



Healthy food product development, the complexity of the multisensory experience

Paula Varela

Consumer & Sensory Sciences

We make sense – om smaksforståelse og matinnovasjon

What would you like to eat for dessert?

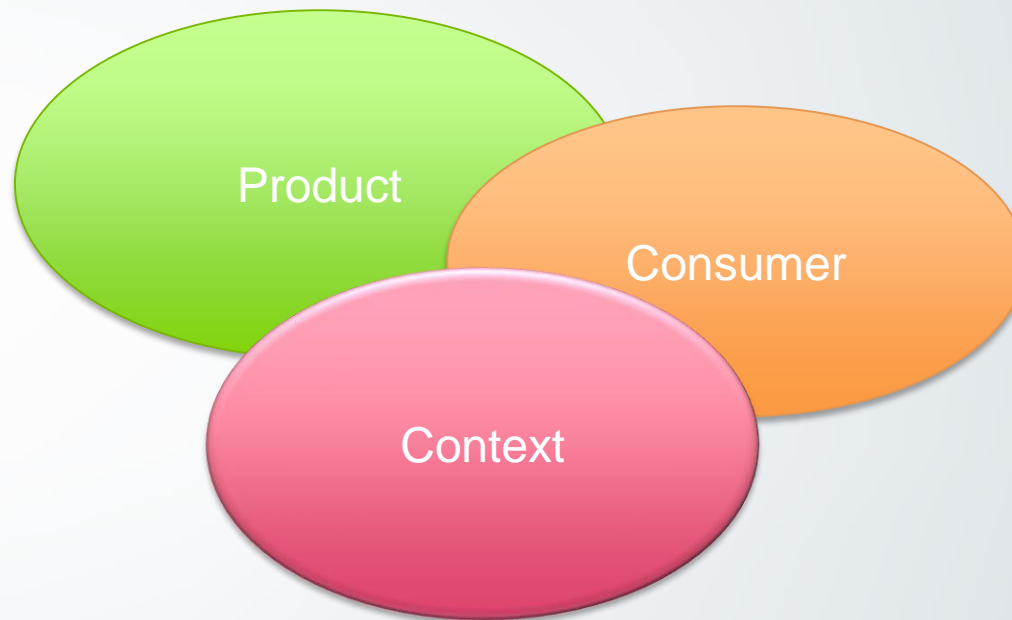


Consumers' sensory perception is what generally drives preferences

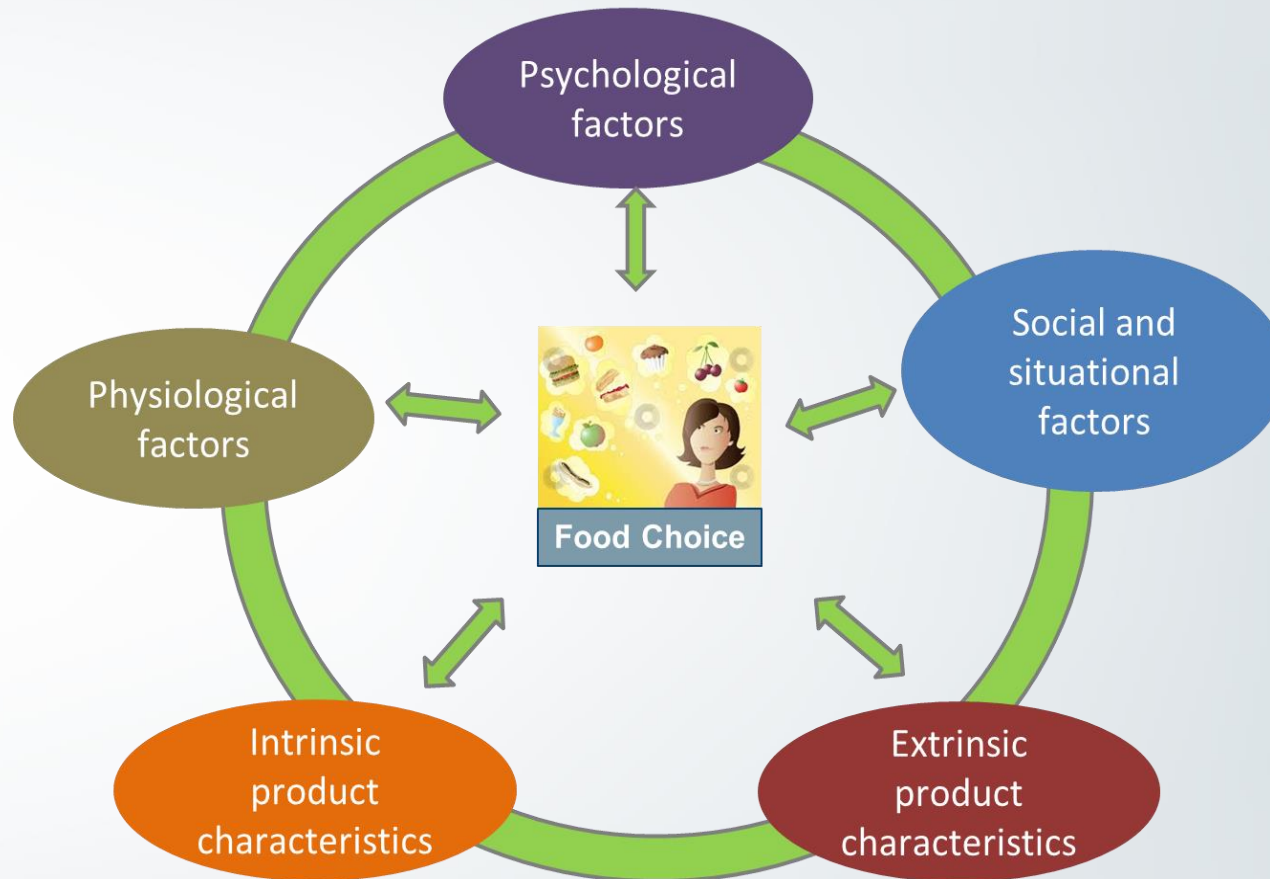
...but choice goes much beyond the **sensory experience**

"The consumer does not behave as he says, he does not say what he thinks and he does not think what he feels." **David Ogilvy Confessions of an Adman 1978**

