

# COMMUNICATING RESULTS FROM TEMPORAL SENSORY STUDIES

SSP/SENSOMETRICS 2012 WORKSHOP



# Workshop Acknowledgements

Thanks to

**Amanda Warnock**

Givaudan Flavors Corp., Cincinnati, USA

**Sarah Kirkmeyer**

Givaudan Flavors Corp., Cincinnati, USA

**Chris Findlay**

Compusense Inc., Guelph, Canada

# Tom Carr

- industry experience working on high-potency sweeteners
- experience consulting for major consumer packaged goods companies
- will discuss communication of time intensity results

# Suzanne Pecore

- Principal Sensory Scientist, General Mills, Inc.
- introduced the TOS method at the 9th Pangborn Symposium in Toronto
- shared slides that she will present at the SSP 2012 meeting in Jersey City

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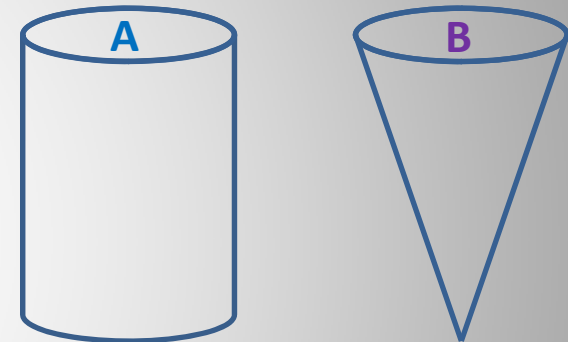
# INTRODUCTION

John Castura

Compusense Inc.

# Measuring A and B

- Instrument 1 tells us  $A = B$ .
- Instrument 2 tells us  $A \neq B$ .



Why this disagreement?

*They measure different dimensions.*

# Descriptive Analysis

- Two products characterized as equally intense.



$$A = B$$

# Difference Testing

- Yet differences between products might be obvious

Same

Different

A ≠ B



# The Temporal Dimension is Missing

- Onset, order, and duration of sensations may differentiate the products.

# Temporal Sensory Methods

- Get another perspective on the problem at hand
  - Investigate a dimension that conventional descriptive analysis might miss
  - Understand systems and interactions
  - Understand the gap between the formulation and the objective

# 1. Evaluations at Time Points

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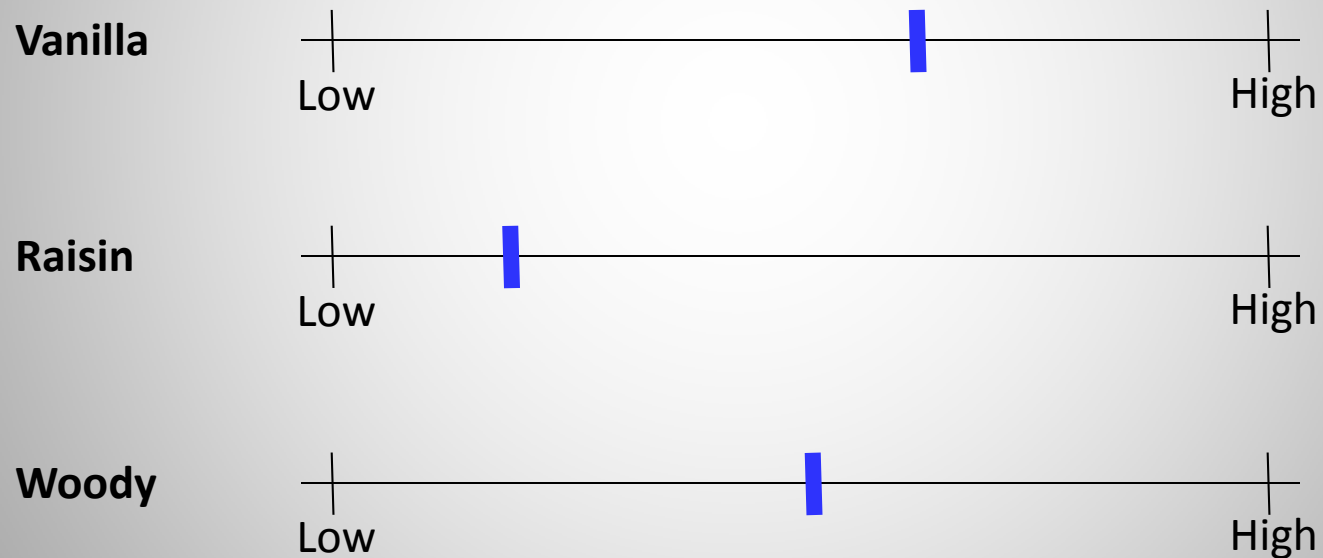
- **Cued evaluation at designated times**
  - Phase of eating
  - Specific intervals (e.g. 1 minute, 2 minutes, etc.)

e.g.

- Progressive Profiling - Jack *et al.*, 1994
- Sequential Profiling - Methven *et al.*, 2010

