



CONVENTIONAL, NITRITE-FREE AND MEATLESS SAUSAGE

What does eye-tracking research tell us about consumer choices?



A choice made in seconds

- Different choices
- Similar Price
- Little time

Which one attracts your attention first?

Which one would you choose?

Food choices often start with a glance

Kuva: Pirjo Latva-Mantila
(Ilta-Sanomat)

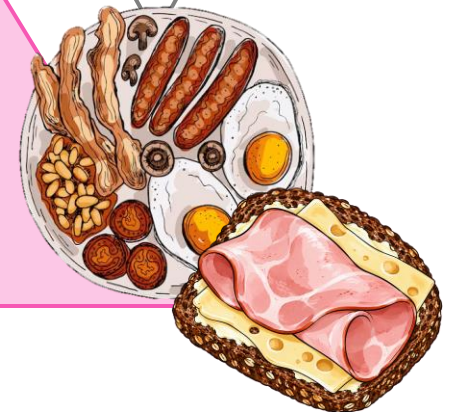
Cured meats in Europe



**Well
established**
eating habits are
often resistant to
behavioural
change

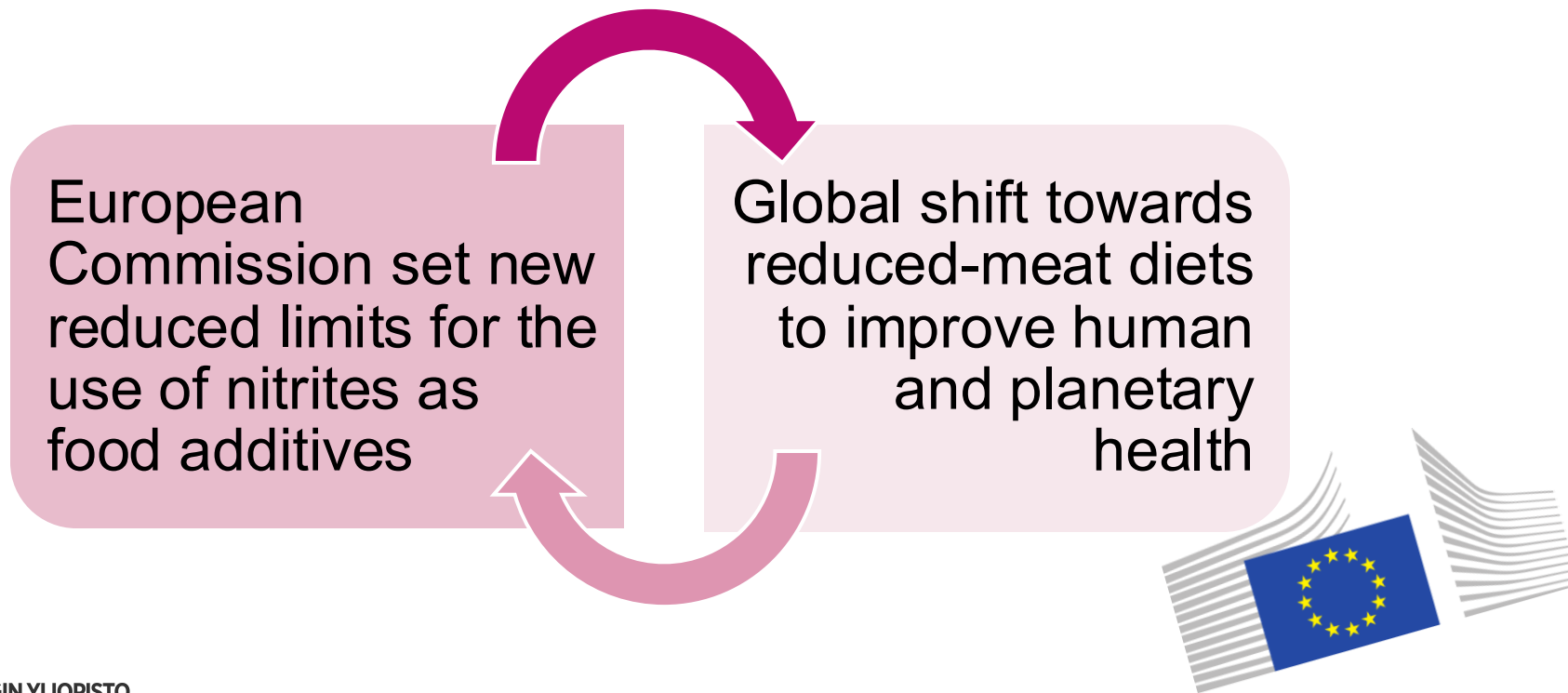
Cured meats such as
ham, bacon,
puddings, and
sausages are deeply
embedded in the
European
gastronomic culture

Cured meats have
a **distinct**
sensory profile
compared to fresh
meat



Transformations in the cured meat market

- In 2018, the International Agency for Research on Cancer (IARC) classified processed meat as carcinogenic to humans due to the **formation of N-nitroso compounds from the use of nitrites**



Alternative products challenges

Sensory quality and consumer perception of reduced/ free-from nitrates/nitrites cured meats