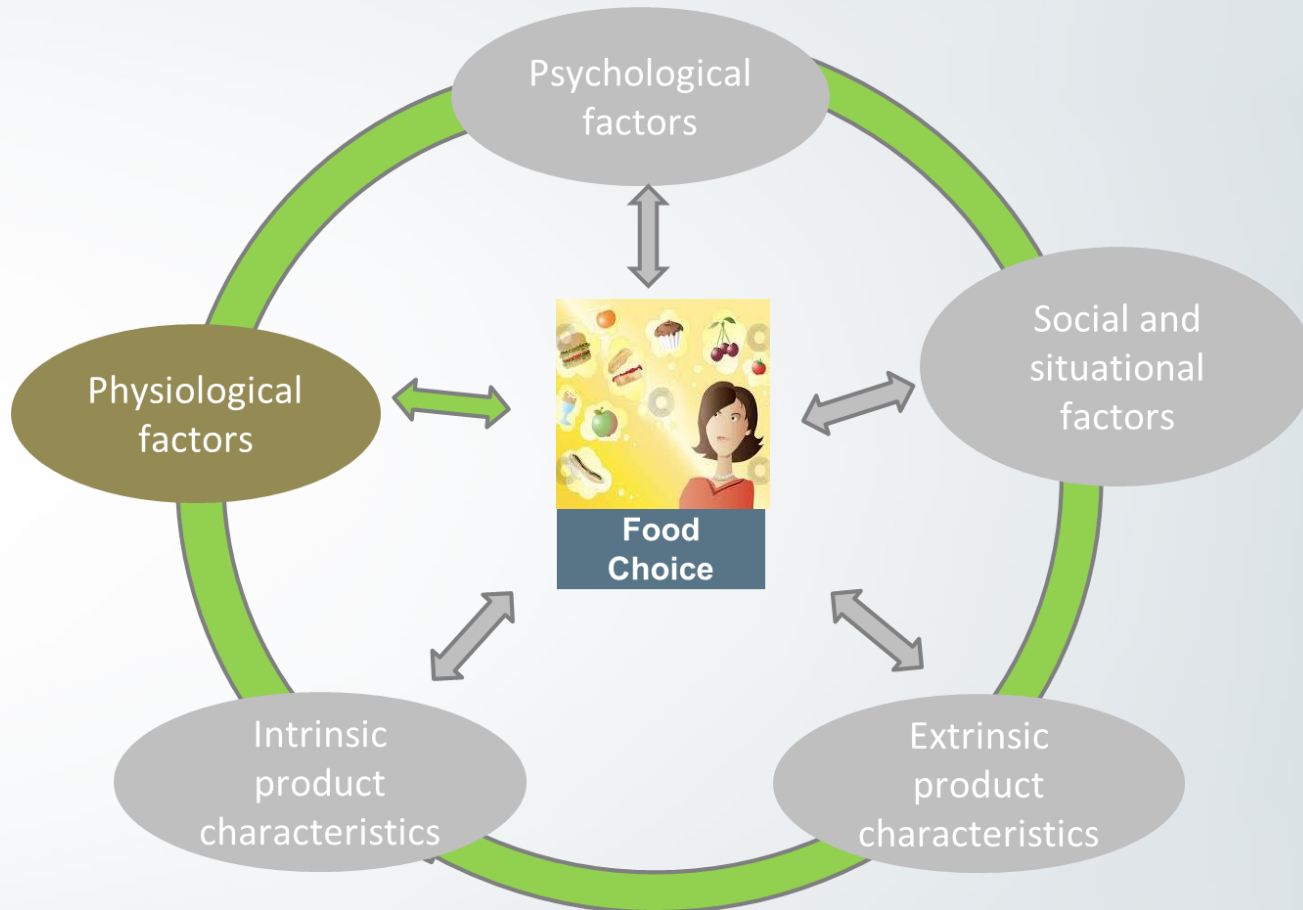
Because food choice is much more complex..



Food choice in a nutshell...



Based on food choice model by Koster & Mojet (2007)

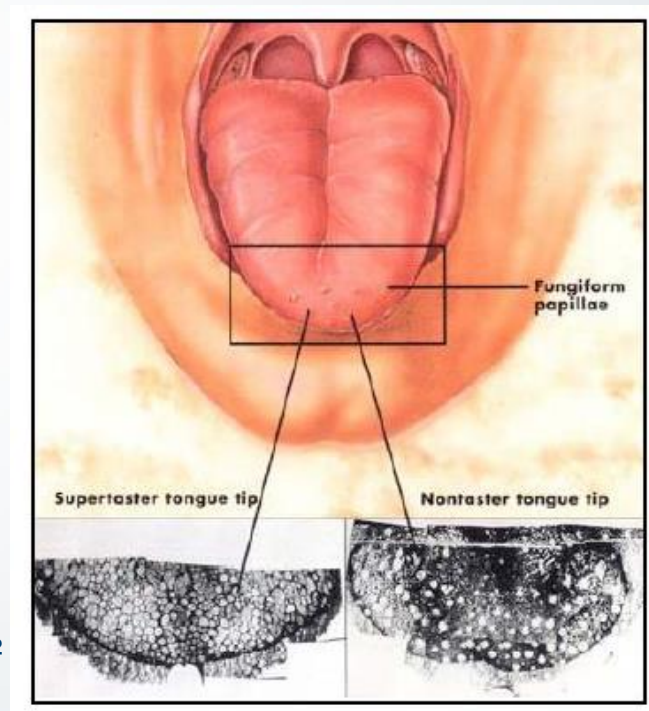


Sensory experiences are individual

Ability to **taste bitter** is genetically determined

PROP status (insensitivity to aromatic thiurea compounds)

nontasters (30% Caucasians), **tasters** (45%) & **supertasters** (25%)



ca 425 papillae pr cm²

95 papillae pr cm²

<http://faculty.uca.edu/~jmurray/baw2004/taste.pdf>

Sensory experiences are individual

Progress in Lipid Research 52 (2013) 438–445

Contents lists available at SciVerse ScienceDirect

Progress in Lipid Research

journal homepage: www.elsevier.com/locate/plipres

ELSEVIER

Review

Fat taste in humans: Sources of within- and between-subject variability 

Cordelia A. Running^a, Richard D. Mattes^{b,*}, Robin M. Tucker^b

^aPurdue University, Department of Food Science, West Lafayette, IN 47905, United States
^bPurdue University, Department of Nutrition Science, West Lafayette, IN 47905, United States

ELSEVIER

Physiology & Behavior, Vol. 61, No. 6, pp. 949–954, 1997
Copyright © 1997 Elsevier Science Inc.
Printed in the USA. All rights reserved
0031-9384/97 \$17.00 + .00

PII S0031-9384(96)00608-7

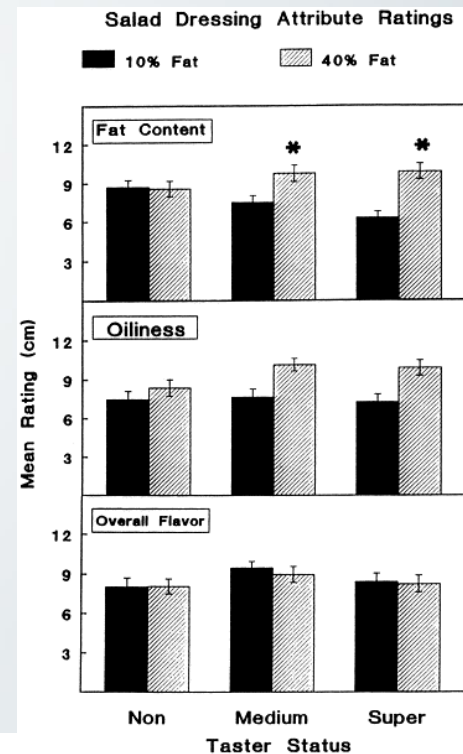
BRIEF COMMUNICATION

Fat Perception is Related to PROP Taster Status

BEVERLY J. TEPPER¹ AND RICKY J. NURSE

Department of Food Science, Cook College, Box 231, Rutgers University,
New Brunswick, NJ 08903-0231 USA

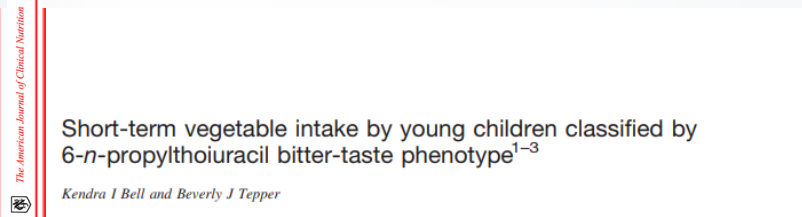
- Fatty acids detectable through **taste**
- Wide variability in **sensitivity**
- Genetics, Sex, diet, and BMI affect sensitivity



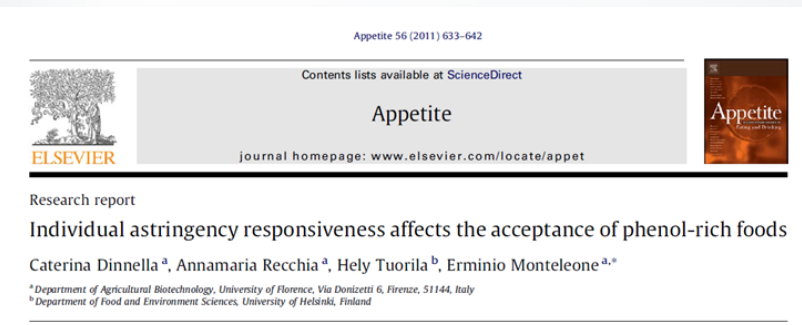
Sensory experiences are individual



People hyposensitive to fat consumed significantly more energy, fat & had greater BMI