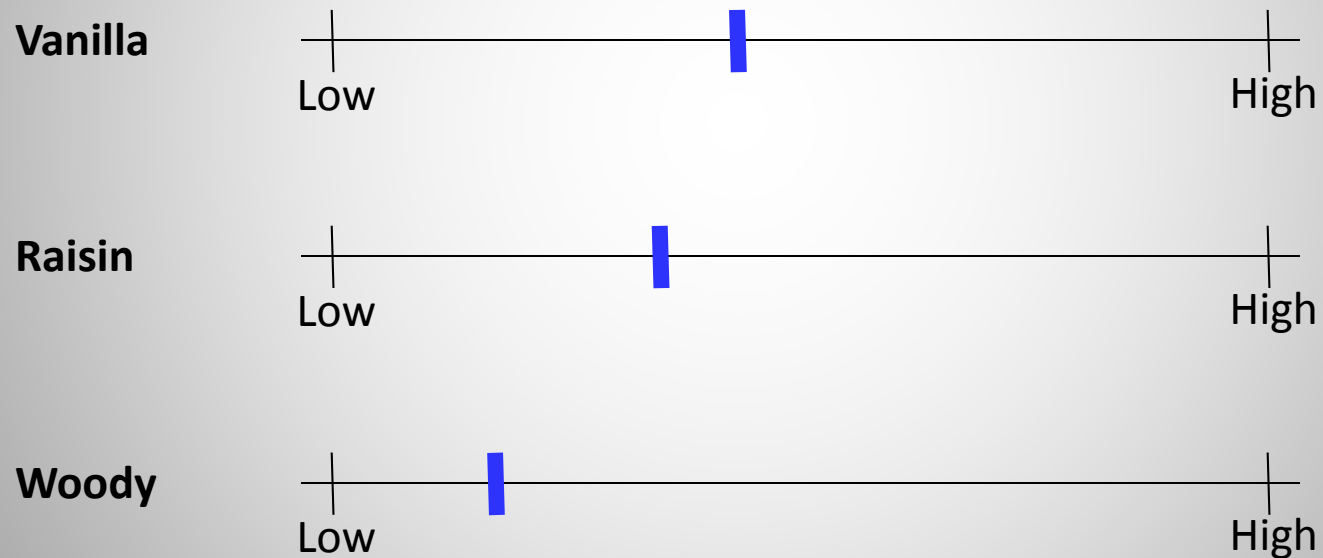
# 1. Evaluations at Time Points

0:04



# 1. Evaluations at Time Points

1:58



# 1. Evaluations at Time Points

- **Multiple Attribute Time Intensity**
  - Introduced by Kuesten *et al.* (2011)

# 1. Evaluations at Time Points

0:14

Vanilla



Raisin



Woody



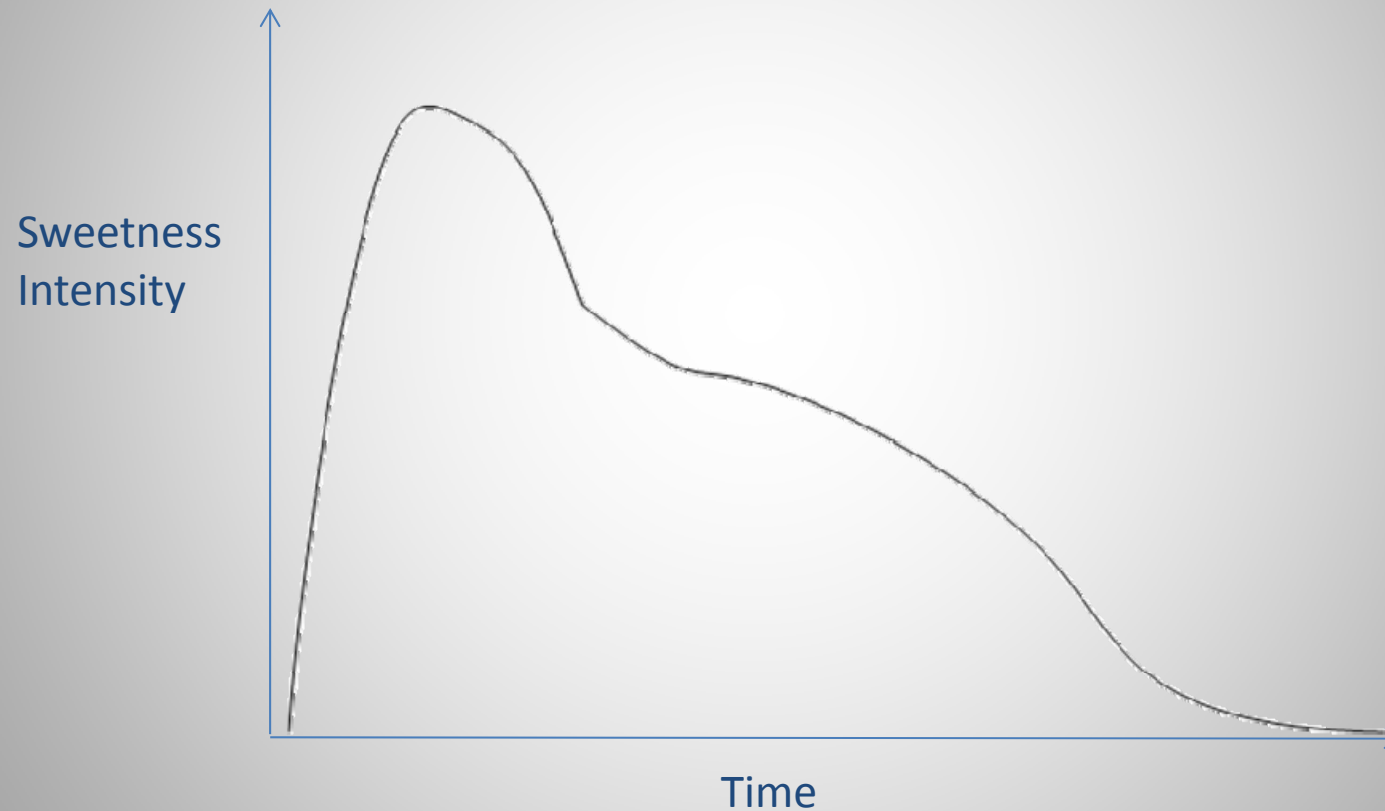


## **2. Time Intensity**

## 2. Continuous Time Intensity

- **Single-Attribute Time Intensity**
- **Dual-Attribute Time Intensity**

## 2. Continuous Time Intensity



## 2. Continuous Time Intensity

- Most common analyses work with extracted TI parameters
  - Area Under Curve
  - Maximum Intensity & Time of Maximum Intensity
  - Increasing and Decreasing Angles
- Other approaches have been proposed