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Emily Crofton¹

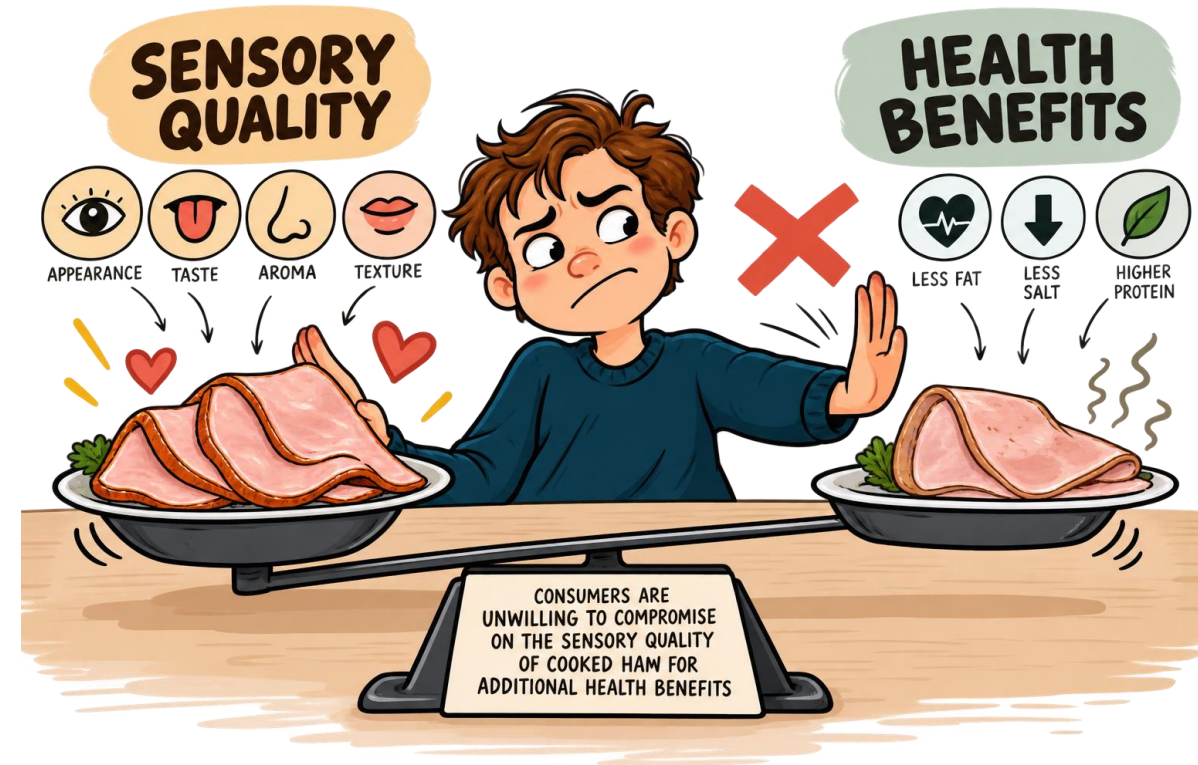


Nitrite-
free
products

Nitrites contribute to the formation of the characteristic cured meat colour, flavour, and texture

