Caracterización sensorial dinámica

Sensometría y Ciencia del Consumidor
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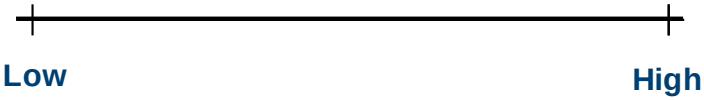
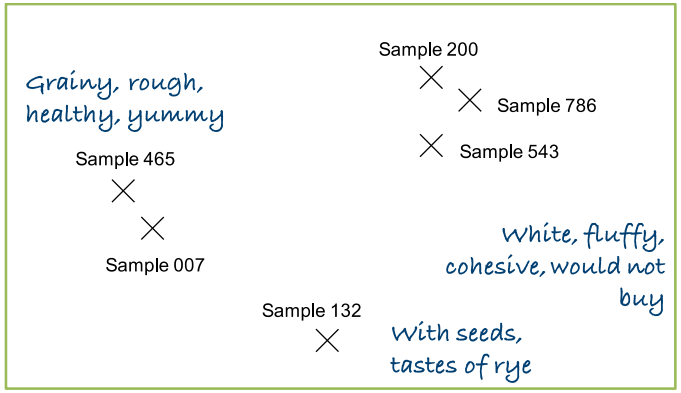
Caracterización sensorial

- Las metodologías estáticas se basan en una única evaluación de las características sensoriales de los productos.



Please, check all the words or phrases which best describe this product:

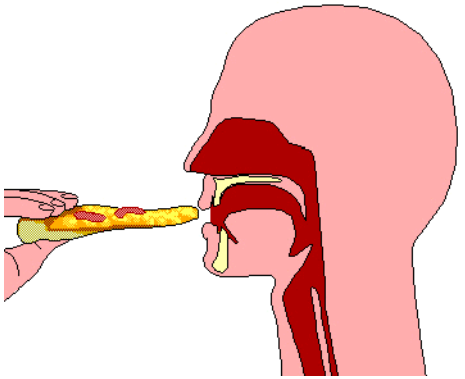
☐ Sweet	☐ Bitter
☐ Bland	☐ Dry
☐ Sour	☐ Firm
☐ Chewy	☐ Crunchy
☐ Juicy	☐ Mealy
☐ Floral	☐ Soft
☐ Mealy	☐ Off flavour



La percepción sensorial es un proceso dinámico

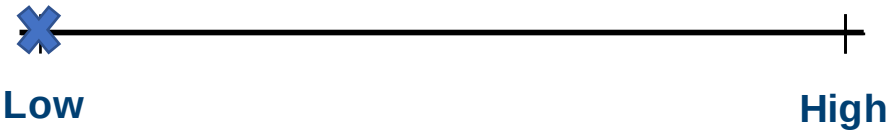
La percepción sensorial es un proceso dinámico

- Diversos cambios ocurren durante el consumo de alimentos (Hutchings & lillford, 1988; Sudre et al., 2012):
  - Ruptura y cambios físicos durante la masticación
  - Mezcla con la saliva
  - Cambios de temperatura

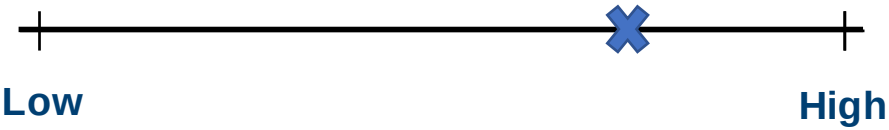


Las metodologías estáticas proporcionan una única medida a lo largo del tiempo

Amargor



Dureza



Las metodologías estáticas informan sobre la intensidad máxima o promedio de las características sensoriales

Table 8.1 Texture attributes at different phases of descriptive analysis

Phase	Attributes	Word anchors
Surface	Roughness	Smooth–rough
	Particles	None–many
	Dryness	Oily–dry
First bite	Fracturability	Crumbly–brittle
	Hardness	Soft–hard
	Particle size	Small–large
First chew	Denseness	Airy–dense
	Uniformity of chew	Even–uneven
Chew down	Moisture absorption	None–much
	Cohesiveness of mass	Loose–cohesive
	Toothpacking	None–much
	Grittiness	None–much
Residual	Oiliness	Dry–oily
	Particles	None–much
	Chalky	Not chalky–very chalky

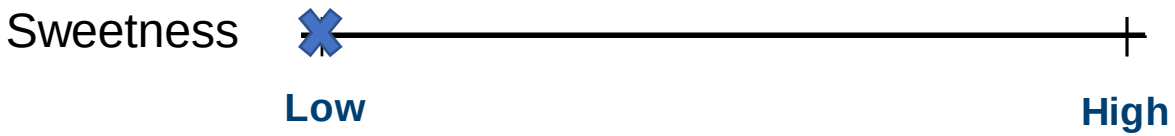
Tiempo intensidad (TI)

7

Tiempo-intensidad

- Primer enfoque para la caracterización sensorial dinámica (Sjöström, 1954).