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# COMMUNICATING RESULTS OF TRADITIONAL TIME-INTENSITY EVALUATIONS

Tom Carr

Carr Consulting, Wilmette, IL, USA

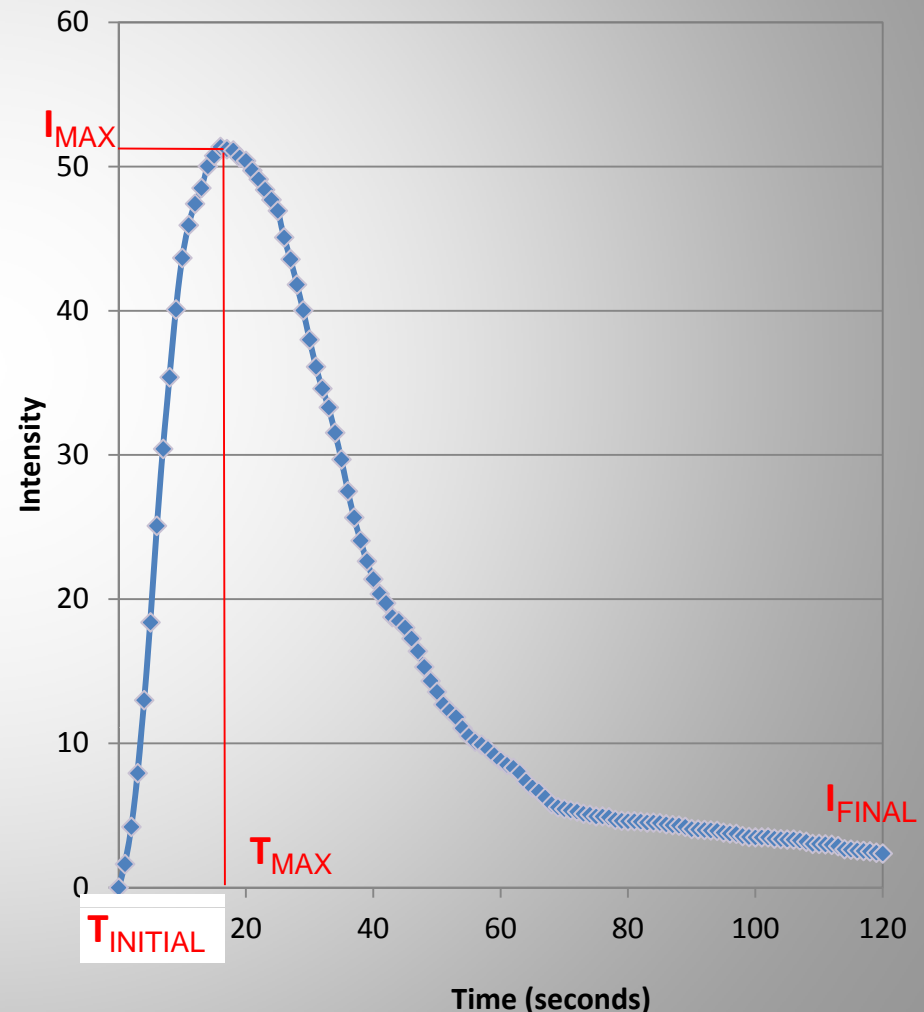
# Traditional TI Method

- One (maybe two) attributes evaluated over time.
- Assessors continuously track and report the perceived intensity of the attribute.
- Key features of the TI curve are extracted from each assessor's curve.
- Test products are compared statistically by performing ANOVA or MANOVA on the key-features data.