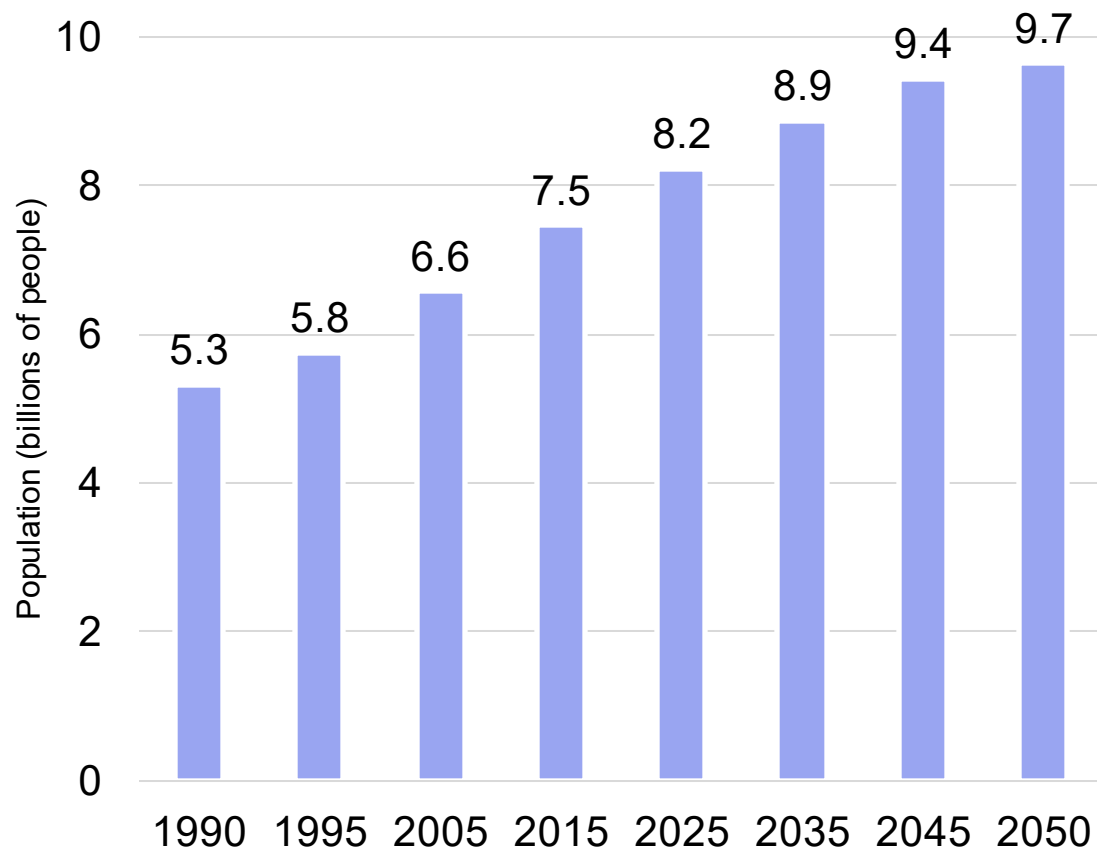
Meatless
options

Do not fully replicate the sensory profile of meat-based products



World population will reach 9.7 billion by 2050

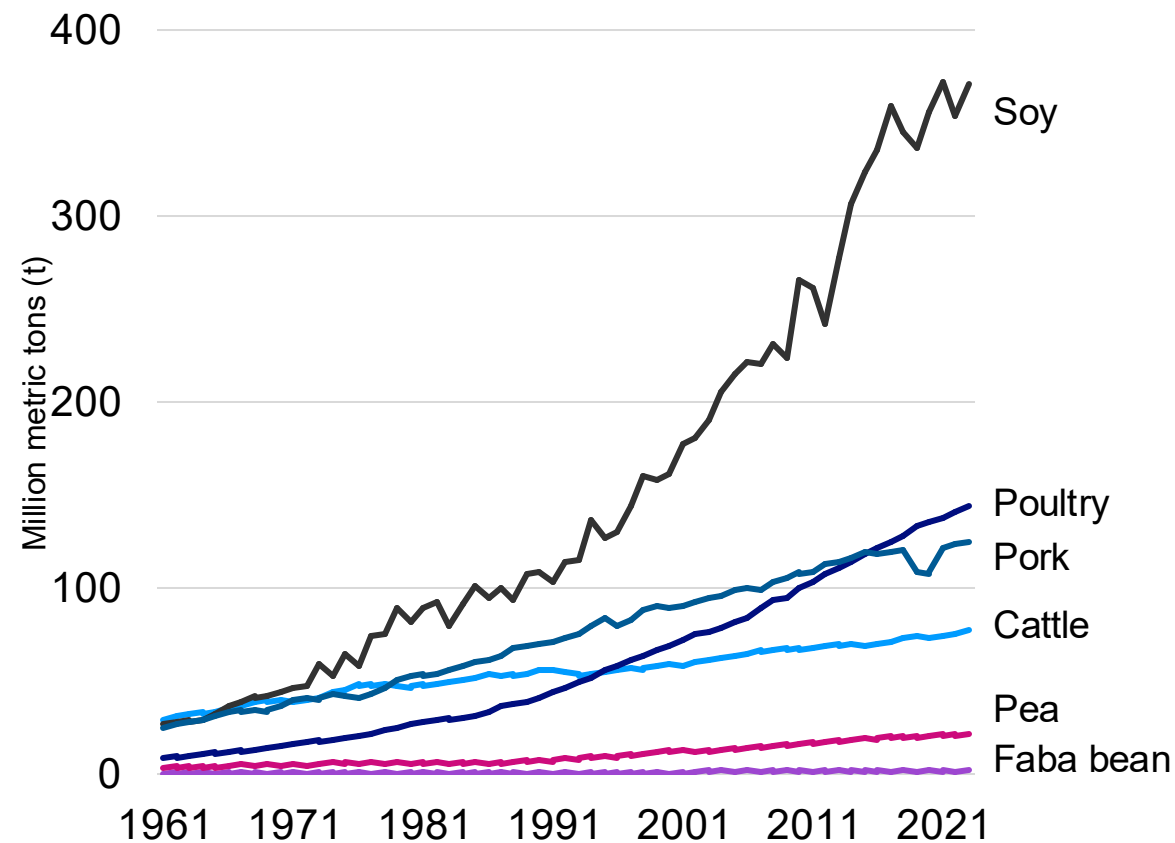
Est. and proj. annual population (billions)



Source: FAOSTAT

Soy and meat lead the global protein production

Global annual production in metric tons (millions)



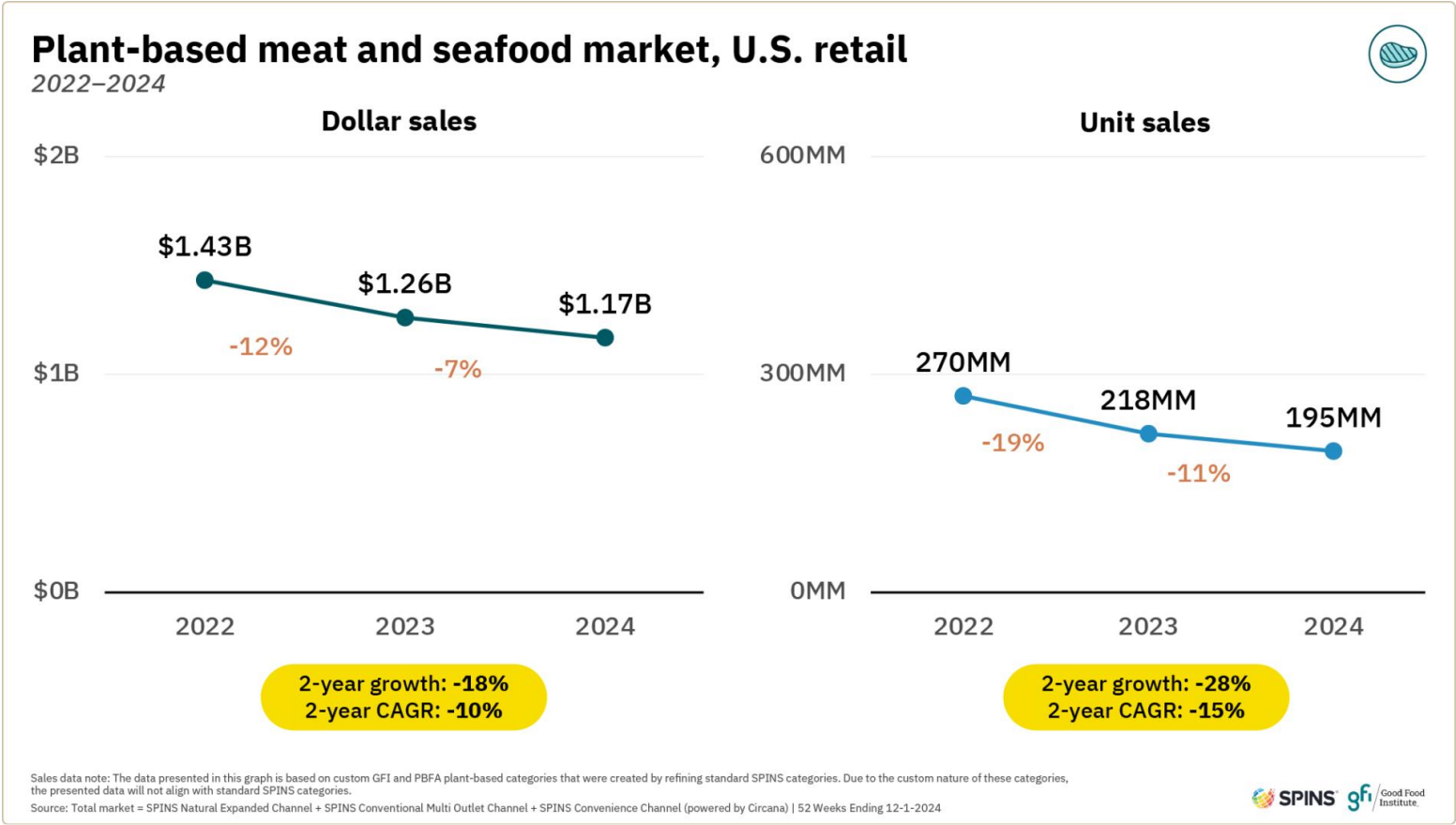
Source: FAOSTAT



Taste determines whether innovation succeeds or fails.