- Los evaluadores tienen que evaluar la intensidad de un atributo sensorial de forma continua en el tiempo.



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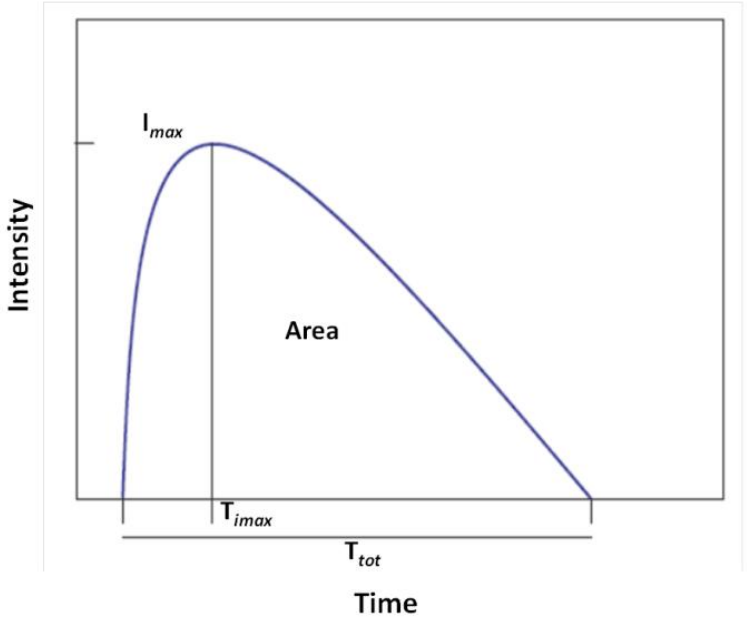
Sweetness

Tiempo intensidad

- Se obtienen curvas de tiempo-intensidad individuales.



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Pasos para llevar adelante un estudio de TI

1. Determinar si TI es adecuado para responder a los objetivos del estudio
2. Determinar cuáles son los atributos a ser evaluados
3. Seleccionar los productos
4. Seleccionar el método de recolección de datos
5. Establecer los parámetros a evaluar y el diseño experimental
6. Reclutar y seleccionar a los evaluadores
7. Entrenamiento de los evaluadores
8. Evaluación de la performance de los evaluadores
9. Realizar el estudio
10. Analizar los datos

Recomendaciones para el entrenamiento (Peyvieux & Dijksterhuis, 2001)

1. Introducción del método

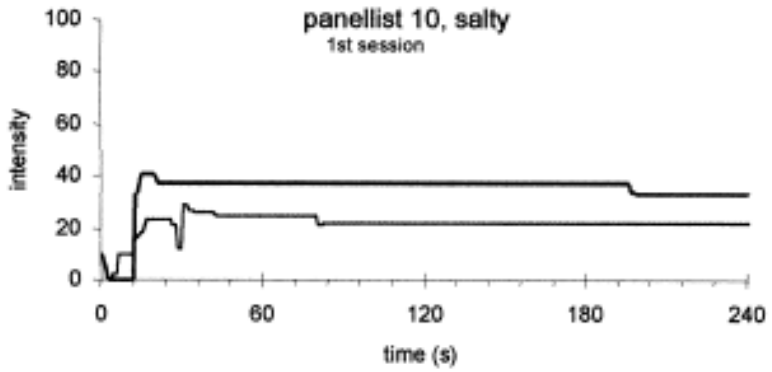
2. Familiarización de los panelistas con el software y evaluación de soluciones de gustos básicos

