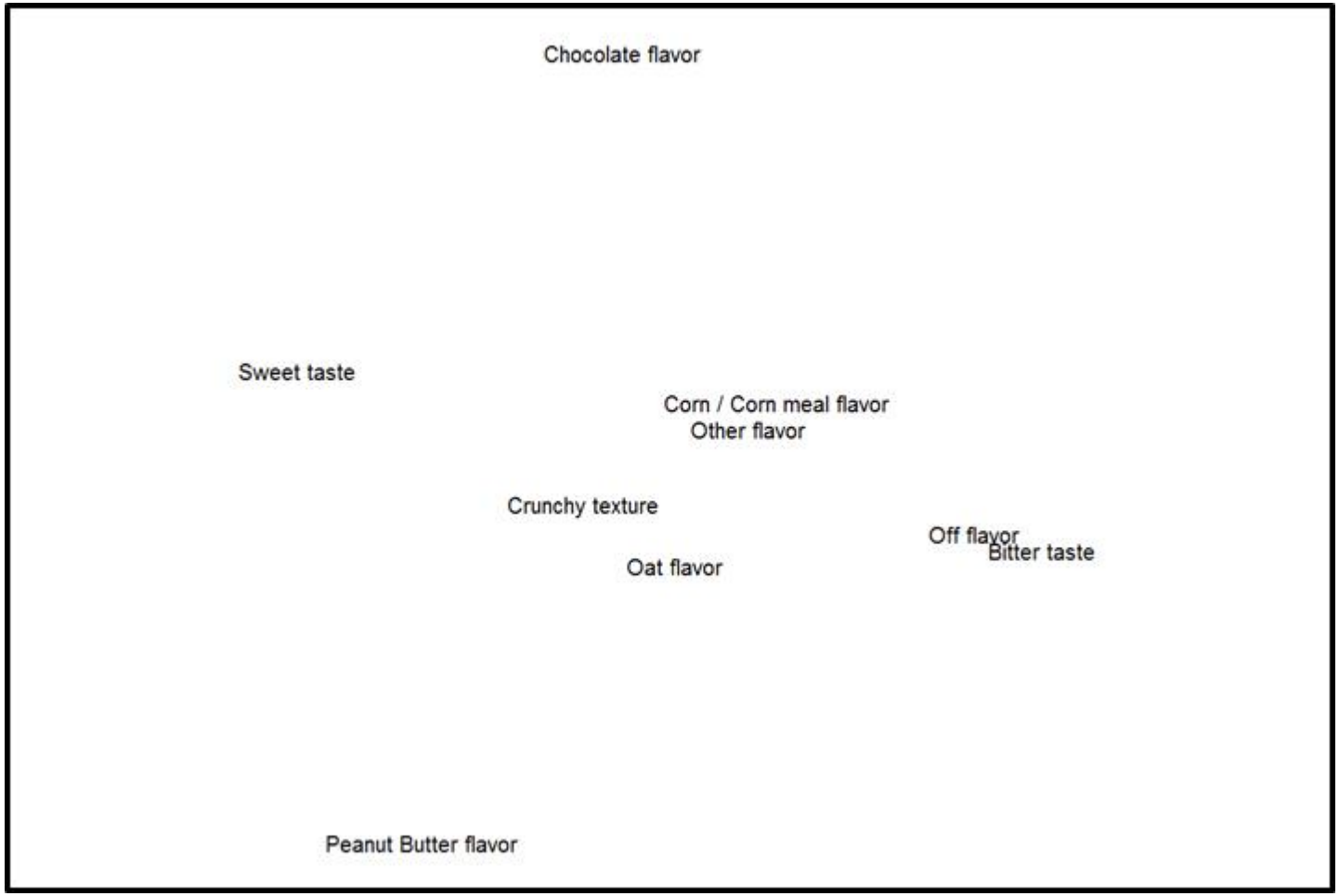
First sensory impressions (up to 20 s)



Attribute correlations

Pearson's ϕ-coefficient measures correlation between binary variables.

MDS based on the distance matrix (1-ϕ).