The future of sustainable
food systems depends
on consumer acceptance.

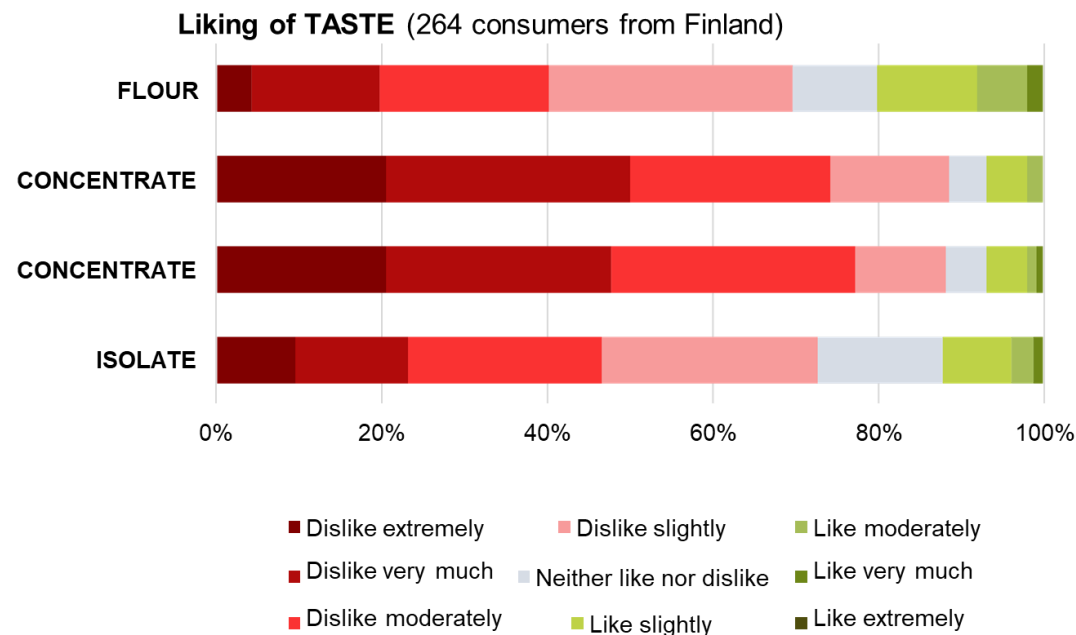
The plant-based market is significant (\$1.2 B), but also faces decline



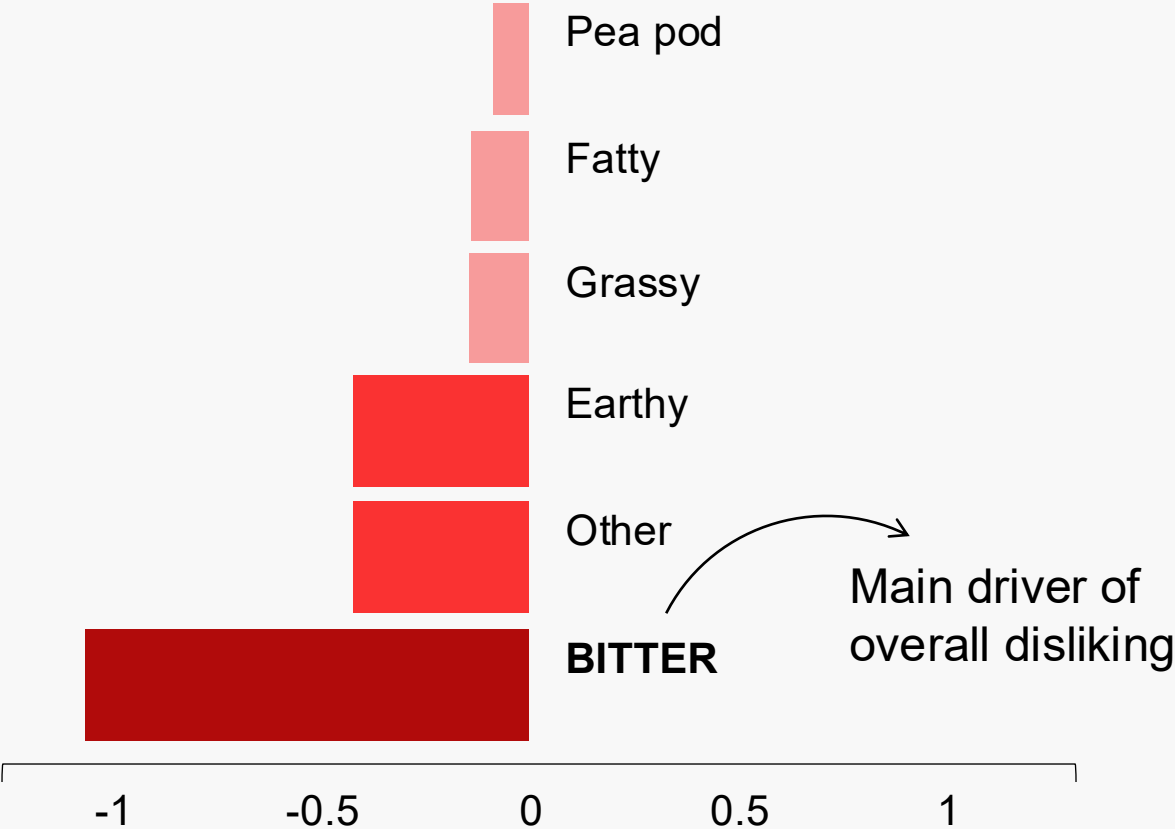
51%
of consumers
unwilling to try
plant-based
meat again

Sources: *State of the Industry Report;*
Wholegrainscouncil.org

Acceptance of faba bean ingredients is low



 Co-funded by the European Union *Source: Tuccillo et al. 2024, Food Quality and Preference*