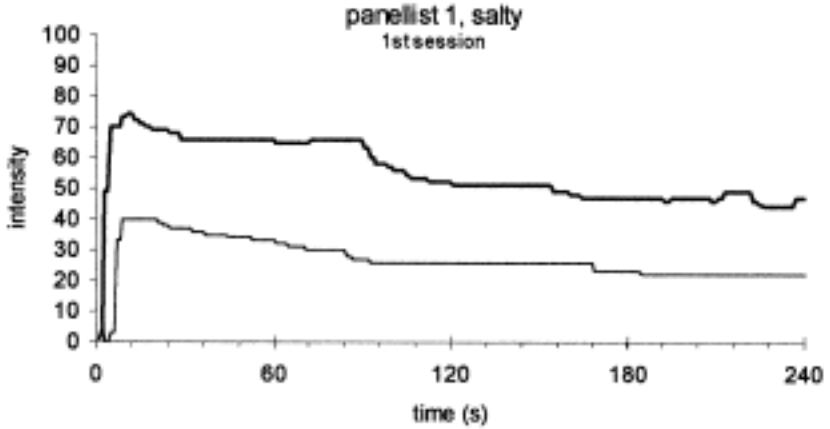
Table 1
Highest threshold in the entire panel and concentrations (g/l) of the beverages given to the panellists in the basic taste TI training step

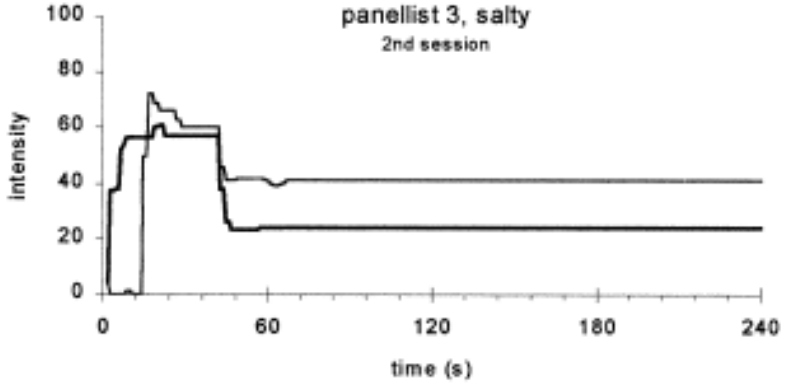
	Acid	Salt	Sweet	Bitter
Highest threshold	0.48	1.4	7.2	0.27
First concentration given	0.6	2.0	12	0.27
Second concentration given	0.93	2.87	33.22	0.5

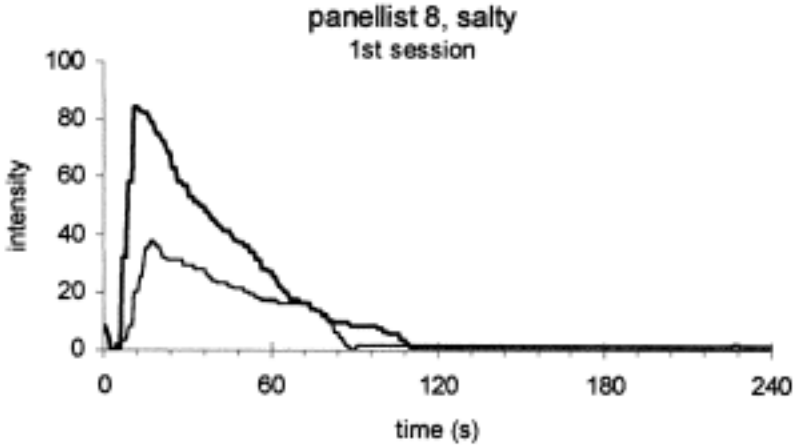
3. Entrenamiento en el producto objetivo