Attribute correlations

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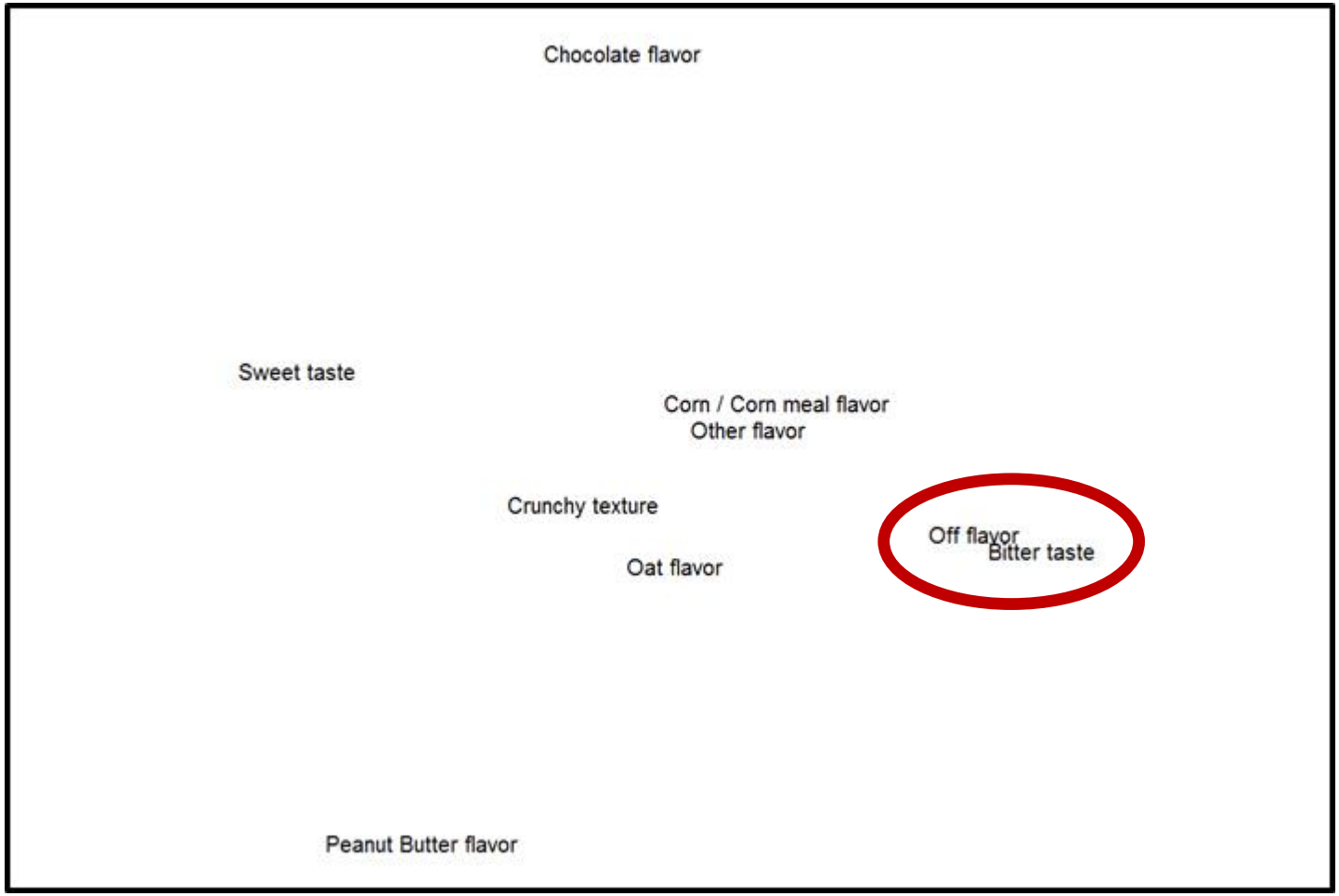