PROP Non-taster children consumed more vegetables, particularly bitter ones

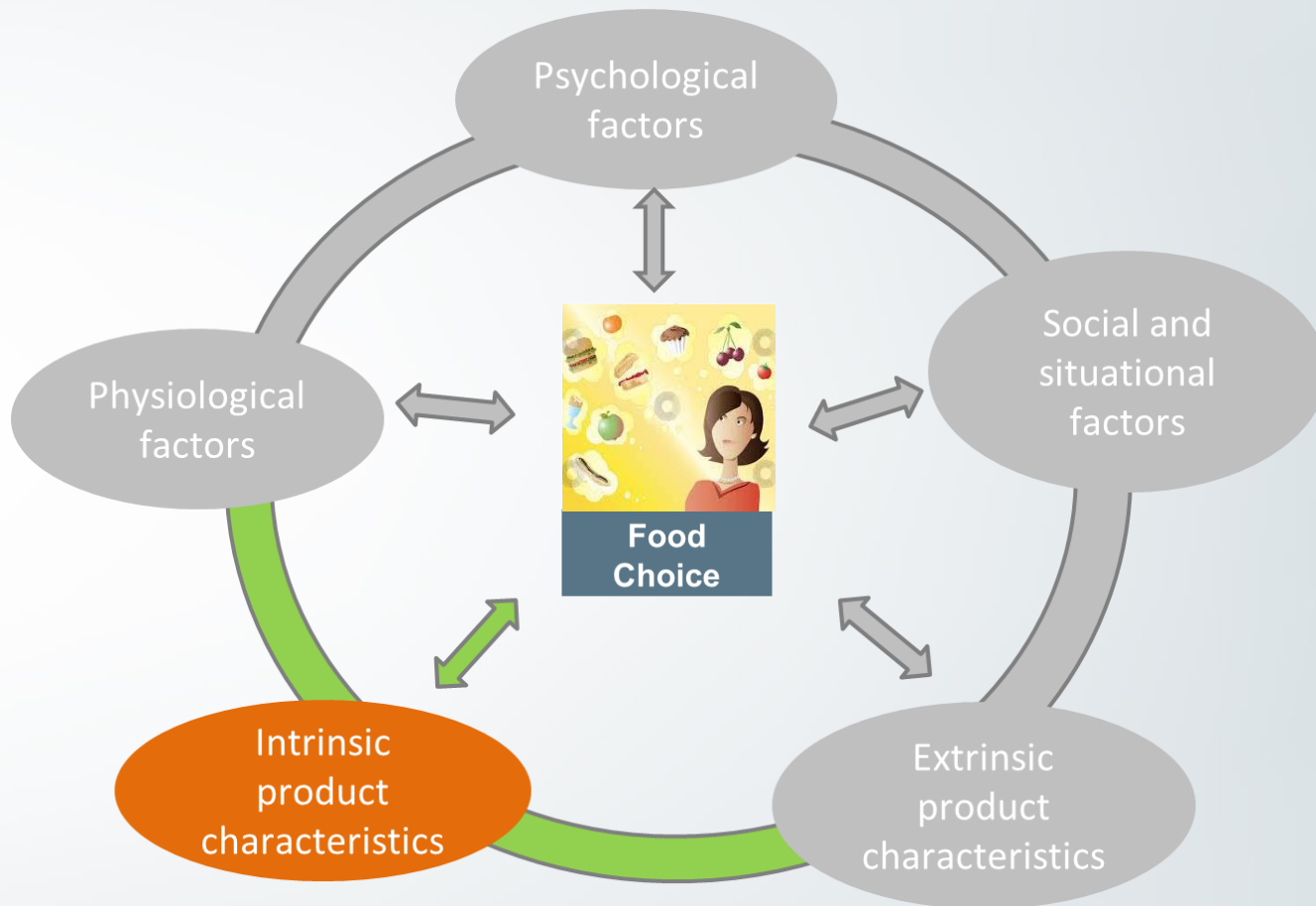


Sensitivity towards astringency can influence acceptability of astringent foods: tea, coffee, chocolate, bitter vegetables

To perceive or not to perceive? That is the question

Depending on what people **perceive** or **do not** perceive in a product, other flavors may be *diminished* or *enhanced*...

...and in turn will influence *preferences* and *diet*



Is it the flavour or is it the texture?

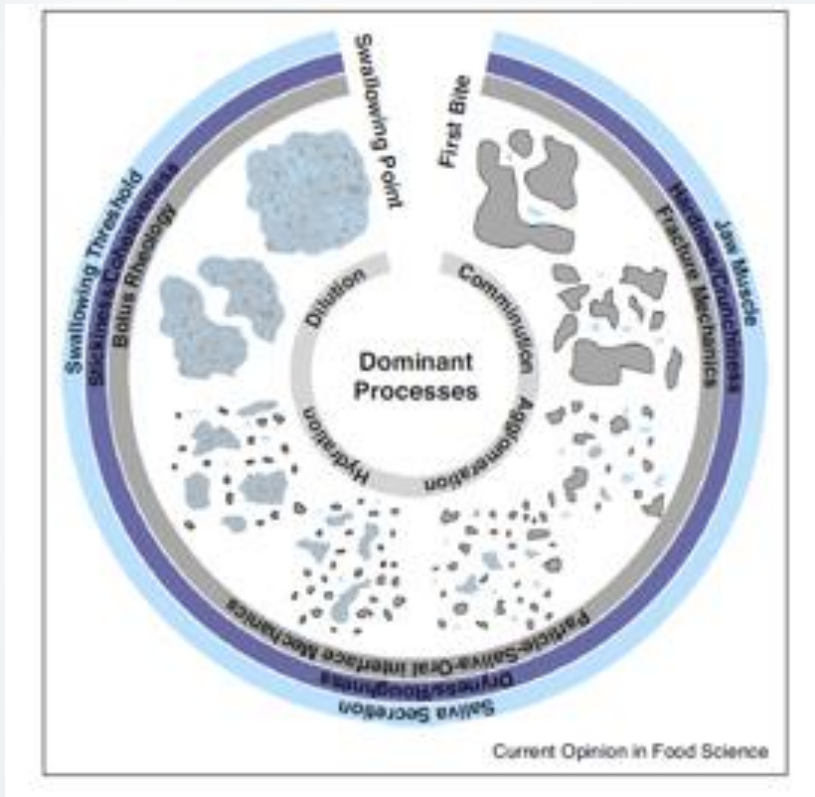
- Viscosity affects release of tastants and hinders **aroma-taste interactions**
- **Fat content** influences the **sensory profile** of foods through their own taste, mouth-feeling, changing solubility, melting point, emulsifying
- **Hydrocolloids** change the matrix structure and water/tastant availability
- **Food structure** is a determinant of the sensory perception



Sensory perception is dynamic

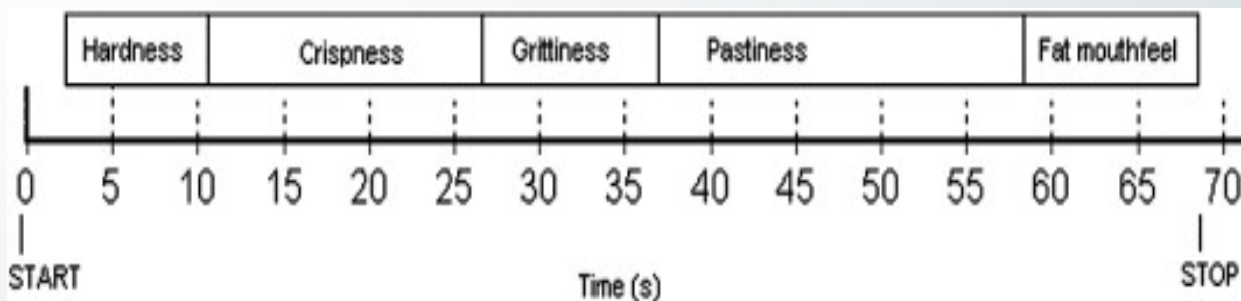
In-mouth-changes over time

- First impression
- Textural changes
- Flavour release
- Mouthcoating
- Swallowing
- Afterfeeling