Problemas usuales durante el entrenamiento









Patrones de respuesta individuales

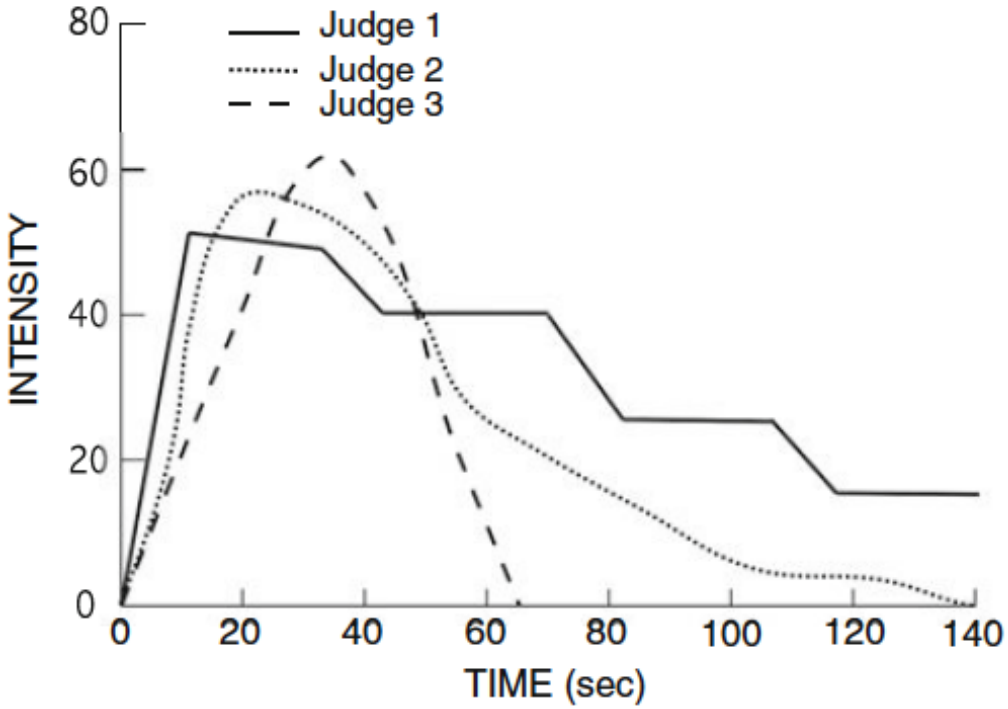
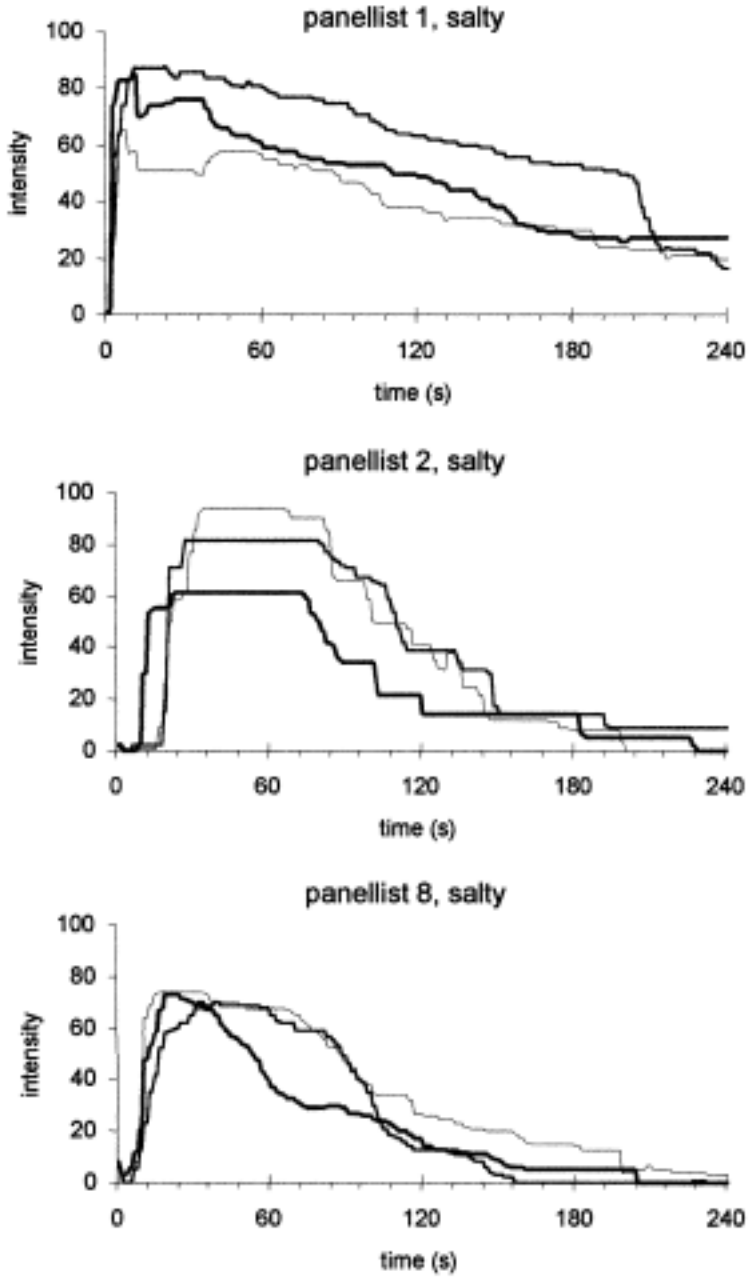


Fig. 8.3 Examples of time–intensity records showing characteristic signatures or shapes. Judge 1 shows a record with multiple plateaus, a common occurrence. Judge 2 shows a smooth and continuous curve. Judge 3 shows a steep rise and fall.