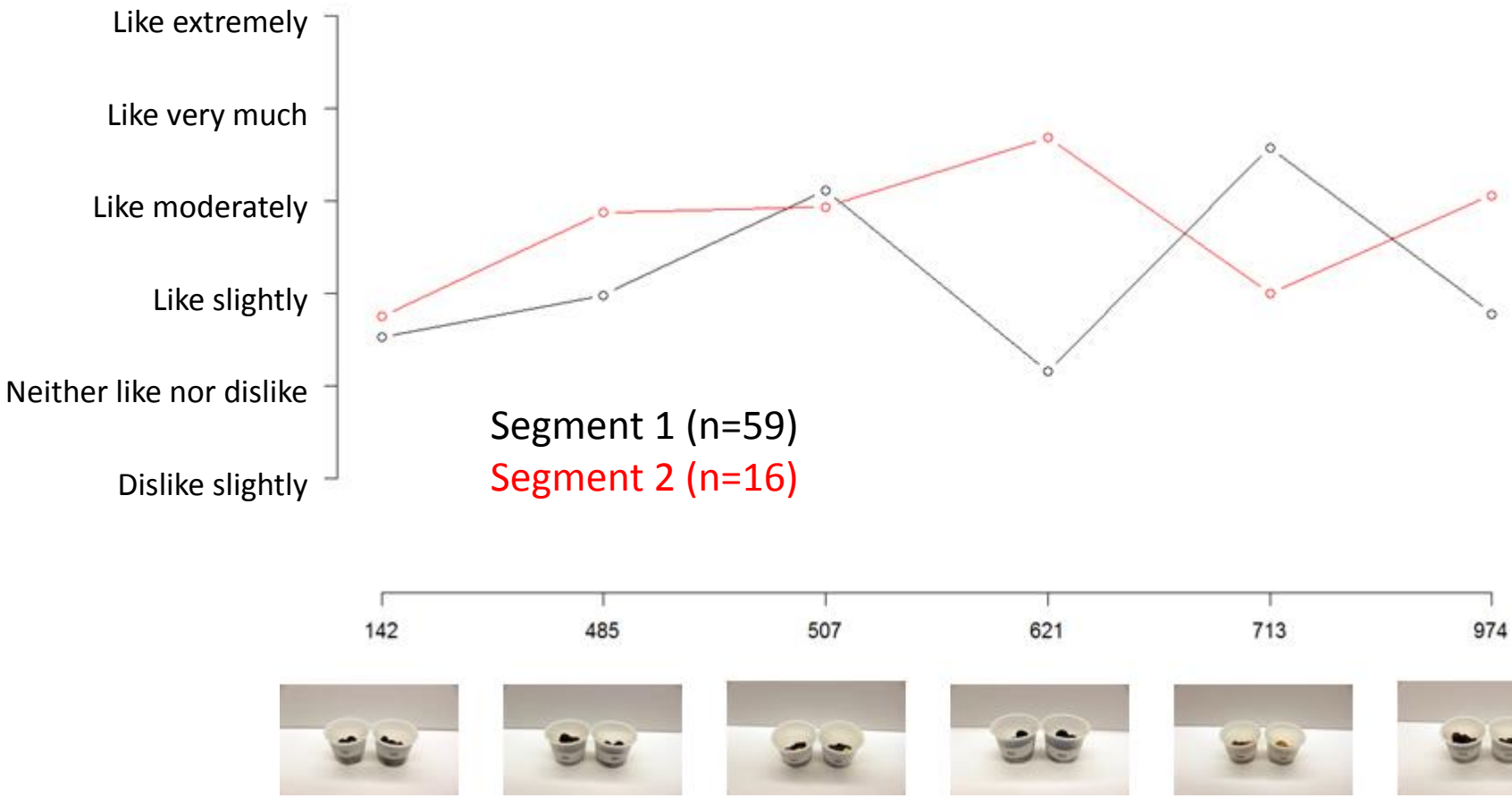
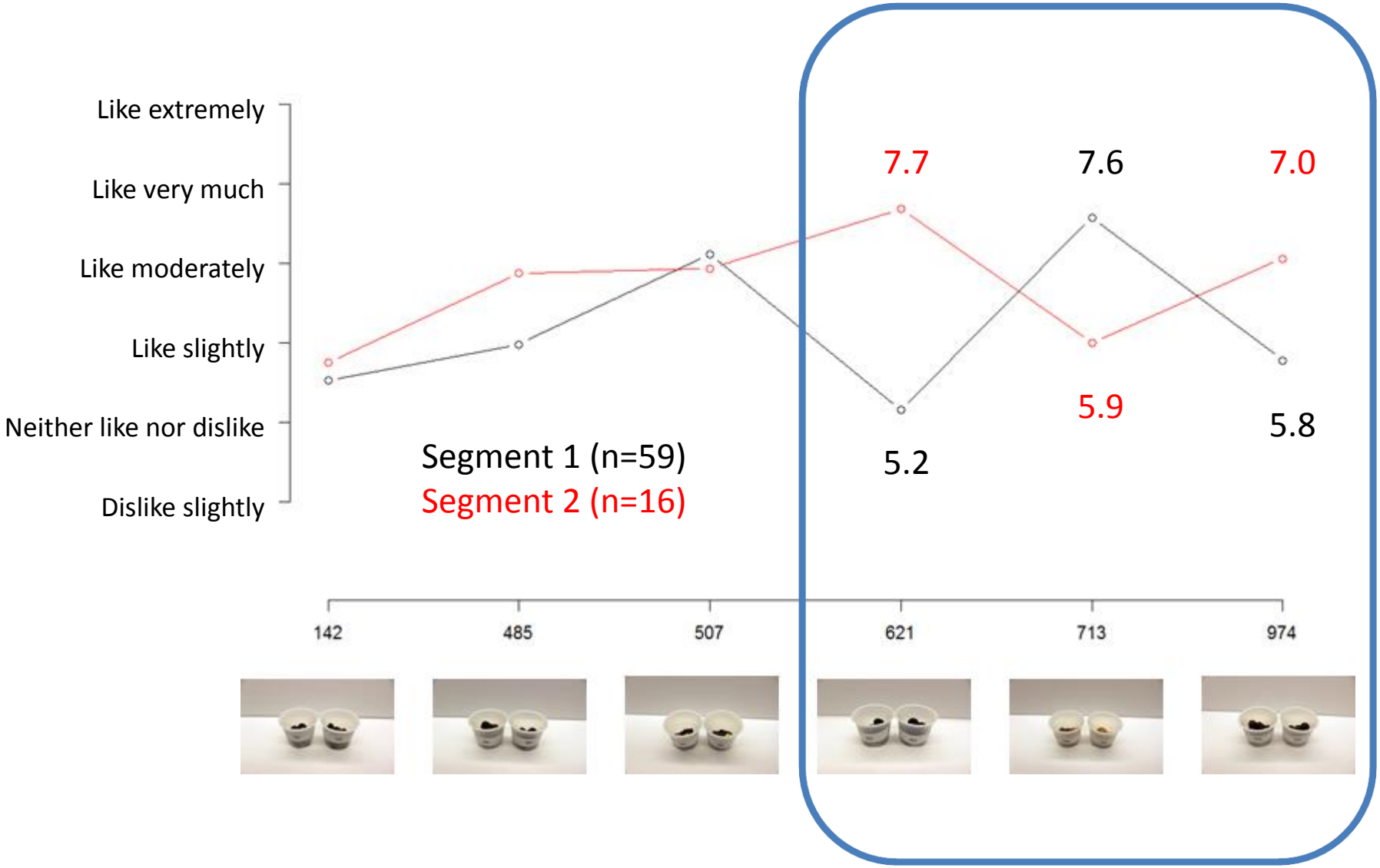