Temporal aspects of perception

Which **attributes are important for the product** at each point in time (order, dominance and relevance)

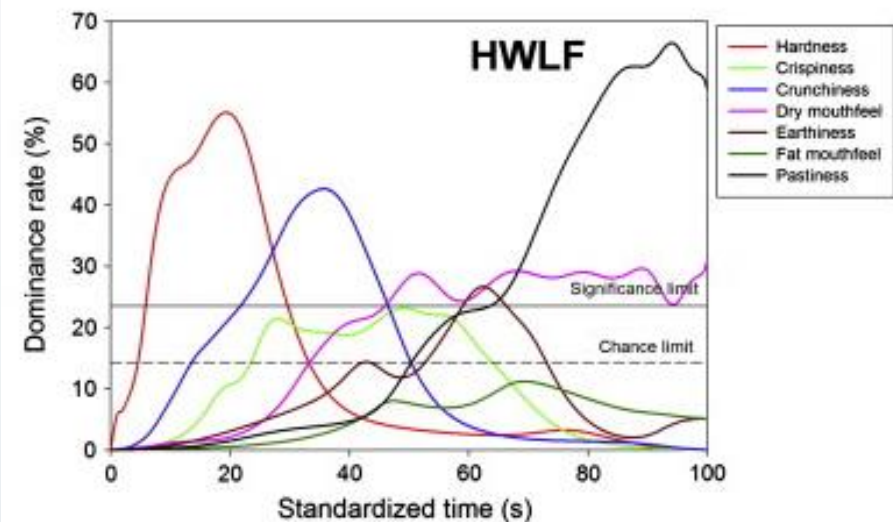
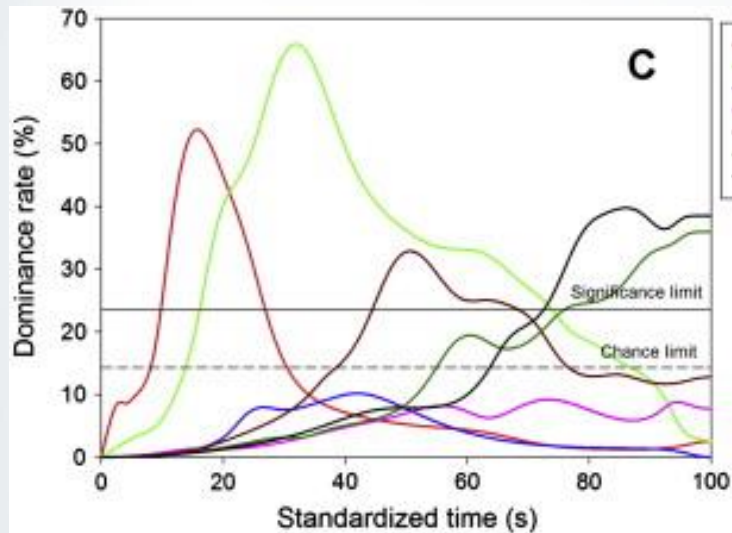




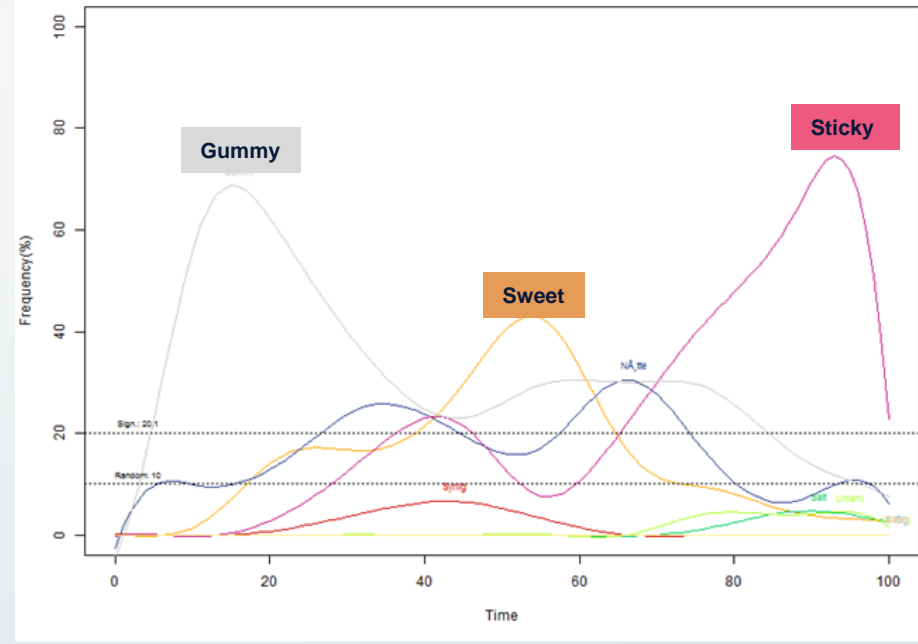
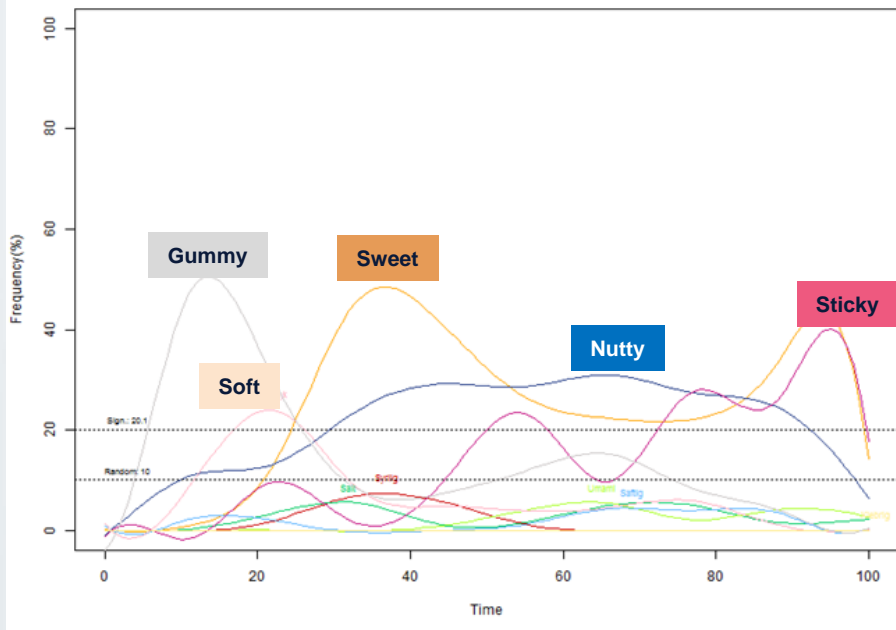
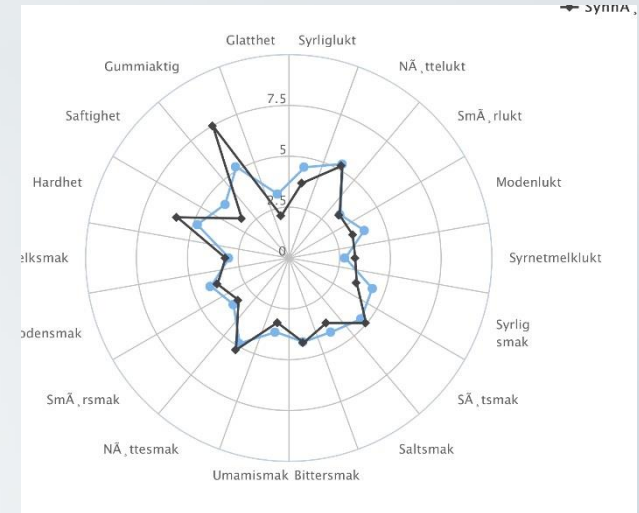
A new sensory tool to analyse the oral trajectory of biscuits with different fat and fibre contents