panellist 1, salty
intensity
time (s)
panellist 2, salty
intensity
time (s)
panellist 8, salty
intensity
time (s)
0
20
40
60
80
100
0
60
120
180
240

Métodos para el cálculo de la curva promedio

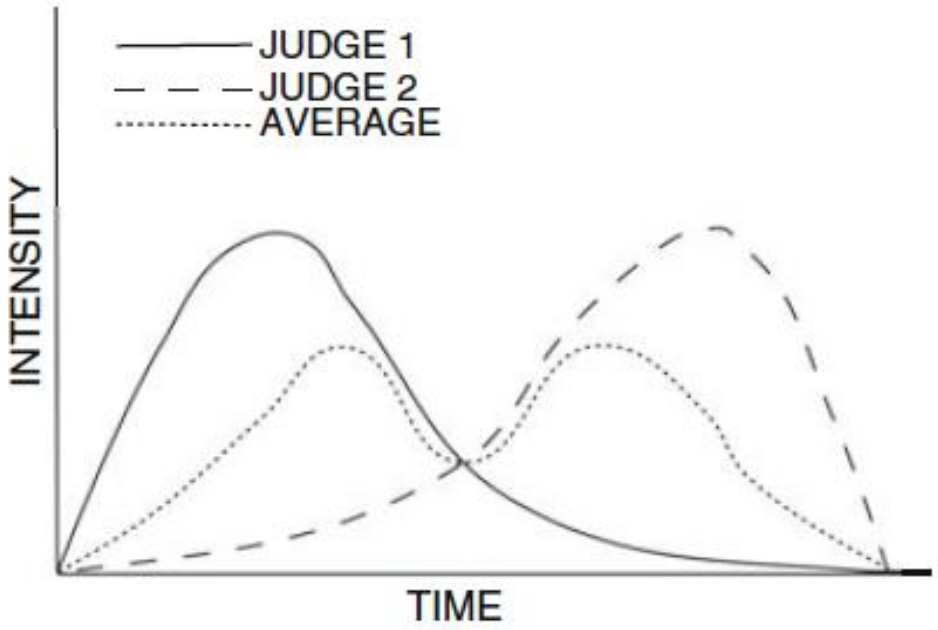
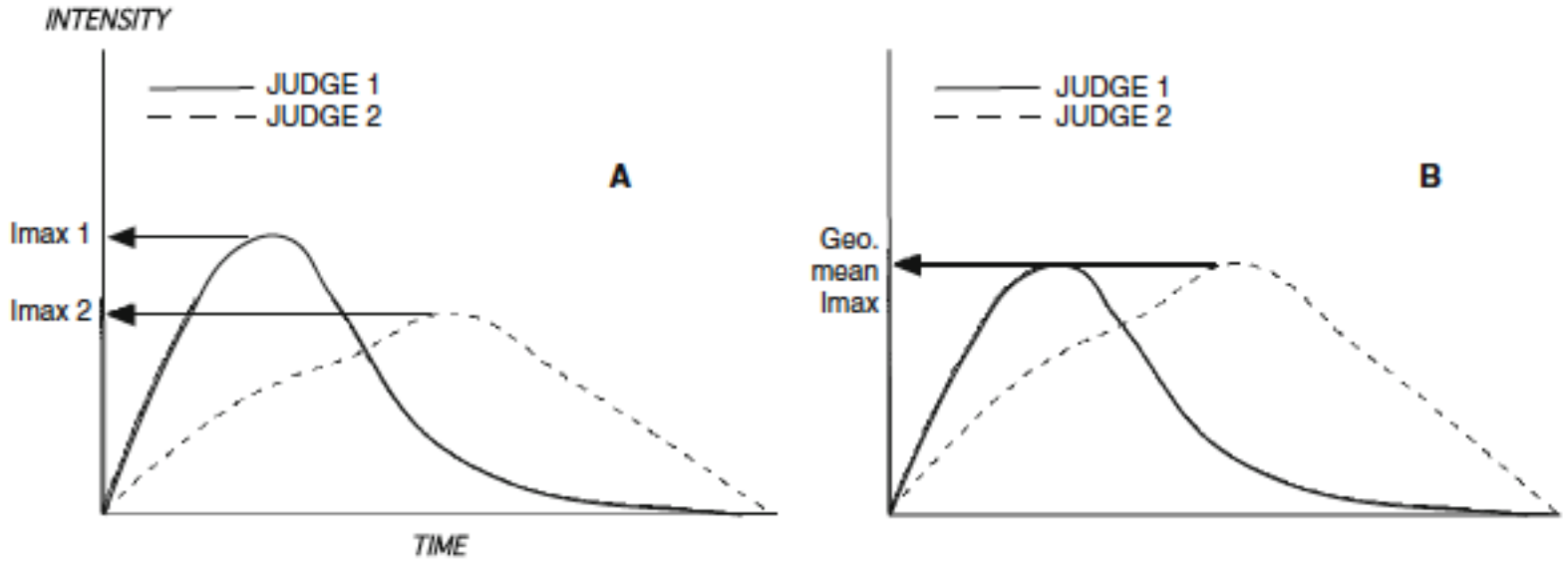
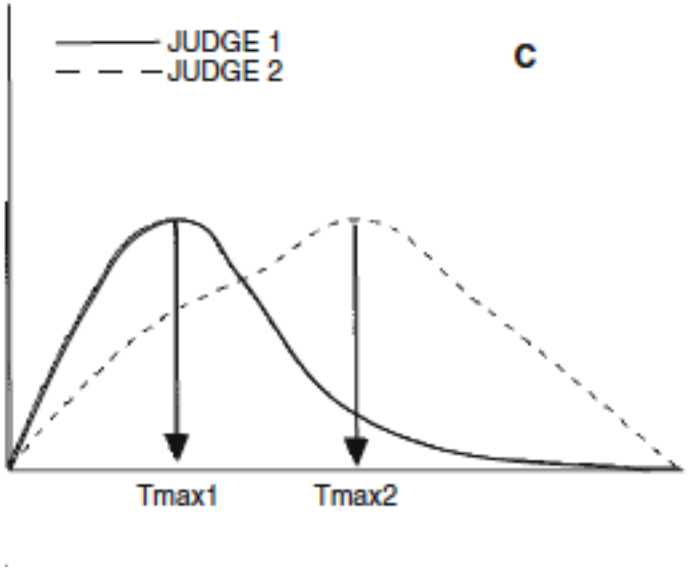
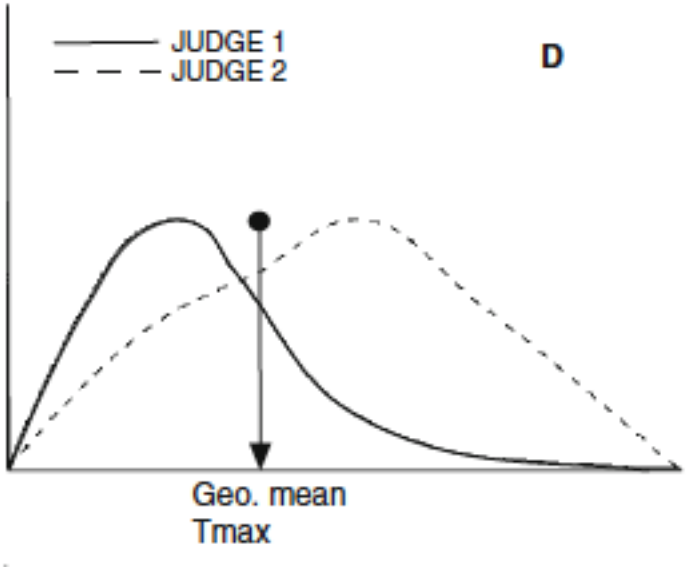