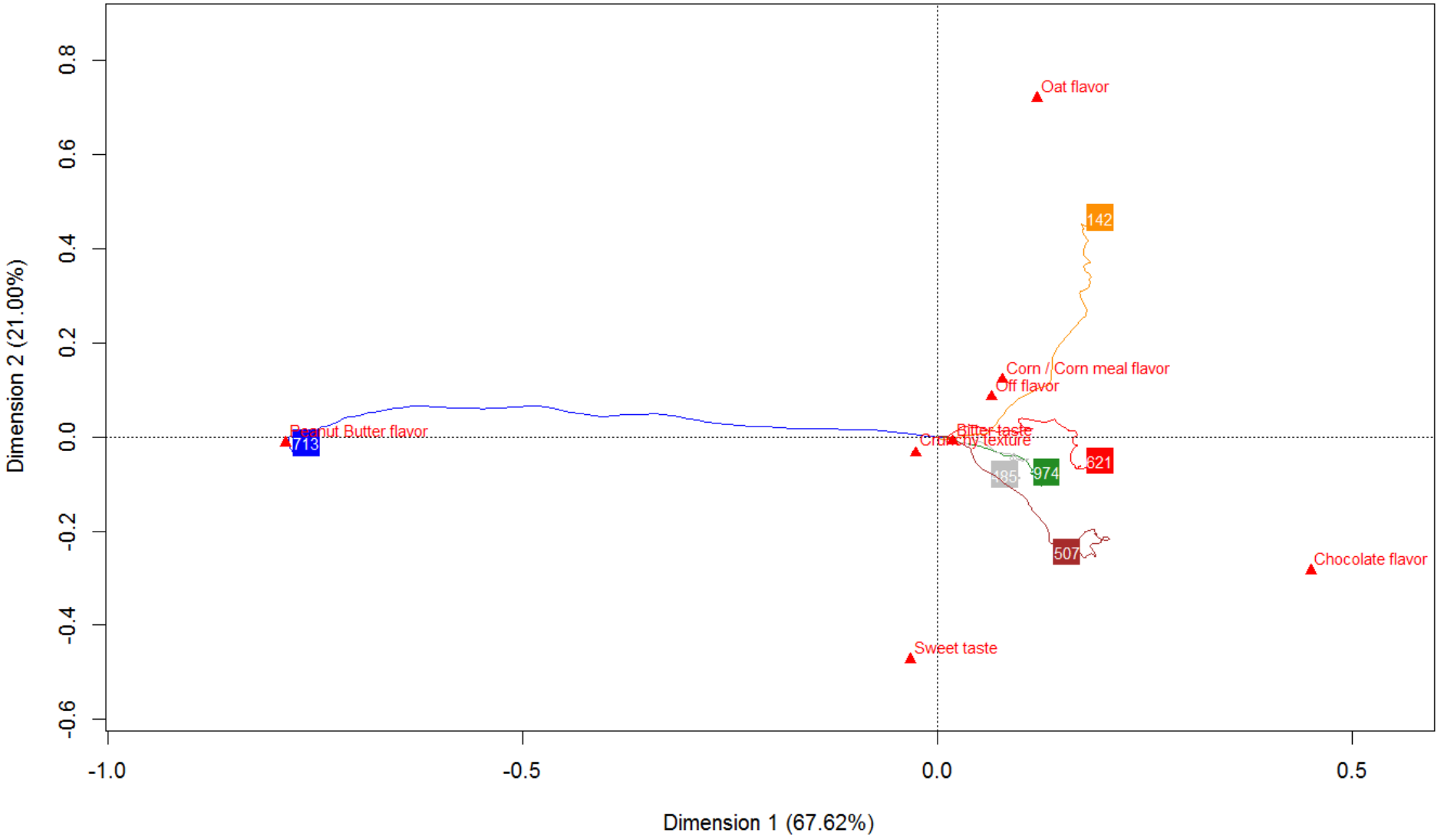
Liking clusters