Laura Laguna , Paula Varela , Ana Salvador , Susana Fiszman 

Instituto de Agroquímica y Tecnología de Alimentos (IATA-CSIC), Agustín Escardino, 7. 46980 Paterna, Valencia, Spain



Jarlsberg-type cheeses from the Norwegian market



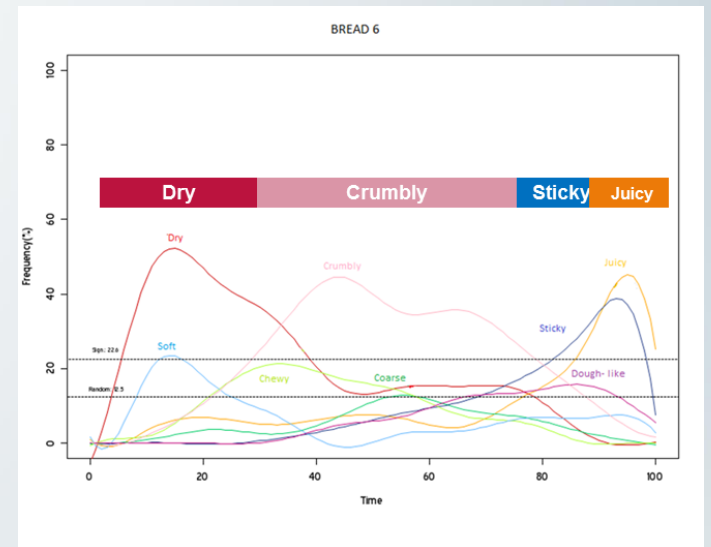
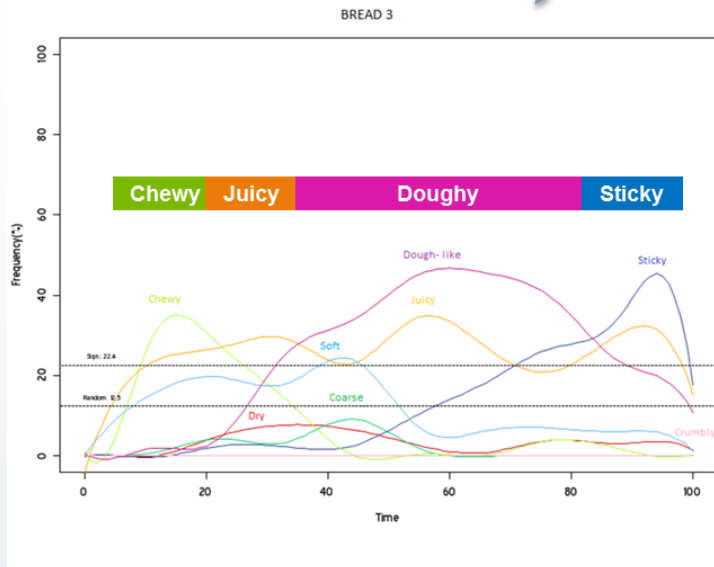
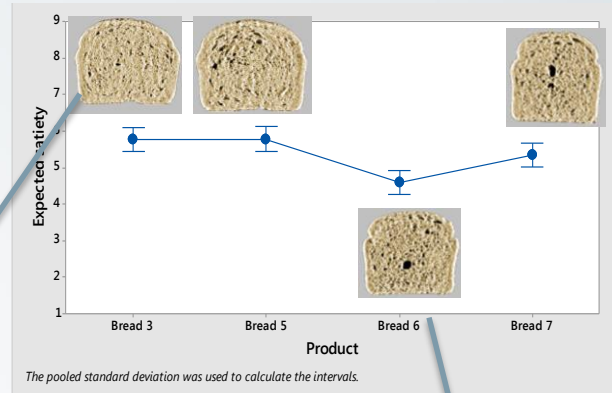


Understanding the role of dynamic texture perception in consumers' expectations of satiety and satiation. A case study on barley bread

Quoc Cuong Nguyen^{a,b}, Marte Berg Wahlgren^a, Valérie L. Almli^a, Paula Varela^{a,*}

^a Nofima AS, Osloveien 1, P.O. Box 210, N-1431 Ås, Norway

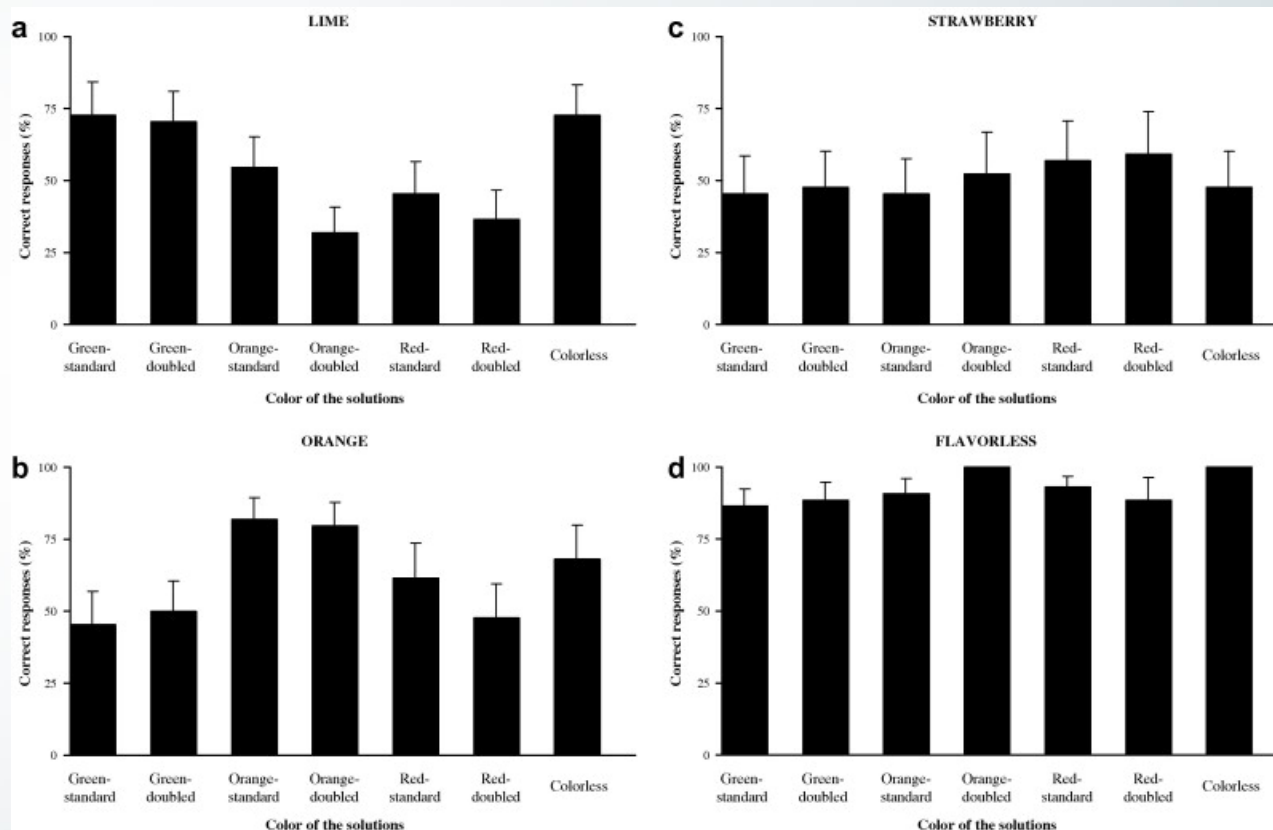
^b The Norwegian University of Life Sciences, Department of Chemistry, Biotechnology and Food Science (IKBM), Ås, Norway



When to perceive or when not to perceive? That is also the question

Differences in **dynamic perception** can be utilised in product development, for example to get more satiating products (*obesity*) or less satiating products (*elderly*)

Multisensory perception: modulatory effect of visual cues on flavour perception



Multisensory integration and expectations

Consciousness and Cognition 19 (2010) 380–390



Contents lists available at ScienceDirect

Consciousness and Cognition

journal homepage: www.elsevier.com/locate/concog



Review

Grape expectations: The role of cognitive influences in color–flavor interactions