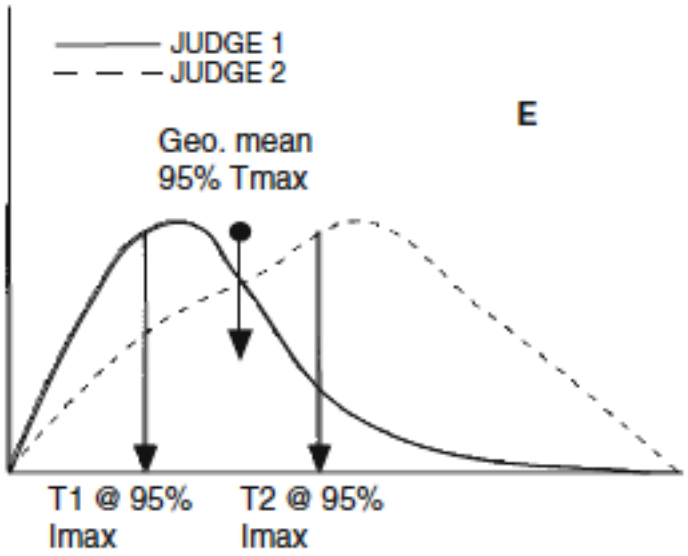
Fig. 8.4 Two curves with different peak times, if averaged, can lead to a double-peaked curve that resembles neither original data record.