Research on consumer acceptance of cured meat alternatives

Currently most of the data come from self-reported measures from online surveys

Overlooks important aspects of the actual choice and consumption experience



Sensory
perception

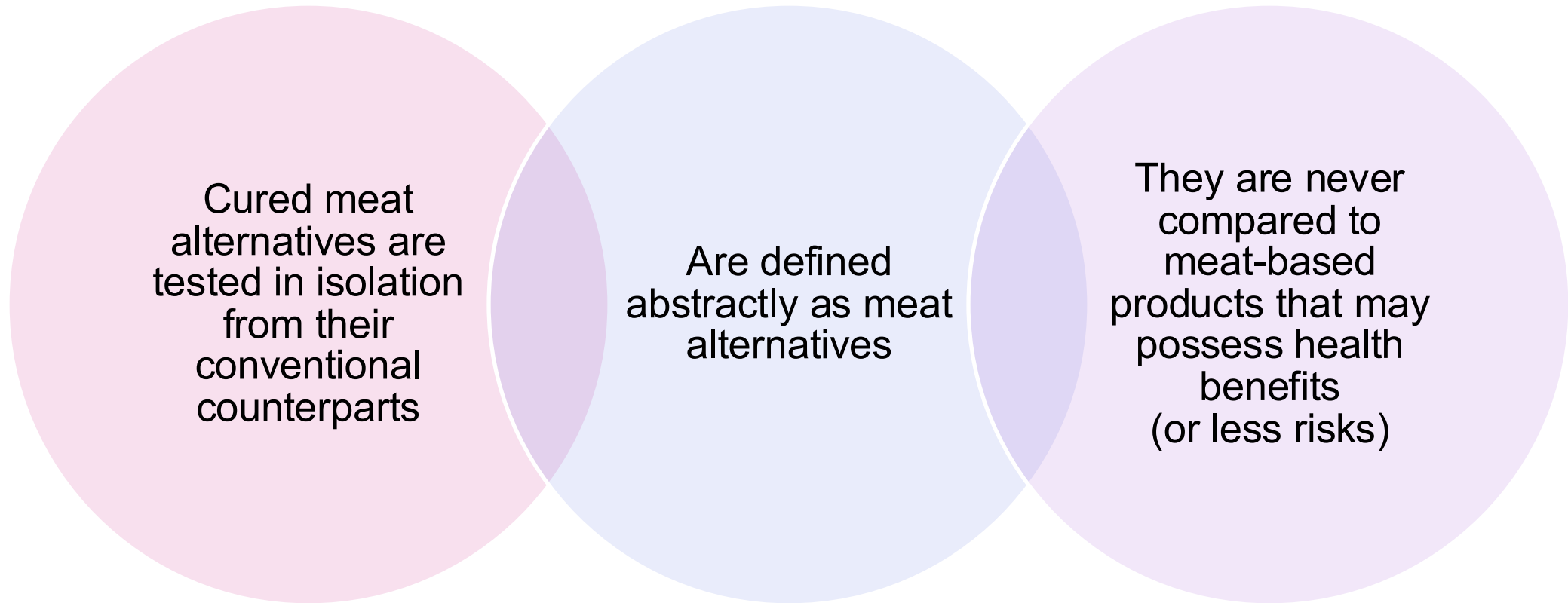
Emotional
perception

Visual
attention

Information
processing

Interplay
with beliefs

Research on consumer acceptance of cured meat alternatives





Visual attention to nitrite-free and plant-based sausages alternatives: Effect of information and cross-cultural differences between Ireland and Finland

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ABSTRACT

Consumers encounter various visual cues while shopping, which influence their food choices. Additionally, concerns related to the use of nitrites in cured meats and the overall impact of animal breeding on the environment are transforming the European cured meat market. The aim of this study was to evaluate the differences in consumer ($n = 66$) visual attention to three sausages (conventional, nitrite-free, and plant-based) under both blind and informed (health risk, health benefit, and health plus environmental benefit) conditions in Ireland and Finland, using a wearable eye-tracker in combination with a food choice task and Flash Profile. Significant differences were observed in consumer visual attention between the countries. Consumers in Ireland were navigating between products, whereas those in Finland tended to focus on each product (or text) for longer periods without revisiting it. In both countries, most consumers in the blind condition chose the conventional product, followed by the plant-based alternative. In the informed condition, the conventional product remained the most preferred in Ireland, while in Finland, the plant-based alternative became the most popular. In Ireland, visual attention differences between products were minimal, but the nitrite-free sausage information text attracted the most attention. In Finland, however, under the blind condition, the plant-based alternative had significantly more dwells with fixation and revisit count. Lastly, dwell time, was the only measure found to be significant in predicting product choice. These results highlight the need for culture-specific approaches underscoring aspects of visual attention and information provision in driving healthier and sustainable food choices among consumers.

1. Introduction

The European sausage market has grown by 2.4 % since 2016, with some countries showing significant growth and others reporting declines (ReportLinker, 2022). In Ireland, the sausage market is projected to grow annually by 5.83 % (compound annual growth rate) over the next few years (statista, 2025), while in Finland, forecasts suggest an annual decline of 1.8 % (ReportLinker, 2024).

Recently, concerns have been raised regarding the use of nitrites in

Cancer (IARC), a specialized cancer agency of the World Health Organization, classified processed meats as carcinogenic to humans (Group 1) due to evidence linking nitrites to the formation of carcinogens (IARC, 2015). This, together with other environmental considerations, has led internationally set dietary guidelines, such as the Nordic Nutrition Recommendation, to suggest only a limited amount of processed meat in human diet (Blomhoff et al., 2023). Currently, food researchers and manufacturers actively explore alternative to nitrites compounds that pose no risk to consumer health.