# Key Features of a Traditional TI Curve

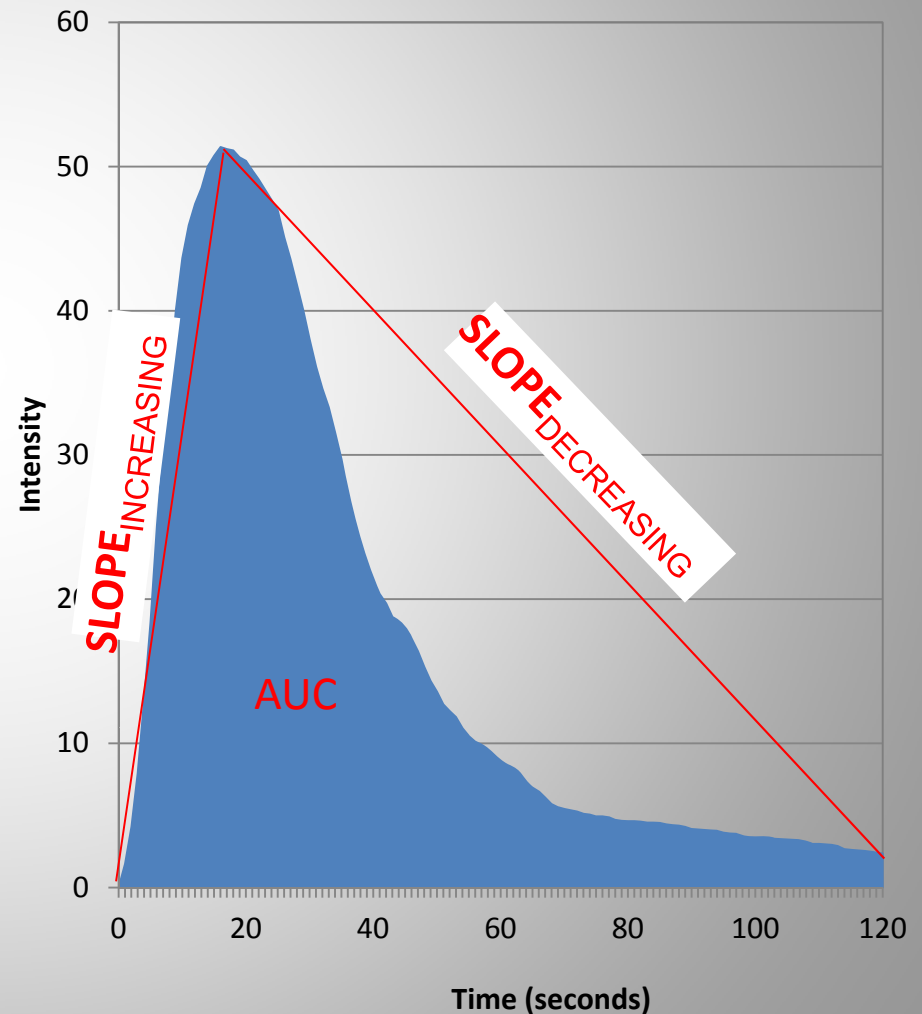
- Direct Measures

- On-Set Time ( $T_{\text{initial}}$ )
- Time to Maximum Intensity ( $T_{\text{max}}$ )
- Maximum Intensity ( $I_{\text{max}}$ )
- Time at Maximum Intensity ( $T_{\text{plateau}}$ )
- Extinction Time ( $T_{\text{final}}$ )
- Possibly, Final Intensity ( $I_{\text{final}}$ )



# Key Features of a Traditional TI Curve

- Derived Measures
  - Rate of Increase ( $\text{Slope}_{\text{increasing}}$ )
  - Rate of Decrease ( $\text{Slope}_{\text{decreasing}}$ )
  - Area Under the Curve (AUC)
  - Possibly, Area Under Increasing Curve, Area Under Plateau and Area Under Decreasing Curve





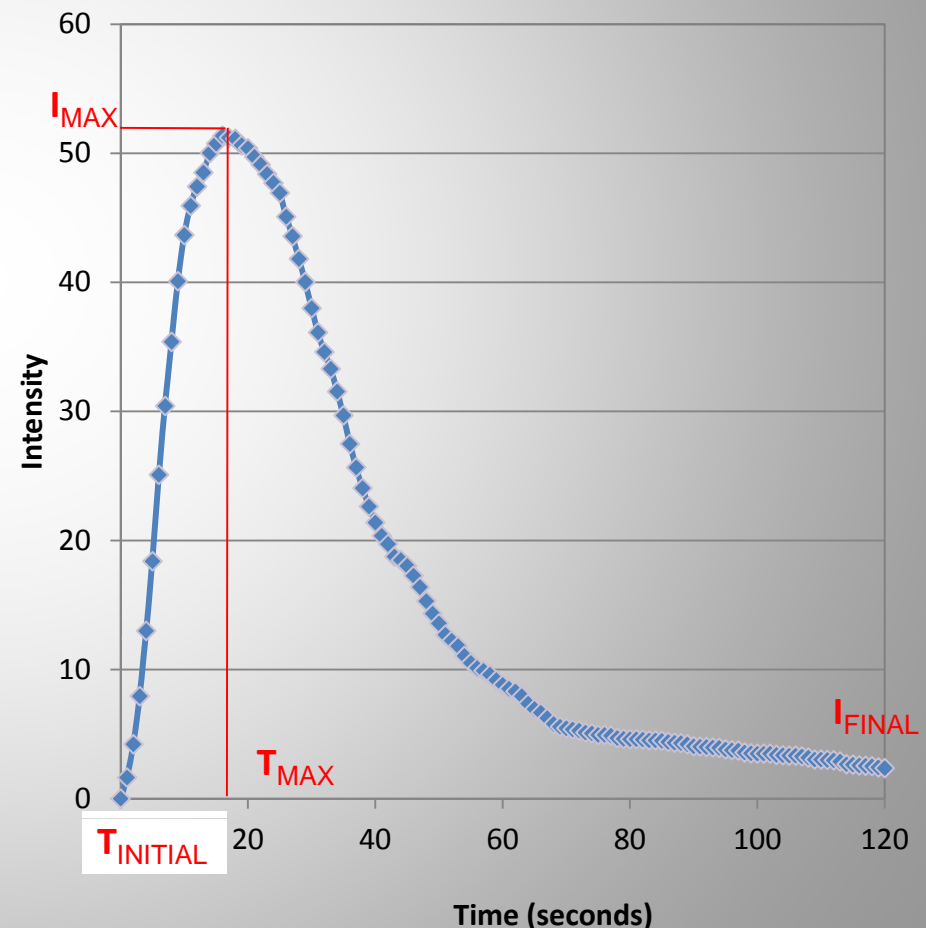
# Summarizing Average TI Curves

- TI Evaluations Lend Themselves to Graphical Summaries.
- To Avoid Confusion, Tabular and Graphical Summaries Should Communicate the Same Information.
- Averages of Key Features (Tabular Results) Do Not Match the Graph of Average Intensities.

# Summarizing Average TI Curves

- Note that Key Features of the Average TI Curve (Graph) Do Not Match the Average of the Key Curve Features (Table).