Maya U. Shankar *, Carmel A. Levitan, Charles Spence

Department of Experimental Psychology, University of Oxford, England, United Kingdom

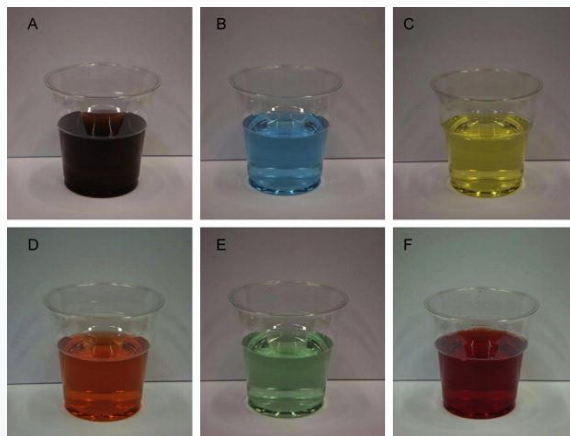


Table 1

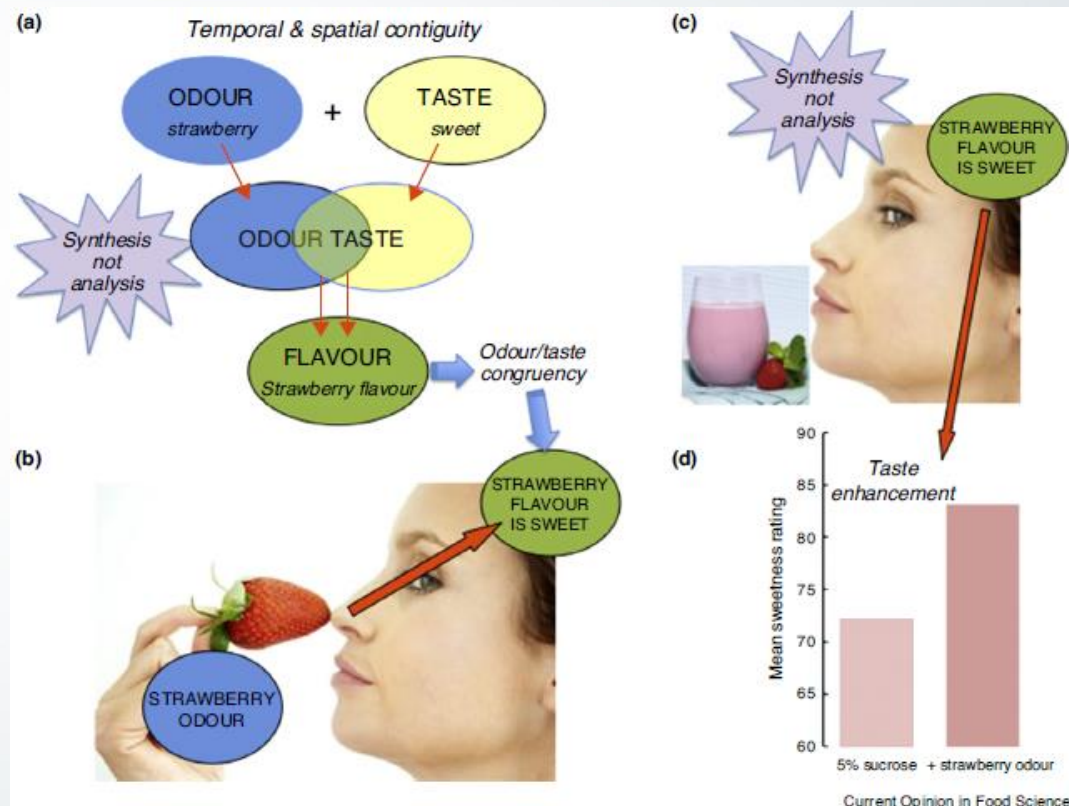
Color–Flavor Responses for British and Taiwanese Populations. Top three^a flavor responses^a within each population are shown, with exact count in brackets. The pattern of flavor responses generated for each color within each group is significantly different from that of a uniform distribution (British: [$p < .01$] and Taiwanese: [$p < .01$], according to the results of a 1-sample Kolmogorov–Smirnov Test (after correcting for multiple comparisons, $p < .01$, was considered as significant; see Ben-Horim & Levy, 1981, pp. 780–786). Significant differences (signified by shaded cells) existed between the responses generated by the two groups for the Brown, Blue, Yellow and Orange colored drinks ($p < .01$), but not for the Green, Clear, and Red colored drinks ($p > .01$), according to the results of a Fisher’s Exact Test (see Howell, 1992, pp. 147–148). P -values were estimated using 100,000 Monte Carlo simulations and were corrected for multiple comparisons (see Howell, 1992, pp. 428–429).

Color	British participants ($N = 20$)	Taiwanese participants ($N = 15$)
Brown	Cola (14), cherry (3), blackcurrant (2)	Grape (6), mulberry (3), cranberry (3)
Blue	Raspberry (8), mint (4), blueberry (3)	Mint (7), cocktail (3)
Yellow	Lemon (11), pineapple (2), grape (2)	Yellow soda (4), White wine (2)
Orange	Orange (13)	Cranberry (2), strawberry (2), apple (2)
Green	Mint (11), lime (4), apple (4)	Mint (5), apple (3), lime (2), kiwi (2)
Clear	Water (16), lemon (2)	Water (14)
Red	Cherry (8), strawberry (4), cranberry (3), raspberry (3)	Cranberry (5), strawberry (2), cherry (2), wine (2)

^a Flavor counts equal to 1 have been omitted for clarity. Tied responses for third place have also been included.

Different colours potentially carry different semantic meanings depending on a person’s previous experiences with specific colour–flavour co-occurrences.

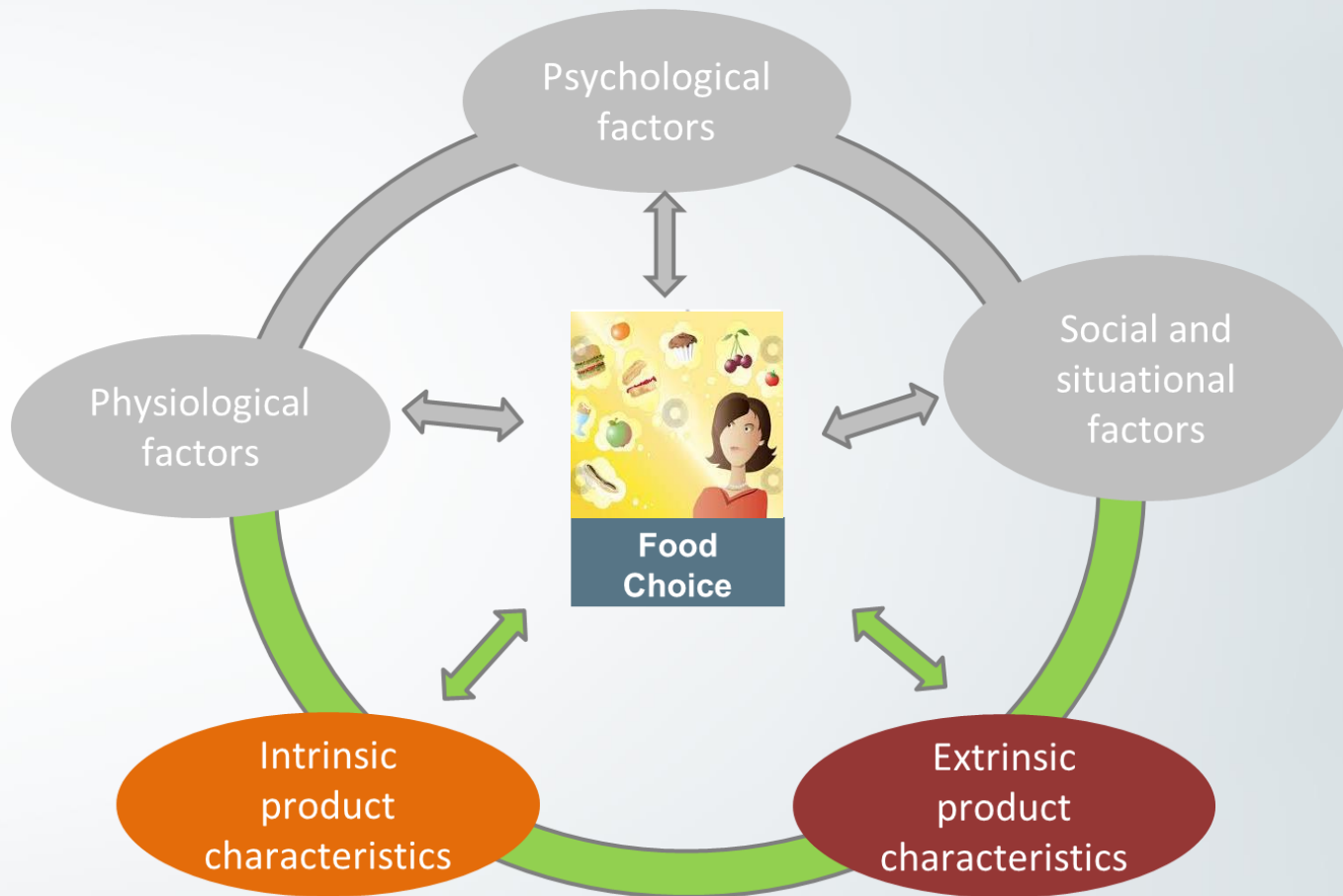
Multisensory perception and crossmodal interactions