Relationship between visual attention and provision of information

A cross-cultural study between Ireland and Finland

Materials and Methods

30
CONSUMERS



36
CONSUMERS



Eye-tracking glasses



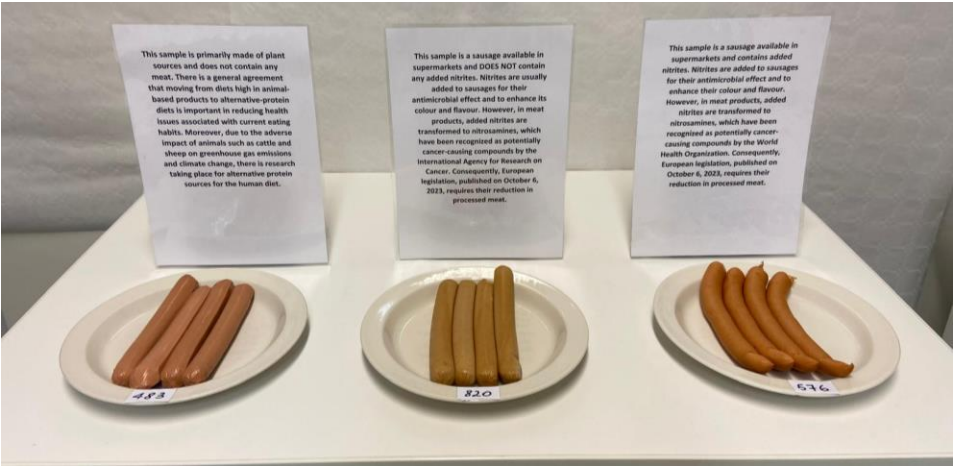
Three products under two
conditions (blind and informed)
over two weeks



Food choice
task
&
Flash profile

Meatless Nitrite-free Conventional

The sausage samples



The information given to participants

Conventional

Information about health risk related to processed meat.

This sample is a sausage available in supermarkets and contains added nitrites. Nitrites are added to sausages for their antimicrobial effect and to enhance their colour and flavour. However, in meat products, added nitrites are transformed to nitrosamines, which have been recognized as potentially cancer-causing compounds by the World Health Organization. Consequently, European legislation, published on October 6, 2023, requires their reduction in processed meat.

Nitrite-free

Information about the health benefit of avoiding nitrites

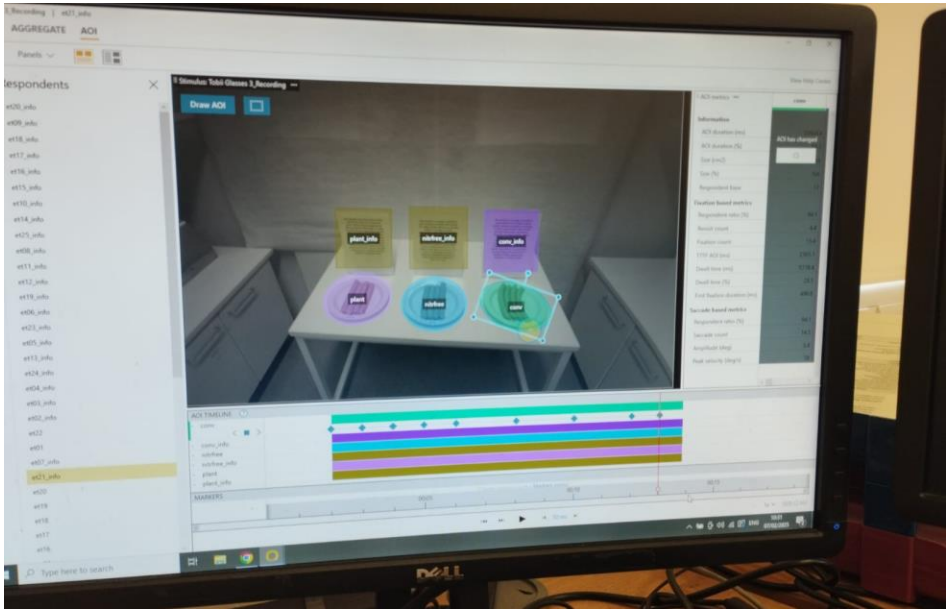
This sample is a sausage available in supermarkets and DOES NOT contain any added nitrites. Nitrites are usually added to sausages for their antimicrobial effect and to enhance its colour and flavour. However, in meat products, added nitrites are transformed to nitrosamines, which have been recognized as potentially cancer-causing compounds by the International Agency for Research on Cancer. Consequently, European legislation, published on October 6, 2023, requires their reduction in processed meat.

Meatless

Information about both health and environmental benefits.

This sample is primarily made of plant sources and does not contain any meat. There is a general agreement that moving from diets high in animal-based products to alternative-protein diets is important in reducing health issues associated with current eating habits. Moreover, due to the adverse impact of animals such as cattle and sheep on greenhouse gas emissions and climate change, there is research taking place for alternative protein sources for the human diet.

The eye-tracking



Three “simple” measures

1

Fixations

Short moments when the eye rests on a product or label.



2

Revisits

How often the person looks back at the same item.



3

Dwell time

The total time spent looking at an item.



The flash profiling

1

Introduction

Consumers received a brief introduction to the Flash Profile task and instructions.



Flash Profile

- Describe the products in your own words
- No right or wrong answers
- Focus on characteristics that are comparable
- Use English or Finnish (or both)

2

Generate descriptors

Consumers generated as many descriptors as they wished to explain their choice, using any type of terms that came to mind, with no restrictions.

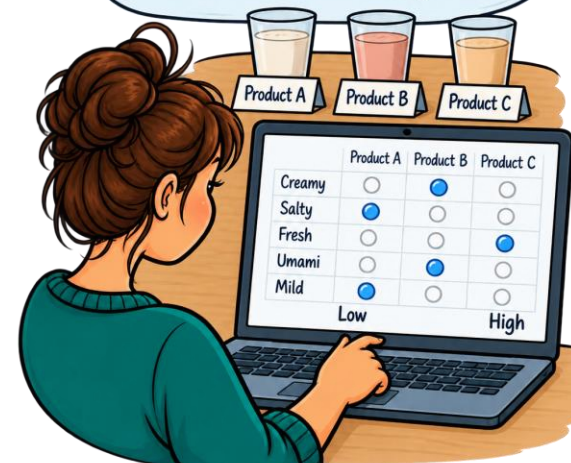


- creamy
- salty
- fresh
- umami
- ...