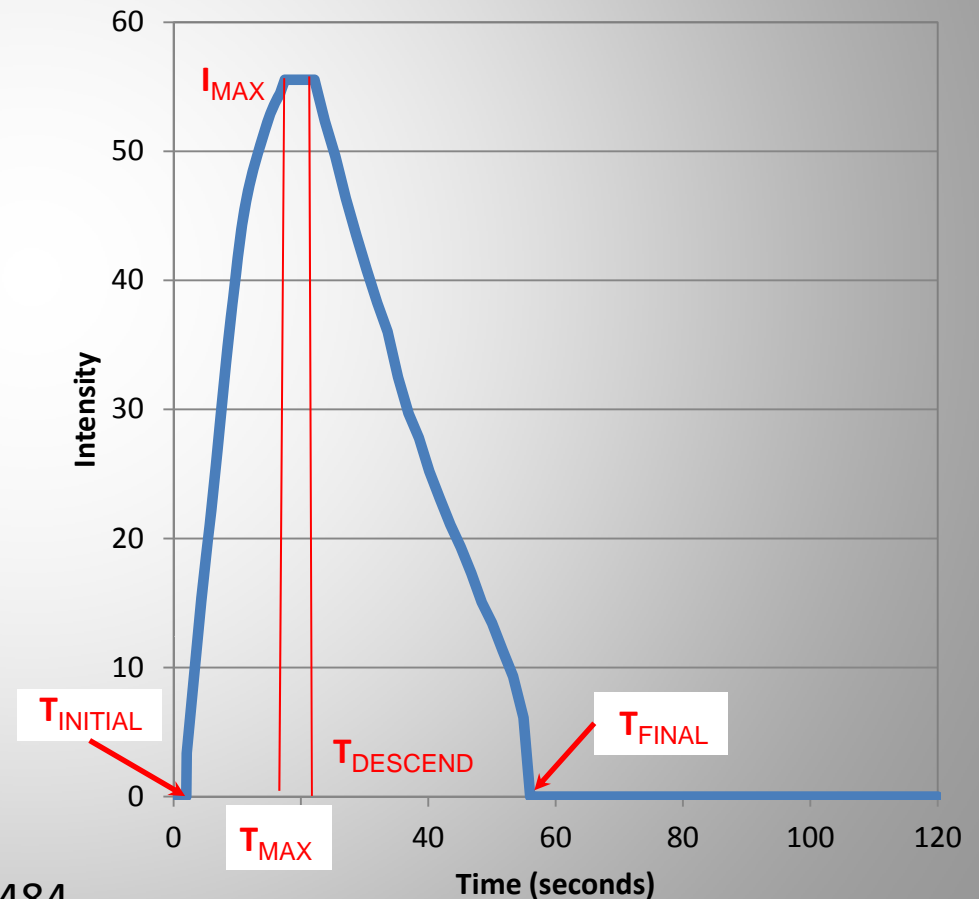
Response	Sample
$I_{Max}$	55.5
$T_{Initial}$	2.1
$T_{Max}$	17.5
$T_{Decent}$	22.1
$T_{Final}$	55.7



# Summarizing Average TI Curves

- Liu and MacFie (1990) propose a method where the TI Curve (Graph) Matches the Average of the Key Curve Features (Table).

Response	Sample
$I_{Max}$	55.5
$T_{Initial}$	2.1
$T_{Max}$	17.5
$T_{Descend}$	22.1
$T_{Final}$	55.7



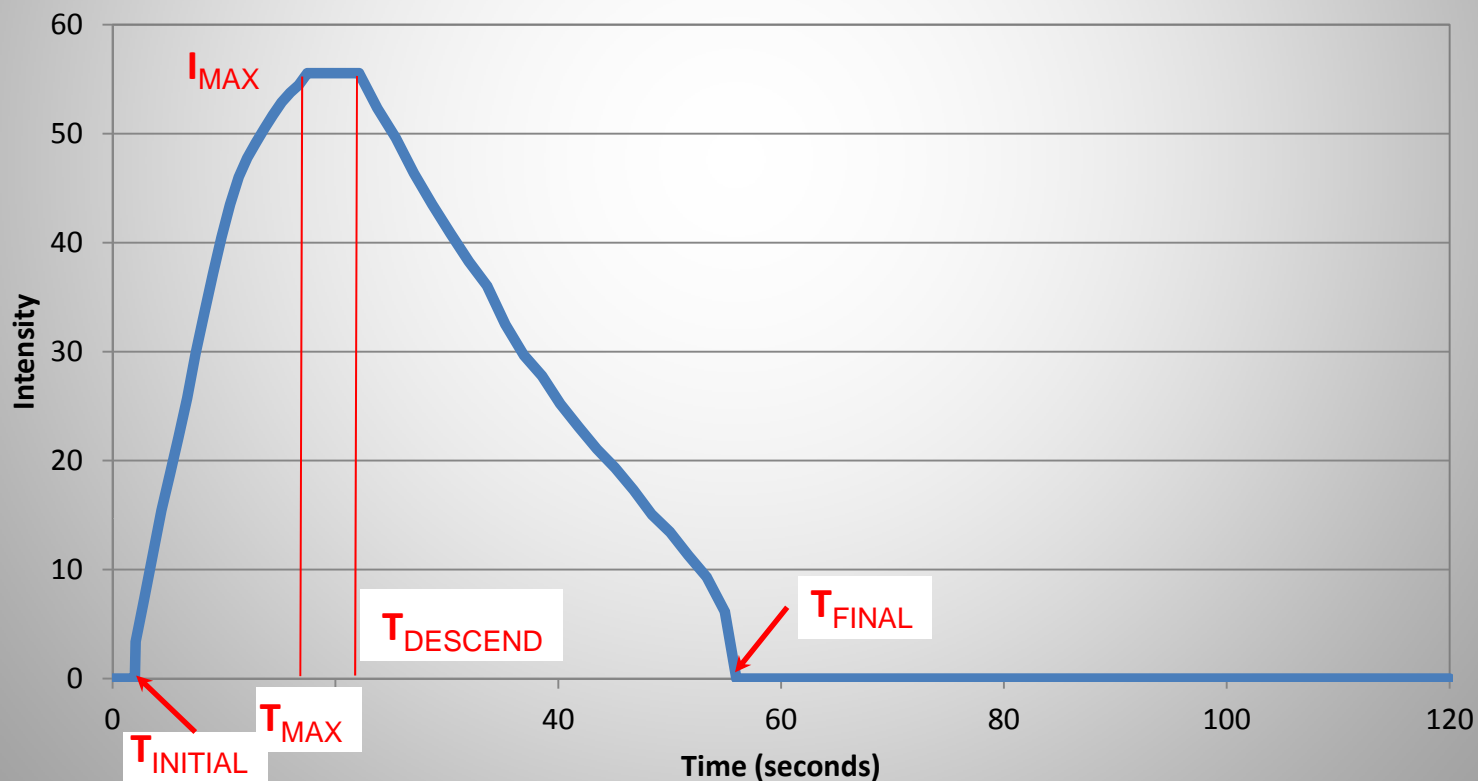
Chemical Senses (1990) vol. 15, no. 4, pp 471-484.