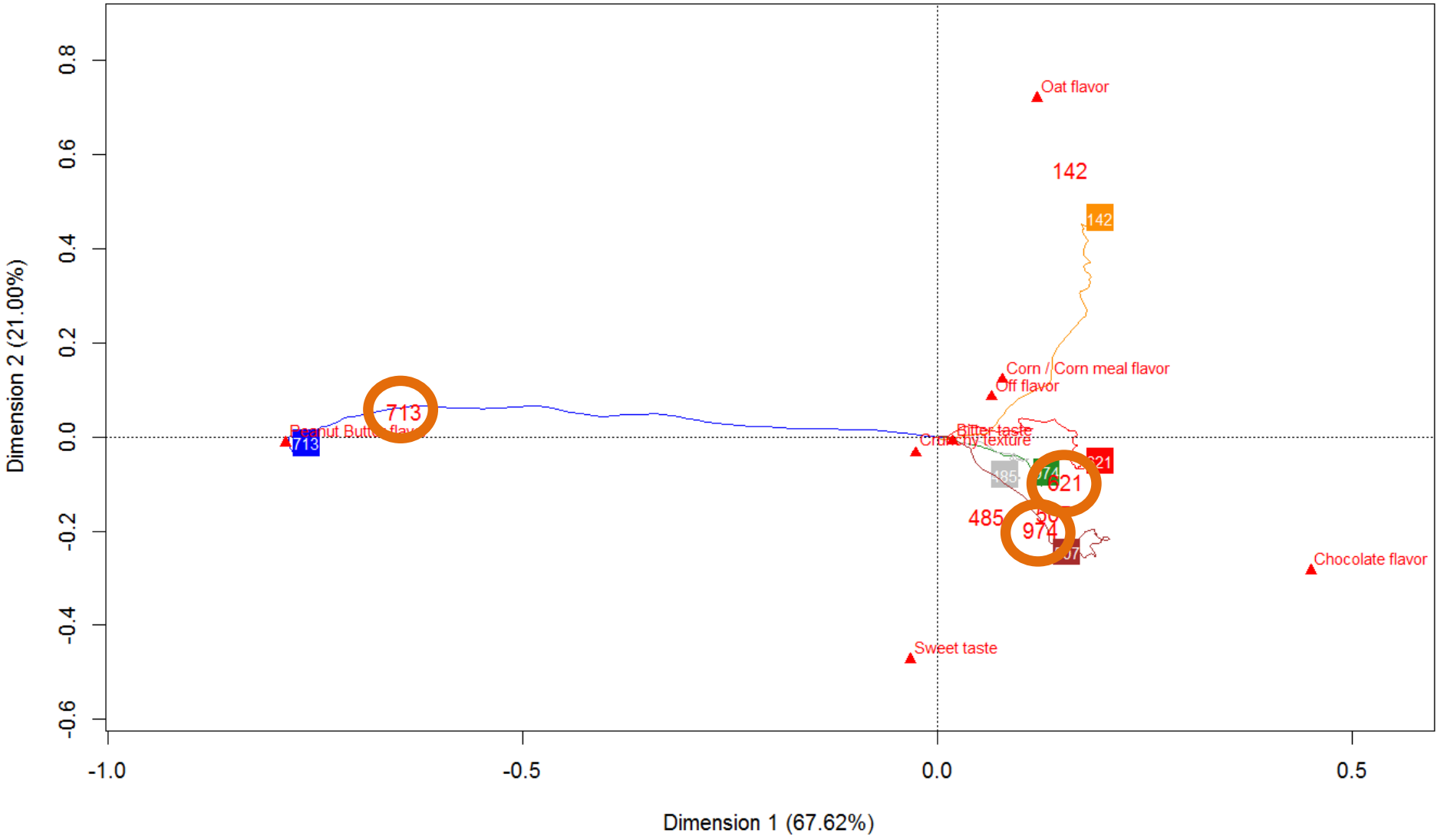
Liking clusters