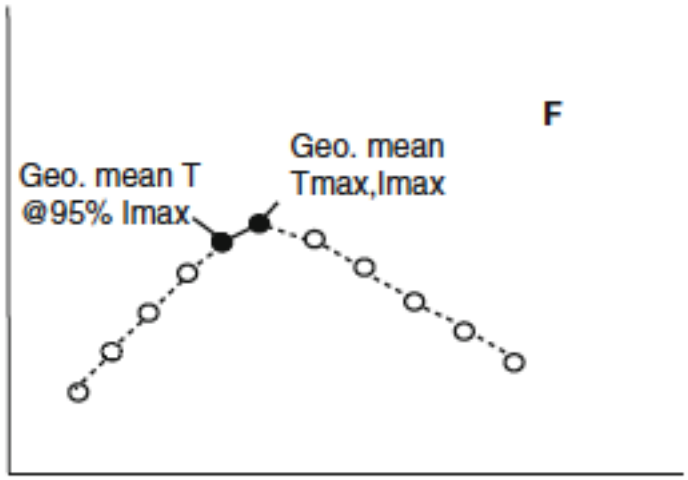
Descripción geométrica de las curvas (Lallemand et al., 1999)




JUDGE 1
JUDGE 2
C
Tmax1
Tmax2


JUDGE 1
JUDGE 2
D
Geo. mean
Tmax


JUDGE 1
JUDGE 2
E
Geo. mean
95% Tmax
T1 @ 95%
Imax
T2 @ 95%
Imax


F
Geo. mean T
@95% Imax
Geo. mean
Tmax,Imax

Parámetros obtenidos de las curvas de TI

Parameter	Alias	Abbrev.	Reference
Maximum intensity		I_{max}	Overbosch *et al.* (1986)
	Initial intensity	I_i	Harrison & Bernhard (1984)
	Height to max. intensity	HTMAX	Ott & Palmer (1990)
	Max. perceived intensity	$(I_p)_{max}$	Dubois & Lee (1983)
	Maximum intensity	MAX	Robichaud & Noble (1990)
Time-to-maximum intensity		T_{max}	Cliff (1987)
	Time to max	TTM	Nasrawi & Pangborn (1990)
	Onset time	T_o	Birch *et al.* (1980)
	Appearance time	AT	Janusz *et al.* (1991)
	TIME to MAX		Dubois & Lee (1983)
			Robichaud & Noble (1990)
Total time		T_{tot}	Cliff (1987)
	Persistence time	T_p	Birch *et al.* (1980)
	Time	T	Kemp & Birch (1992)
	Persistence	P	Portmann *et al.* (1992)
	Finish time	T_{end}	Liu & MacFie (1990)
	Extinction time	ET	DuBois & Lee (1983)
	Total duration	DUR	Robichaud & Noble (1990)
Plateau time		T_{plat}	Cliff (1987)
	Protraction of max. int.	T_i	Birch *et al.* (1980)
Lag time		T_{lag}	Cliff (1987)
	Start time	T_{start}	Liu & MacFie (1990)
	Reaction time	T_r	Birch *et al.* (1980)

Expectoration			
	Highest intensity before expectoration	HIBE	Ott & Palmer (1990)
	Highest intensity before ingestion	HIBI	Ott & Palmer (1990)
Recording time		RT	Ott & Palmer (1990)
	Total recorded time	T_s	Birch *et al.* (1980)
	Total elapsed time		Janusz *et al.* (1991)
Time of ½ maximum		$t_{½}$	Lawless & Skinner (1979)
			Janusz *et al.* (1991)
	Time of ½ max (decay)	T_{hdec}	Pecore (1992)
	Time of ½ max (onset)	T_{hmax}	Pecore (1992)
Decline time		T_{dec}	Liu & MacFie (1990)
Time after maximum			
	Time of taste to linger	t_l	Kemp & Birch (1992)
Maximum intensity–time		IT	Kemp & Birch (1992)
Area			
	Total amplitude		Yoshida (1986)
	Total gustatory resp.	TGR	Kemp & Birch (1992)
	Total intensity	STIP	Nasrawi & Pangborn (1990)
	Area under curve	AUC	Ott & Palmer (1990)
Rate of increase			
	Max. rate of adsorption	M_{ads}	Cliff (1987)
	Maximum intensity rate	MIR	Kemp & Birch (1991)
		RATE MAX	Ott & Palmer (1990)
	Rate of onset	ONSET	Robichaud & Noble (1990)
			Leach & Noble (1986)
	Slope rising		Pecore (1992)
	Max. rate of onset	M_{onset}	Cliff (1992)
Rate of decrease			
	Max. rate of desorption	M_{des}	Cliff (1987)
	Rate of decay	DECAY	Robichaud & Noble (1990)
			Leach & Noble (1986)
	Slope tailing		Pecore (1992)
	Max. rate of decay	M_{decay}	Cliff (1992)