# Reporting Results

- Focus on What You Learned, Not What You Did.
  - State Objective of the Study.
  - Briefly summarize what samples were tested and the basics of the methodology.
    - Number and Qualifications of Assessors.
    - Attribute(s) Evaluated.
    - How were Data Collected and Sampling Frequency.
    - Duration of Evaluations (Fixed Time or Until Extinction).
- One Slide – Anything More is a Methods Document.

# Reporting Results

- Define Key Curve Features Graphically.
  - Consider presenting only those that relate to the objective of the study or that revealed new learning.



# Reporting Results

- Speak to Your Audience.
  - How you present results to product developers can be different than how you present results to marketing and upper management.
- Report Results as They Relate to the Objectives.
  - Focus on the Relevant Curve Features.
  - Do Not Present a Laundry List of Significant Differences.
- For a Non-Technical Audience, Discuss Key Curve Features Non-Technically.
  - e.g., “Sample A achieved its maximum intensity 4 seconds earlier than Sample B” as opposed to, “ $T_{\max}$  of Sample A was significantly lower than  $T_{\max}$  of Sample B.”
- Draw a Conclusions Relative to The Objectives.

# 3. Temporal Sensations

# 3. Temporal Order

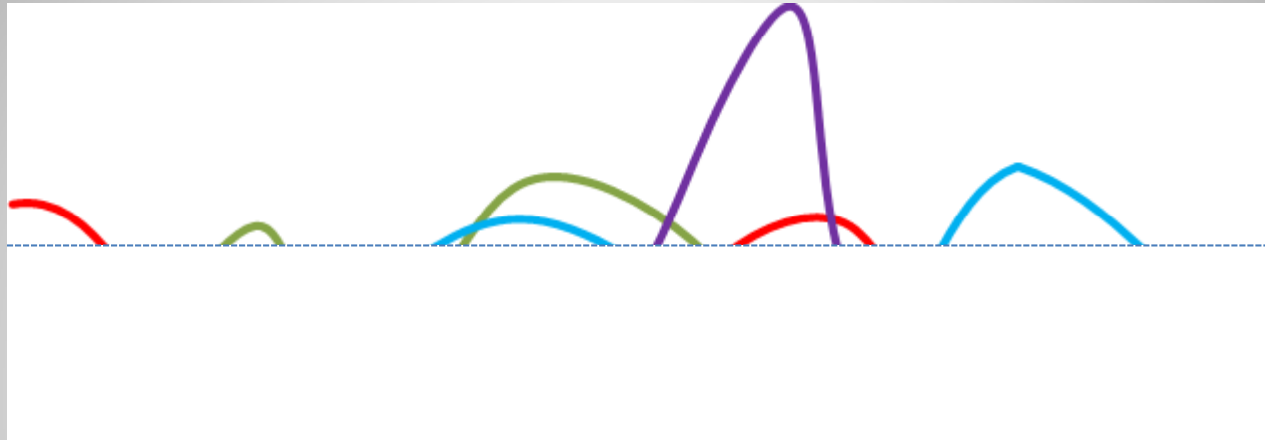
- **Temporal Dominance of Sensations**

- Introduced by Pineau *et al.* (2004)

- Assessors indicate the “dominant” attribute



# 3. Temporal Order



- A significance line can be added to better communicate 'signal' and 'noise'

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*In Practice...*

# TEMPORAL ORDER OF SENSATIONS

Suzanne Pecore

General Mills, Inc.

# Why would you do TOS?

- If you suspect/notice any disruption to the temporal profile, as in:
  - Onset or linger of key flavors
  - Flavor release
- If the eating experience seems to vary with succeeding bites, as when:
  - Upfront tastes noticeably vary by bite
  - Upfront tastes vary with formulation

# Why TOS over other Temporal Methods?

- It's focused purely on attribute onset
  - Intensity of attributes is irrelevant
  - Intensity of attributes is captured by other means
- It's efficient:
  - No extensive panelist training required
  - No customized software is needed
  - Easy and fast data collection

# TOS versus TDS

- TOS is a technique to measure the order that key attributes appear over the eating experience, i.e., over ***several spoonfuls*** and into the aftertaste
- TDS is a technique to measure the order and the time that key attributes are dominant during a ***single spoonful*** of product.
  - A 2<sup>nd</sup>, more sophisticated level of TDS includes intensities of the dominant attributes over time.

# What does TOS capture?

- 1<sup>st</sup> Sip/Spoonful :

Take a spoonful of the product and quickly check which attributes hit 1st - 2nd - 3rd in the order they are perceived. Do not give intensity ratings.