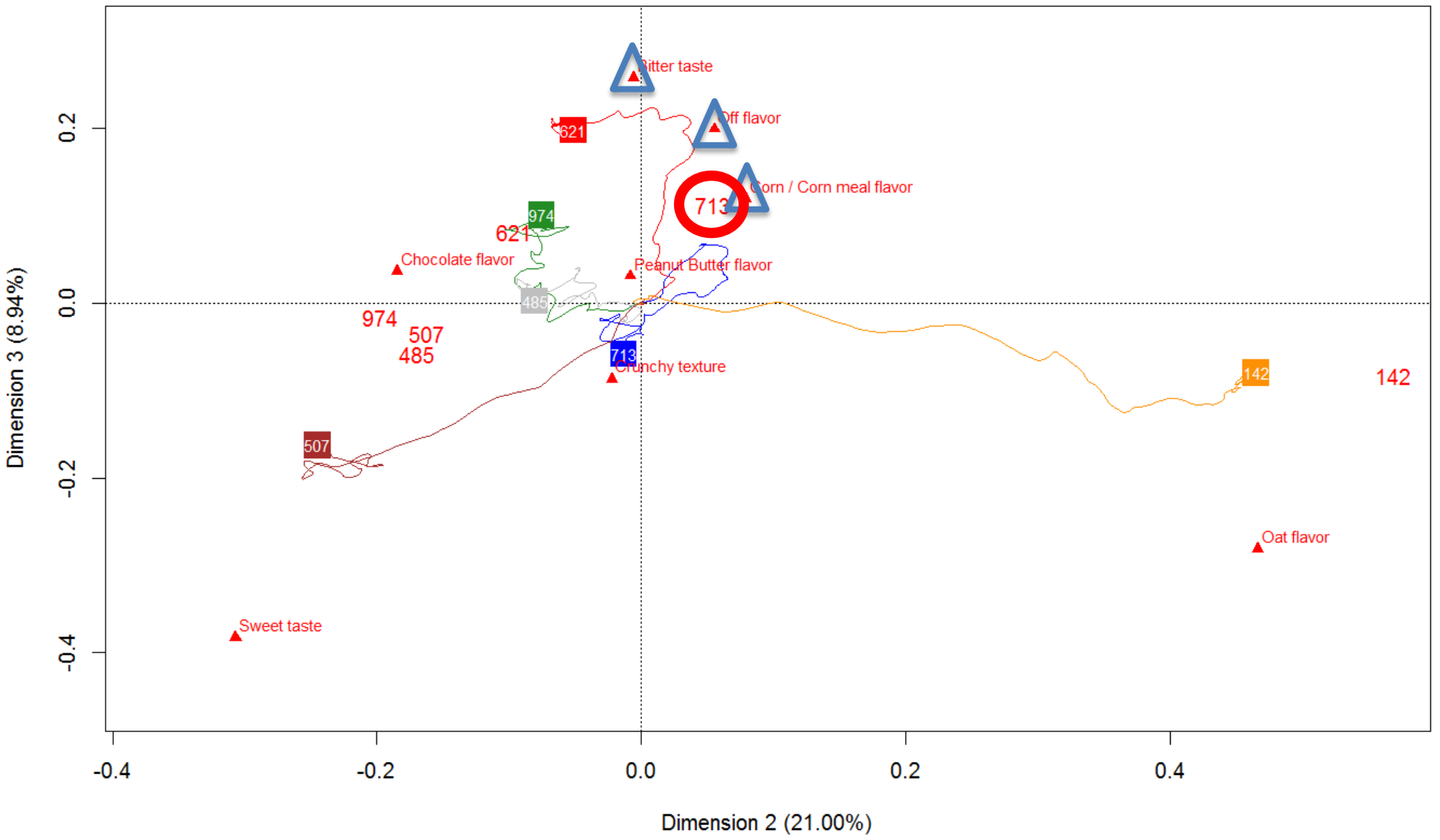
First sensory impressions (up to 20 s)