3

Rank the products

For each descriptor, consumers ranked the three products on a comparative 3-point scale from "low" to "high".



Eye tracking and product choice



	Nitrite-free		
	Conventional		Meatless
Products during informed condition			
Dwell time (gaze, ms)	A	B	A
Text during informed condition			
Dwells with fixations	B	A	AB
Revisit count (fixation dwells)	B	A	AB
Revisit count (gaze dwells)	B	A	AB

Letters indicate significant statistical difference with A > B

Eye-tracking measures

Product choice

	Blind		Info	
Products	n	%	n	%
Conventional	23	76.7	13	43.3
Nitrite-free	1	3.3	6	20.0
Meatless	6	20.0	11	36.7
Total	30	100	30	100

Eye tracking and product choice



Eye-tracking measures

Nitrite-free
Conventional Meatless
Products during blind condition

Dwells with fixations	AB	B	A
Revisit count (fixation dwells)	AB	B	A
Revisit count (gaze dwells)	AB	B	A

Products during informed condition

Dwell time (gaze, ms)	AB	B	A
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Text during informed condition

Dwells with fixations	AB	B	A
Last dwell duration	A	AB	B
Revisit count (fixation dwells)	AB	B	A

*Letters indicate significant statistical
difference with A > B*

Product choice

Products	Blind		Info	
	n	%	n	%
Conventional	18	50.0	11	30.6
Nitrite-free	5	13.9	6	16.7
Meatless	13	36.1	19	52.8
Total	36	100	36	100

Attention patterns differed



Ireland

Participants moved their gaze between products more often and revisited them more frequently.



Finland

Participants spent longer continuous periods looking at one product or information card

Different patterns of attention provide a reason to be cautious about one-size-fits-all communication.