	Order Perceived		
	Hits 1st	Hits 2nd	Hits 3rd
Flavor 1			
Flavor 2			
Flavor 3			
Other? Identify			
Salt			
Sweet			
Sour			
Bitter			

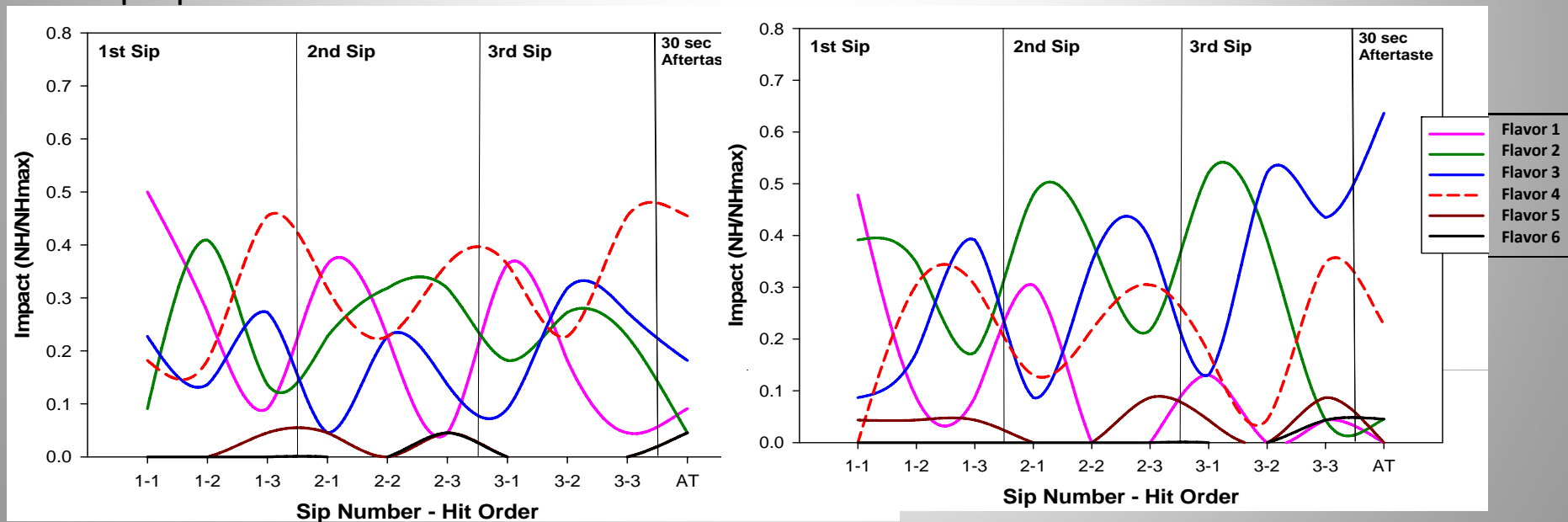
Extensive  
List NOT  
recom-  
mended

- Repeat for TWO MORE Samplings
- Aftertaste Checklist follows 4<sup>th</sup> Sampling

# TOS Output based on Proportions\*

**Pros:** Illustrates differences in onset and linger of key flavors, particularly in the 2<sup>nd</sup> and 3<sup>rd</sup> sips. First sip data alone would not have been that useful. Aftertaste also differed.

**Cons:** Smoothed curves often mistaken for intensity changes. Connecting “proportions” does not make intuitive sense.



\* Adapted from Pineau, et al. (2009)

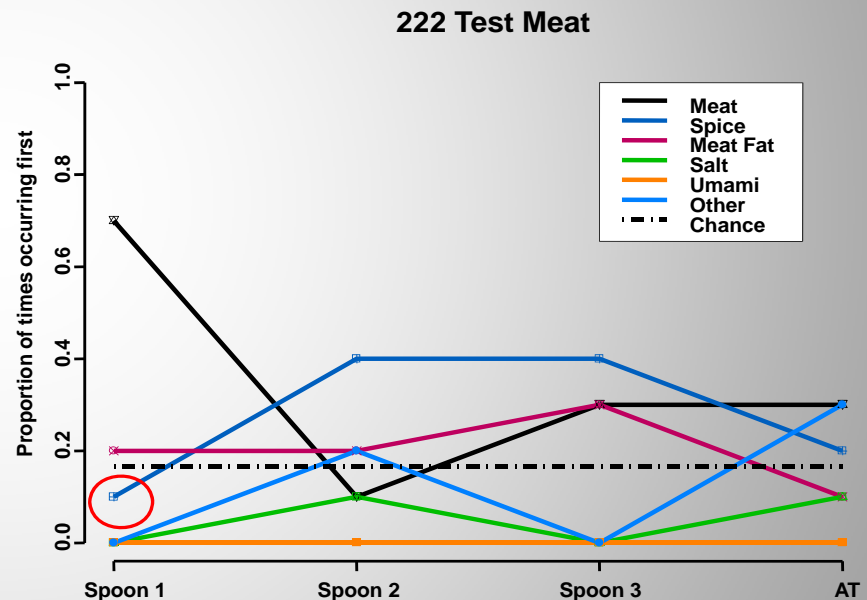
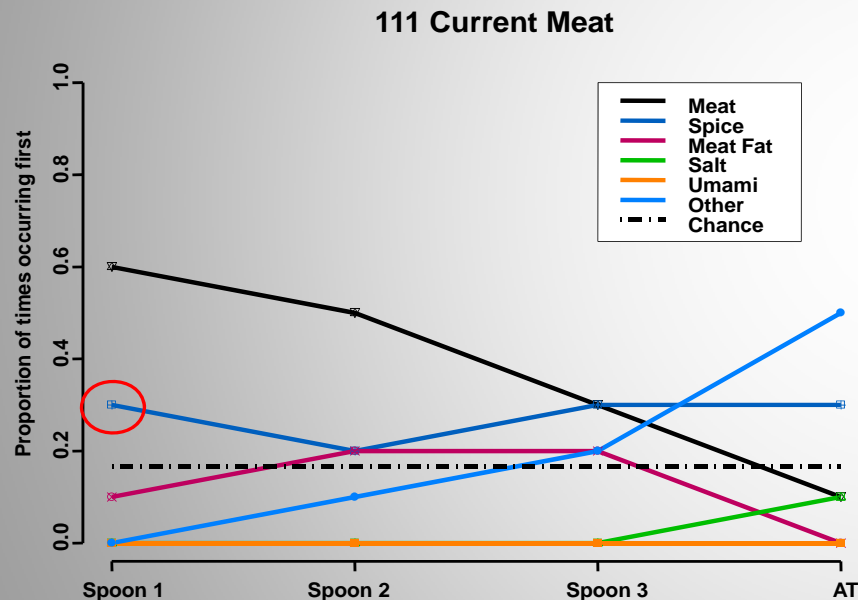
# TOS in Practice