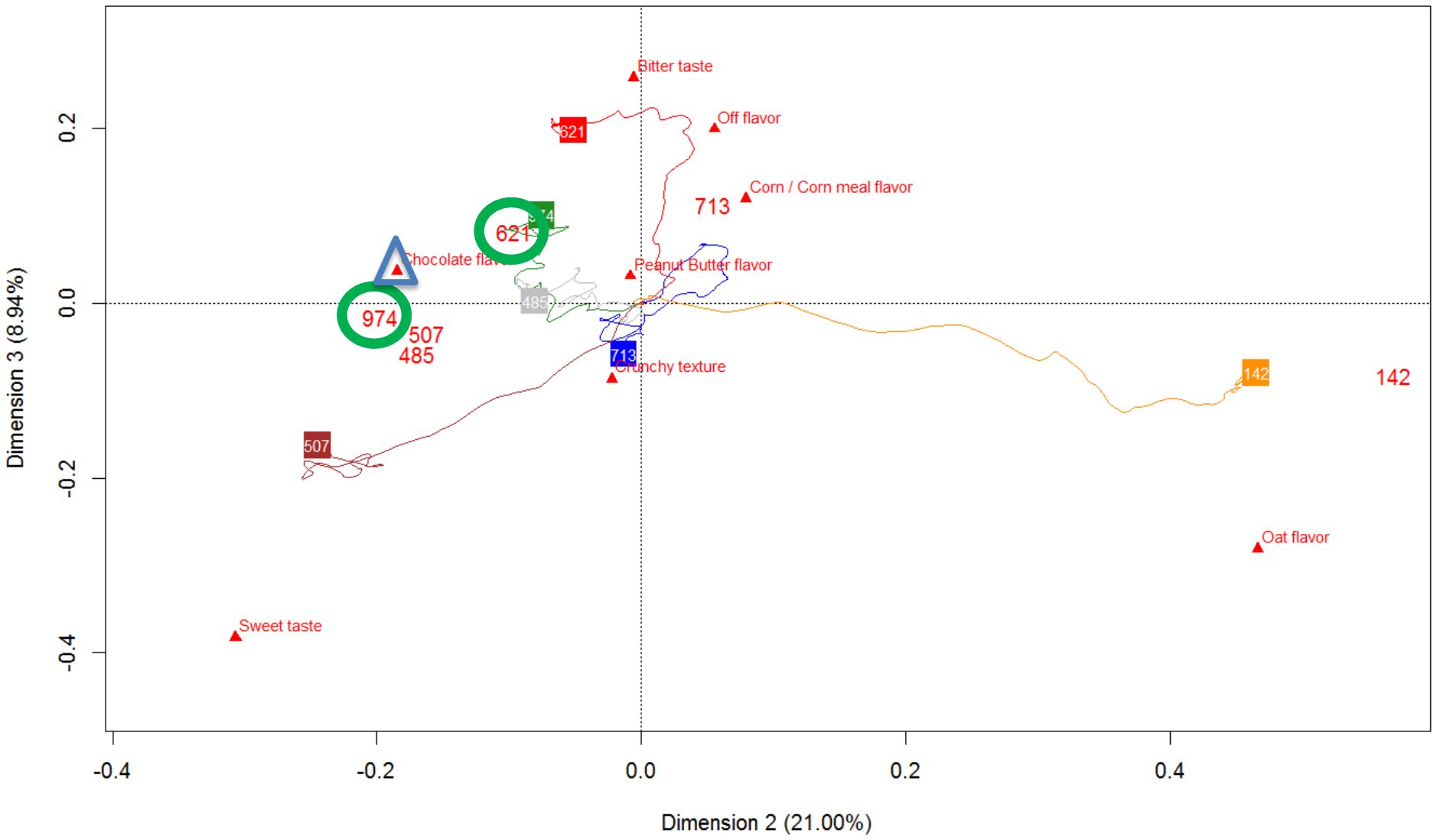
First sensory impressions (up to 20 s)



First sensory impressions (up to 20 s)



First sensory impressions (up to 20 s)



Positive hedonic drivers (selected)

Concurrent attributes	Proportion	Effect
Crunchy + Sweet	0.19	+1.9
Peanut butter + Sweet	0.12	+1.7
Sweet	0.51	+1.4
Peanut Butter	0.20	+1.3

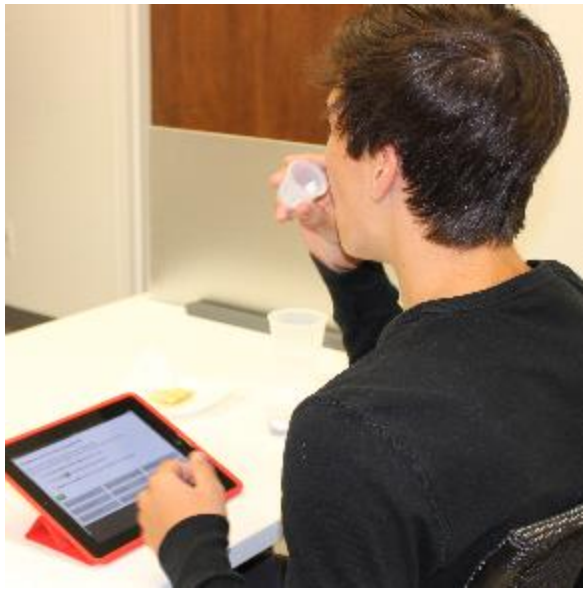
Negative hedonic drivers (selected)

Concurrent attributes	Proportion	Effect
Bitter	0.14	-1.7
Off flavor	0.16	-1.7
Corn/Corn meal	0.22	-0.5

Conclusions

Products can be characterized dynamically using the TCATA method with negligible training by **teenage** consumers.