J. Prescott (2016)

To taste more or not to taste more? That is also the question

Multisensory integration
could be utilised for example
to formulate products with low
salt or sugar



Effects of evoked meal contexts on consumers' responses to intrinsic and extrinsic product attributes in dry-cured ham

Margrethe Hersleth ^a ✉, Erminio Monteleone ^b, Anne Segtnan ^a, Tormod Næs ^{a, c}



Please evaluate sample **894**

Imagine a situation where you eat dry cured ham in a meal with several small dishes i.e. "finger food" or "tapas".

How much do you like or dislike this dry cured ham?

Dislike extremely				Neither like nor dislike				Like extremely
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Traditional vs novel meal context and origin



Imagine that you are in a shop and that you are going to buy a package of dry cured ham to a meal with dry cured hams and scrambled eggs.

Look at the image, and rate your probability of buying this package of dry cured ham.

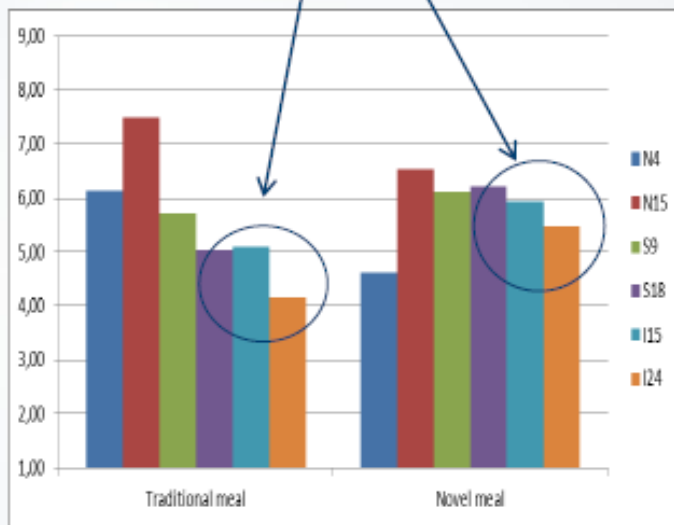


Imagine that you are in a shop and that you are going to buy a package of dry cured ham to a meal with several small dishes i.e "finger food" or "tapas".

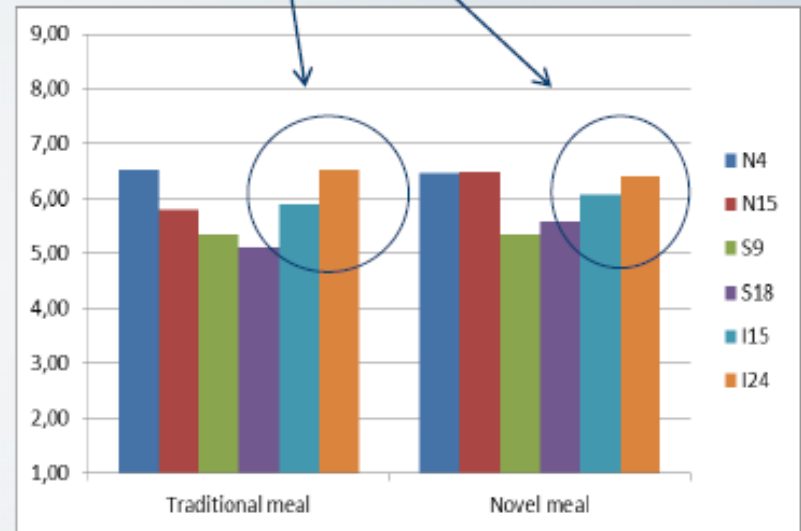
Look at the image, and rate your probability of buying this package of dry cured ham.



Choice: Effect of meal



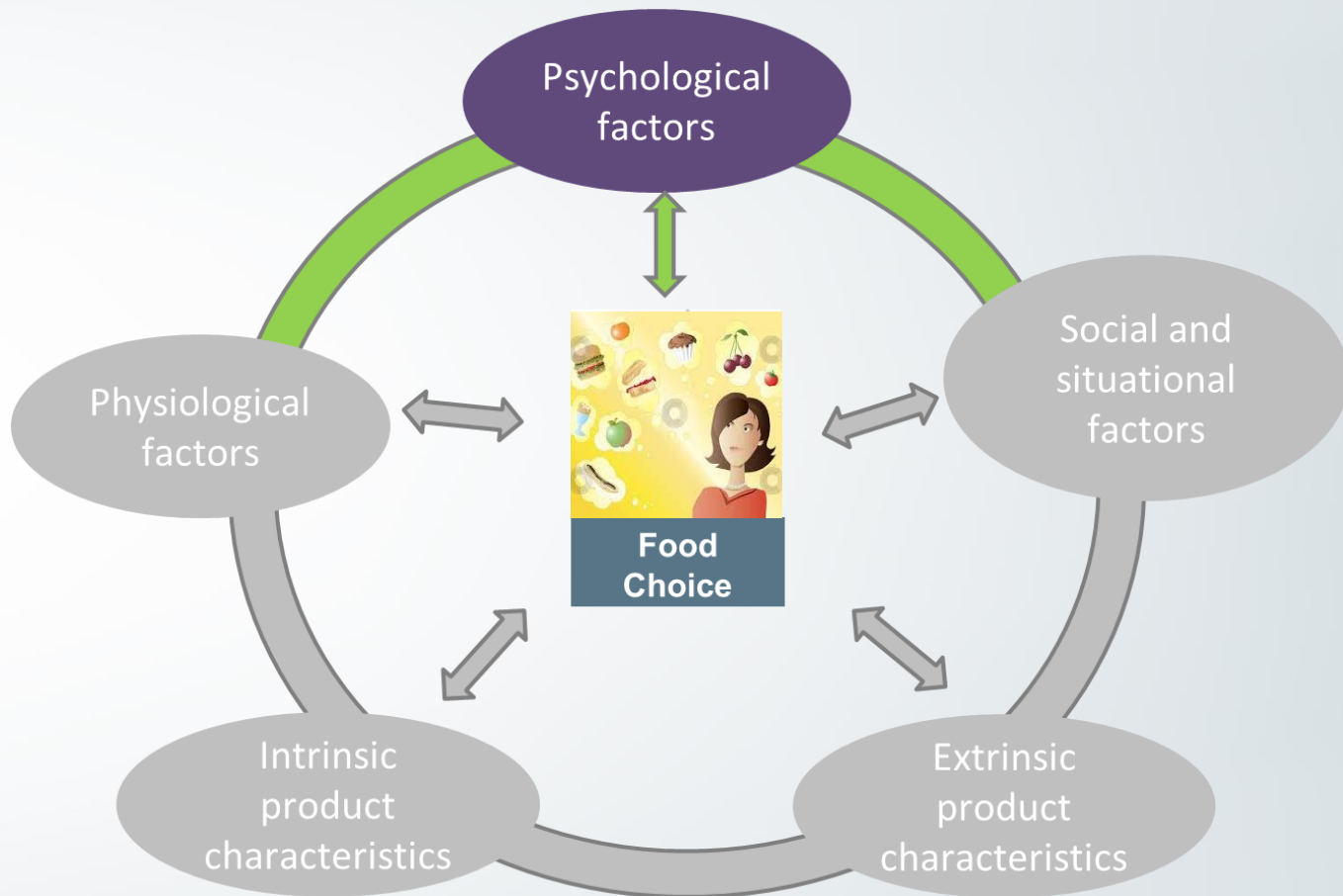
Acceptance: Minor effect of meal



Consumers expect a difference dependent on meal, but they don't perceive it in blind condition