Information did not shift both countries in the same way



Ireland

43.3%

conventional remained first



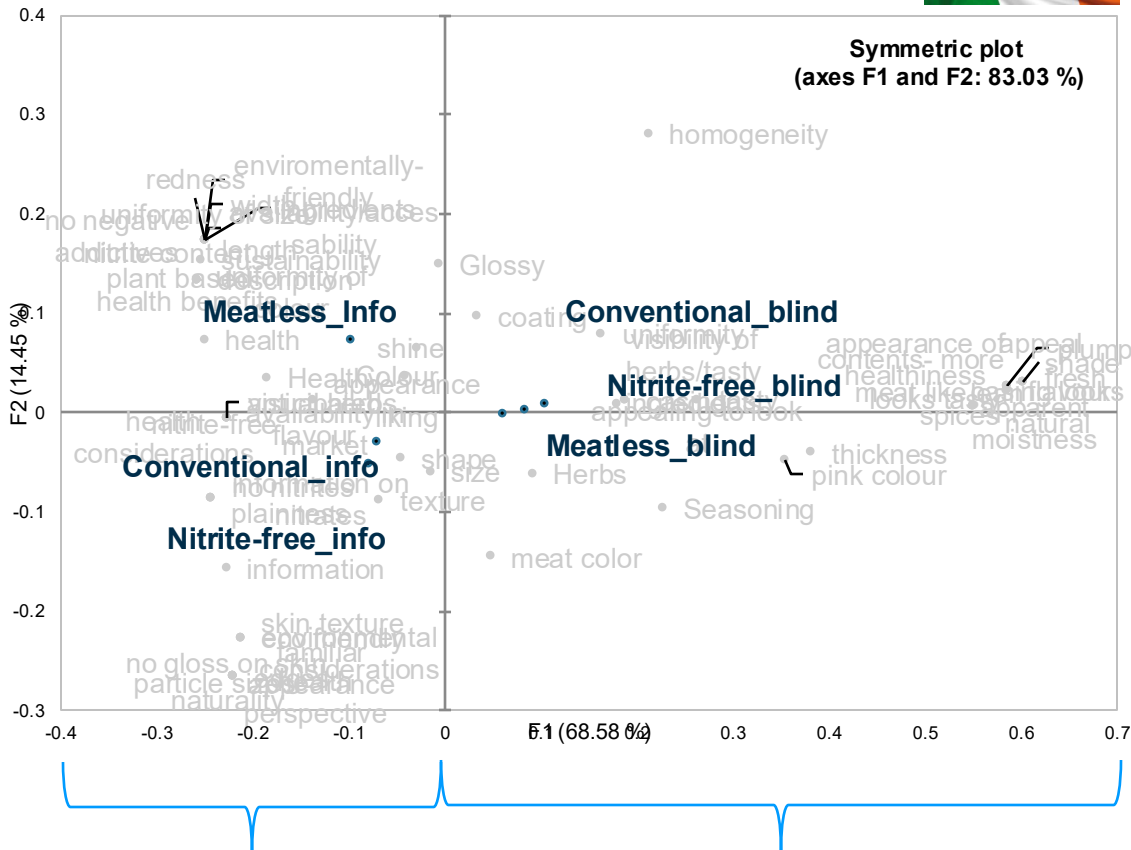
Finland

52.8%

plant-based became first

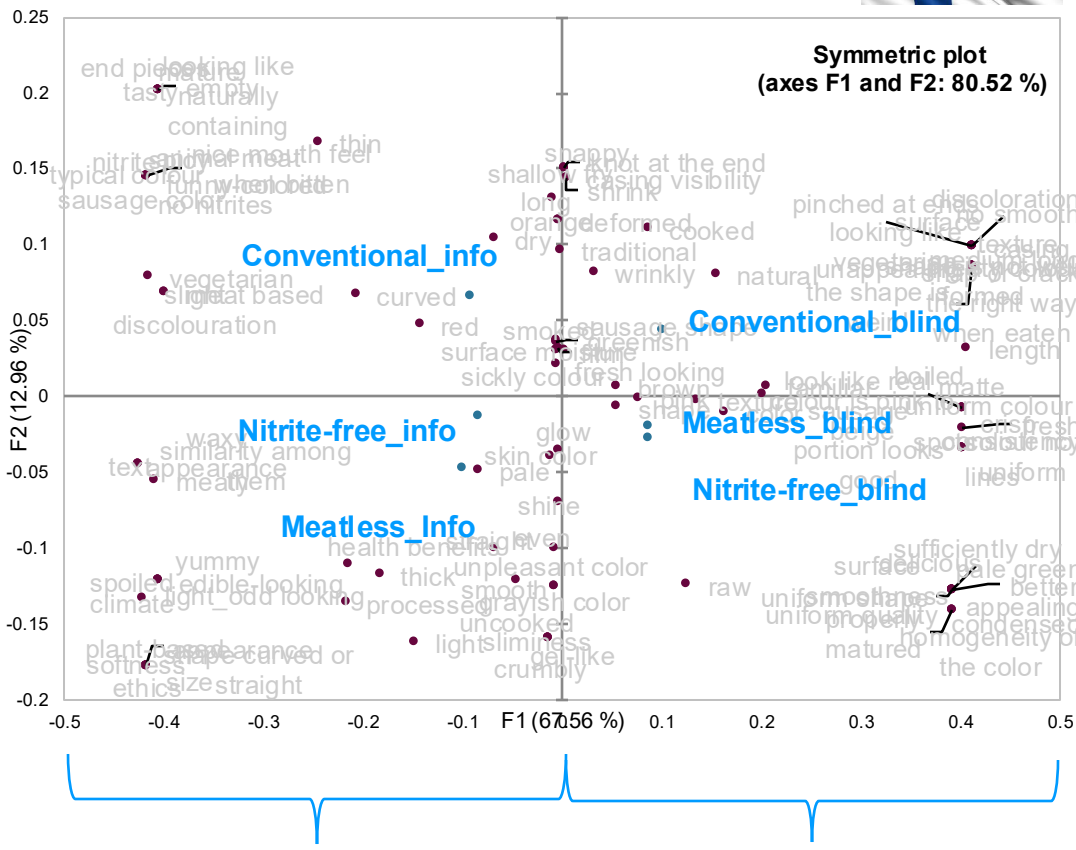
**The same information can lead to different choices
in different cultural settings.**

Product profiles



Predominately health
and environmental
aspects

Predominately sensory
terms

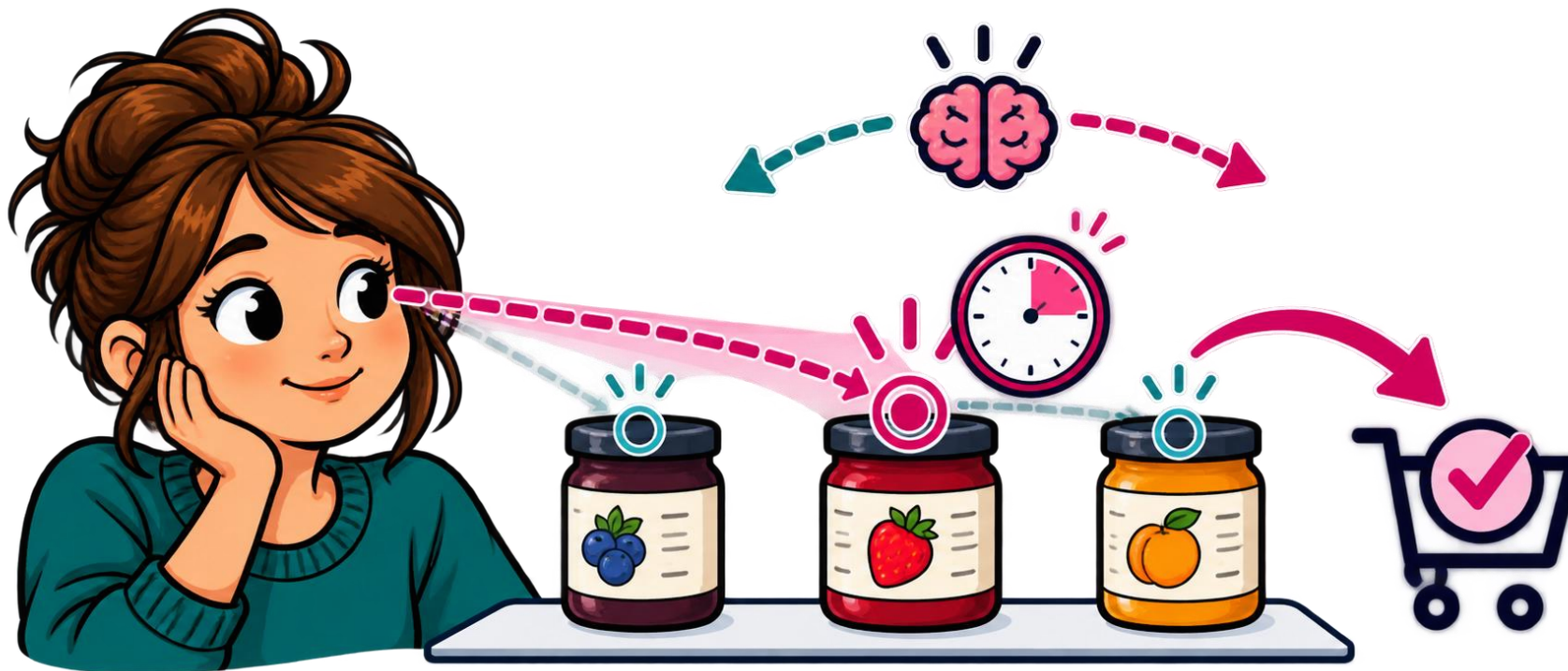


Both sensory terms
and health and
environmental aspects

Predominately
sensory terms

Dwell time was the only eye-tracking measure that significantly predicted product choice

- The longer people spent looking at an option, the more informative that measure was about their eventual choice.



This is a relationship,
not proof that looking
longer causes the
choice.

Key takeaways

Measures of visual attention to food products can potentially predict selection; however, this does not apply for attention to benefit-related information

Benefit information can significantly increase perception and choice, but only for products that are already well liked, which we describe as the “inner treasure framework”

The Finnish and Irish results remind us that food communication needs local understanding.



If we want
healthier, more
sustainable, and more
inclusive food systems,
sensory experience
must become a central
innovation priority.

That requires **food design**.

Thank you 😊



HORIZON
2020

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