It is possible to co-investigate hedonics and dynamics of consumer perception to understand variability.



Some examples of TCATA applications

- Early-stage formulation/reformulation
  - Explore the temporal evolution of sensations of prototypes and/or of products in the category
- Investigating impact of ingredients/process
  - Designed experiments to investigate how ingredient/process changes affect sensory outcomes
- Product reformulations
  - Confirm that reformulation/process changes have successfully differentiated the product

Refereed Publications

Ares, G., Castura, J. C., Antúnez, L., Vidal, L., Giménez, A., Coste, B., Picallo, A., Beresford, M. K., Chheang, S. L., & Jaeger, S. R. Comparison of two TCATA variants for dynamic sensory characterization of food products. Food Quality and Preference, 54, 160-172. http://dx.doi.org/10.1016/j.foodqual.2016.07.006

Ares, G., Jaeger, S. R., Antúnez, L., Vidal, L, Giménez, A., Coste, B., Picallo, A., & Castura, J. C. (2015). Comparison of TCATA and TDS for dynamic sensory characterization of food products, *Food Research International*, 78, 148-158. http://dx.doi.org/10.1016/j.foodres.2015.10.023

Baker, A. K., Castura, J. C., & Ross, C. J. Temporal check-all-that-apply characterization of Syrah wine. *Journal of Food Science*, 81, S1521–S1529. http://dx.doi.org/10.1111/1750-3841.13328

Boinbaser, L., Parente, M. E., Castura, J. C., & Ares, G. (2015). Dynamic sensory characterization of cosmetic creams during application using Temporal Check-All-That-Apply (TCATA) questions. *Food Quality and Preference*, 45, 33-40. http://dx.doi.org/10.1016/j.foodqual.2015.05.003

Castura, J. C., Antúnez, L., Giménez, A., & Ares, G. (2016). Temporal Check-all-that-apply (TCATA): A novel dynamic method for characterizing products. *Food Quality and Preference*, 47, 79-90. http://dx.doi.org/10.1016/j.foodqual.2015.06.017 Open access

Castura, J. C., Baker, A. K., & Ross, C. F. (2016). Using contrails and animated sequences to visualize uncertainty in dynamic sensory profiles obtained from temporal check-all-that-apply (TCATA) data. *Food Quality and Preference*, 54, 90-100. http://dx.doi.org/10.1016/j.foodqual.2016.06.011 Open access

Jaeger, S. R., Beresford, M. K., Hunter, D. C., Alcaire, F., Castura, J. C., & Ares, G. (2017). Does a familiarization step influence results from a TCATA task? Food Quality and Preference, 55, 91-97. http://dx.doi.org/10.1016/j.foodqual.2016.09.001

Meyners, M., Castura, J. C., & Carr, B. T. (2013). Existing and new approaches for the analysis of CATA data. *Food Quality and Preference*, 30, 309-319. http://dx.doi.org/10.1016/j.foodqual.2013.06.010

Oliveira, D., Antúnez, L., Giménez, A., Castura, J. C., Deliza, R., & Ares, G. (2015). Sugar reduction in probiotic chocolate-flavored milk: Impact on dynamic sensory profile and liking. *Food Research International*, 75, 148-156. http://dx.doi.org/10.1016/j.foodres.2015.05.050

Acknowledgements

- Thanks to Chris Findlay & Compusense Sensory Services for product selection advice, teen recruit, and data collection.
- Thanks to The Saul Zaentz Company for permission to use the clip from the movie *Amadeus*, and to Paul Zaentz for kind handling of this request.

  Reference:

  Zaentz, S. (Producer), & Forman, M. (Director). (1984). *Amadeus* [DVD]. Burbank, CA: Warner Home Video.

- Thanks to Jess Anselmini and Sara King of Compusense Inc. for video editing assistance, and Jess for photos of products and teens used in this presentation. All photos used with permission.
- Thanks to the AACC International and the Society of Sensory Professionals for the invitation to participate in this meeting.
- **Also, thank you for your kind attention.**

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