To claim or not to claim? That is also the question

On- pack communication and product positioning can drive perception and acceptance, but drivers can work differently in different products



Our perception of food draws on an integration of all the senses



Smell and **taste** are linked neurologically in a way that no other human senses are

Sound can also affect taste perception

In the orbitofrontal cortex of the brain there are **neurons that respond specifically to the texture of fat** in the mouth (creamy “touch”)

We **unconsciously discriminate** between high and low-calorie foods by **sight**

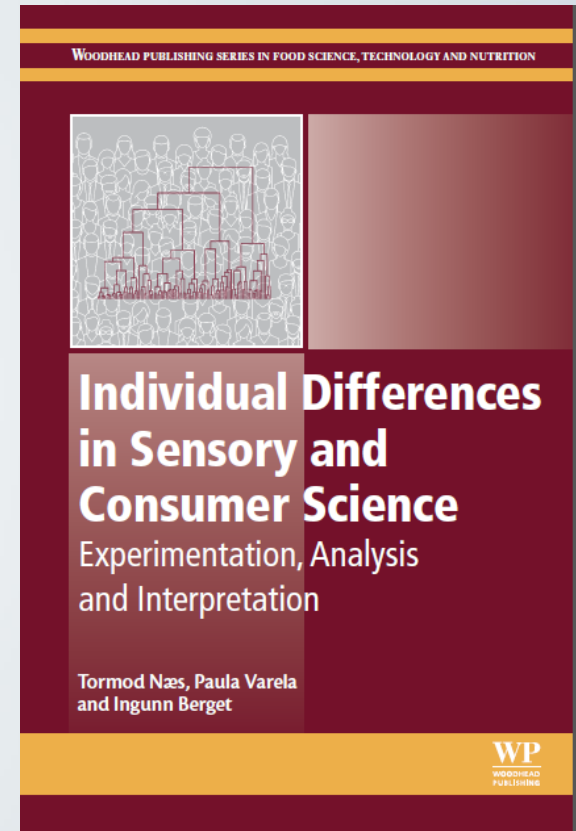
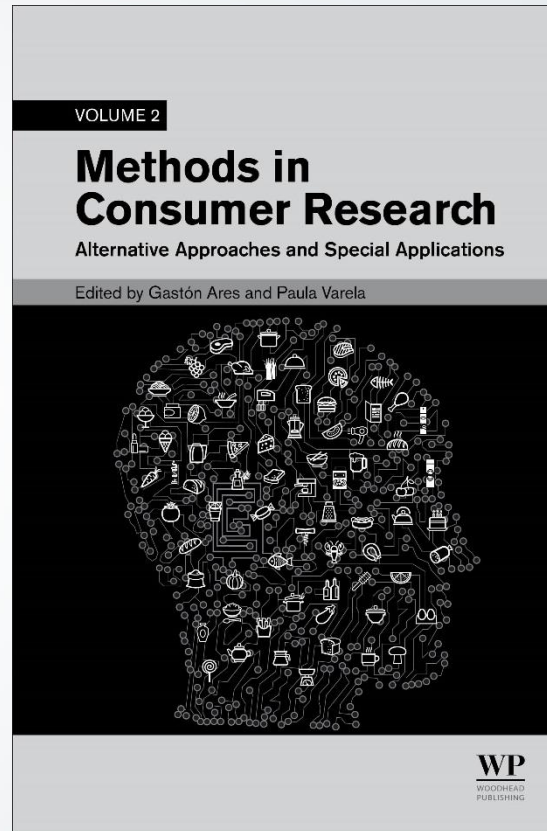
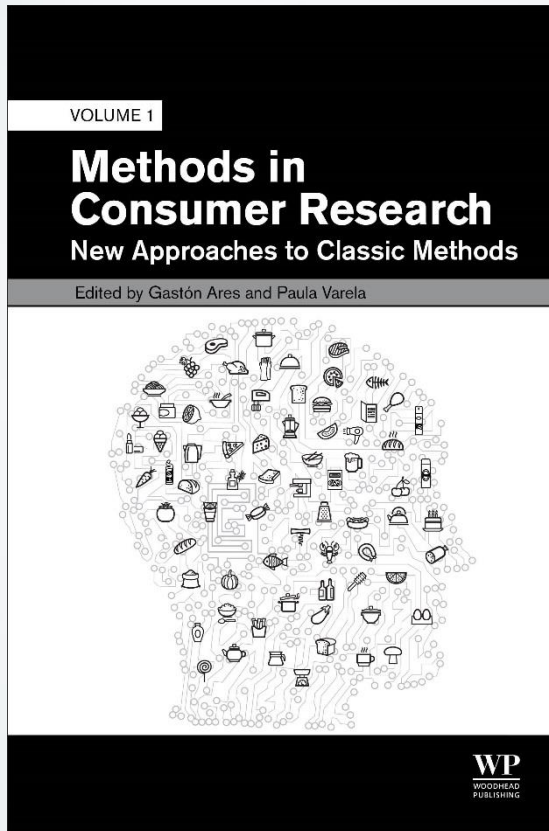
Pictures of high- and low-calorie foods provokes responses in different parts of the brain, **related to pleasure**

So...what would you like to eat for dessert?



Complex problems require multidimensional approaches

...because there is no such thing as a “simple” sensory experience





Takk for oppmerksomheten

www.nofima.no

- **Fondet for Forskingsavgift på Landbruksprodukter (FFL)**
- **Norges ForskningsRåd (NFR)**

Forbrukertest - sjokolade



- Check – All – That – Apply (CATA)

<https://tinyurl.com/sfidag>



Forbrukertest - sjokolade



- Check – All – That – Apply (CATA)

På en skala fra 1 til 9, hvor godt likte du prøve 813?

- | |
|---|
| <input type="radio"/> 1. Liker ikke i det hele tatt |
| <input type="radio"/> 2. |
| <input type="radio"/> 3. |
| <input type="radio"/> 4. |
| <input type="radio"/> 5. Hverken liker eller misliker |
| <input type="radio"/> 6. |
| <input type="radio"/> 7. |
| <input type="radio"/> 8. |
| <input type="radio"/> 9. Liker svært godt |

Forrige Neste

Huk av for alle de egenskapene du synes beskriver prøve 578 best:

<input type="checkbox"/> Melk	<input type="checkbox"/> Tørr
<input type="checkbox"/> Vanilje	<input type="checkbox"/> Klebrig
<input type="checkbox"/> Karamell	<input type="checkbox"/> Smelter
<input type="checkbox"/> Salt	<input type="checkbox"/> Kakao
<input type="checkbox"/> Nøttesmak	<input type="checkbox"/> Ettersmak
<input type="checkbox"/> Bitter	<input type="checkbox"/> Syrlig
<input type="checkbox"/> Myk	<input type="checkbox"/> Hard
<input type="checkbox"/> Fyldig	<input type="checkbox"/> Søt
<input type="checkbox"/> Annet	

Forrige Neste