- Alternate source of meat was suspected to deliver spiciness later in eating experience than current meat
- Concern that delayed spiciness could impact consumer acceptance
- ***TOS recommended to understand onset of spiciness***



# TOS Output based “Seen 1<sup>st</sup>”

Proportion showing spicy flavor 1<sup>st</sup> in Spoon 1 was lower for Test Meat, and less than chance level.



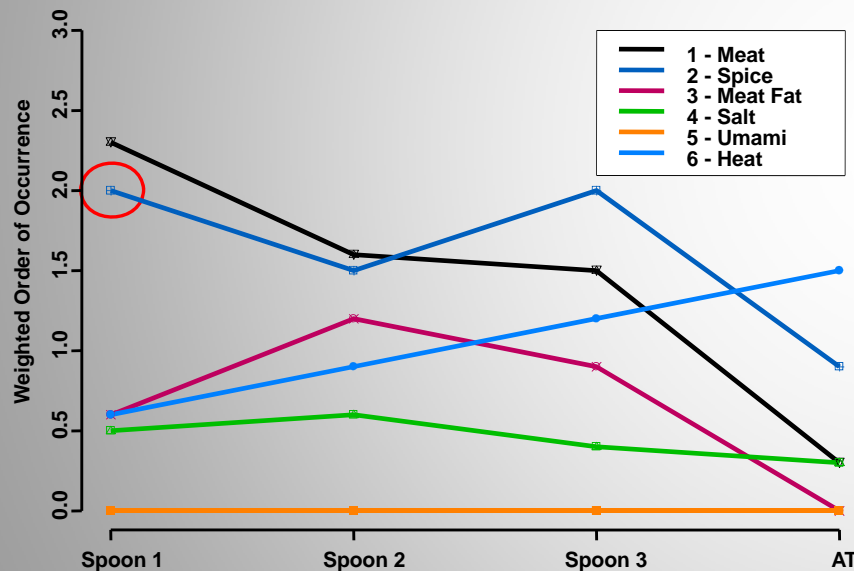
**Pros:** Immediate understanding of upfront taste within each bite. Can establish significance by comparing binomial proportions to chance (1/total number of attributes)

**Cons:** Loses information on full eating experience.

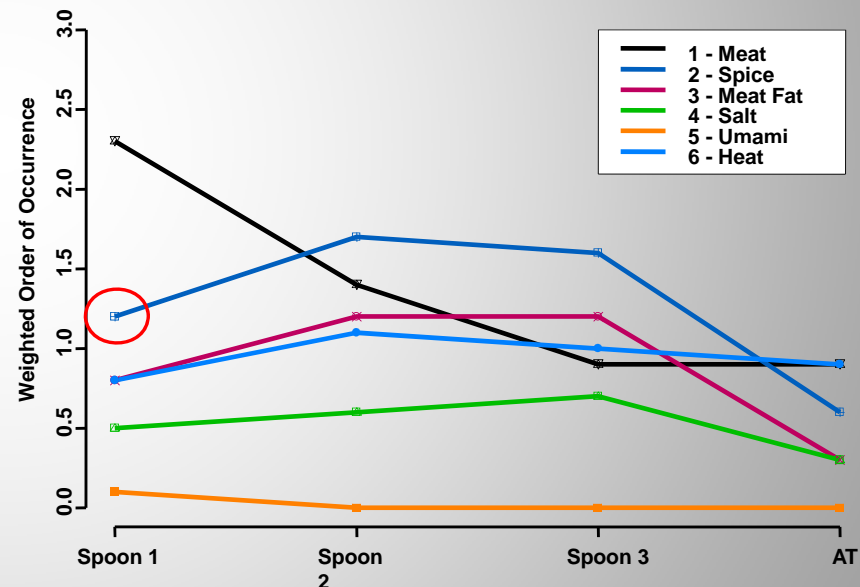
# TOS Output based Weighted Order of Occurrence

Weighted order of occurrence score demonstrated later delivery of spicy flavor in Test Meat

111 Current Meat



222 Test Meat



**Pros:** The higher the rating the earlier/more often that attribute appears (assigned '3' if hits 1<sup>st</sup>, a '2' if 2<sup>nd</sup>, and '3' if 3<sup>rd</sup>). Data can be subjected to standard statistical analyses.

**Cons:** Within sip differences are obscured.

# TOS Influenced Business Decision

- TOS identified critical differences in eating experience
- Results guided supplier to a formulation more closely matching the TOS profile of current
- No loss of product sales with switch to new meat supplier.

**Some key points...**

# Temporal Sensory Methods

- Advantages and disadvantages to every temporal method available in sensory science
- Methods are a tool for problem-solving and hypothesis generation
- Consider the results and how they change the current understanding

# Some Conclusions

- Select appropriate sensory methods
  - Each captures *different* information, not better information
  - Each costs money, so should deliver value
  - Coupling methods gives different perspectives to assist with problem-solving
- Communicate well!

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## DISCUSSION