Area-before-maximum intensity		A	Yoshida (1986)
		H_{area}	Cliff (1987)
			Matuszewska (1992)
Area-after-maximum intensity		B	Yoshida (1986)
		OH_{area}	Cliff (1987)
			Matuszewska (1992)
Aftertaste	Area after max./area before max.		
		B/A	Yoshida (1986)
		Ratio	Cliff (1987)
		AT	Ott & Palmer (1990)

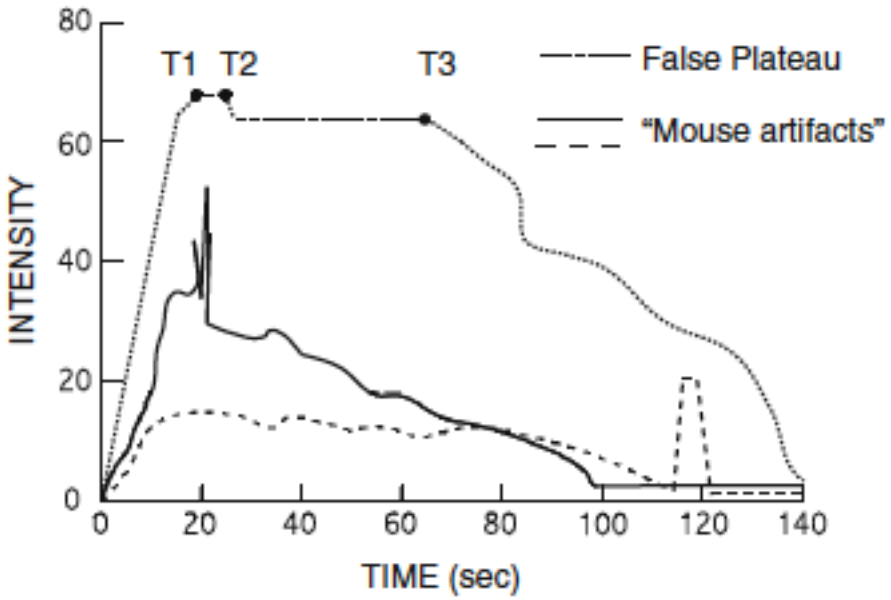
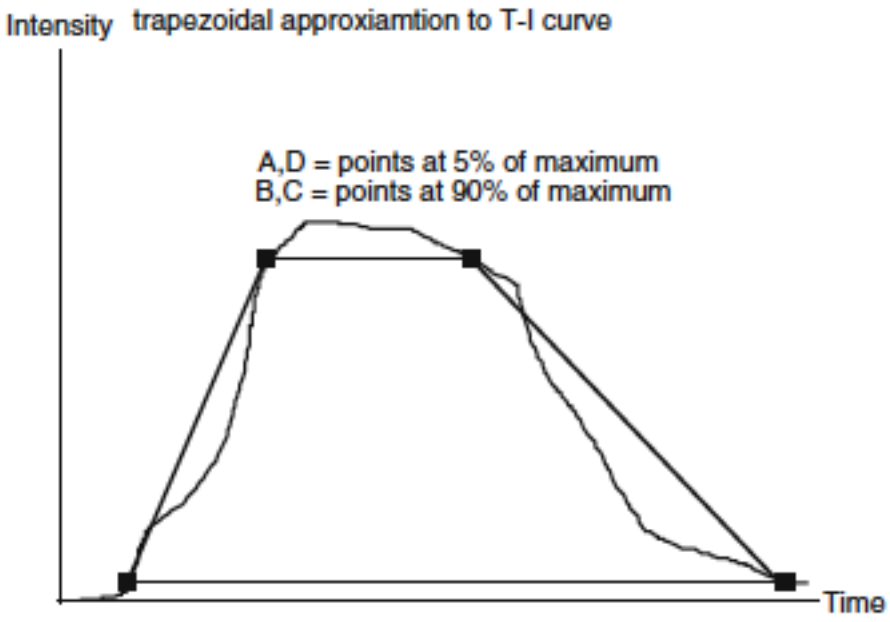
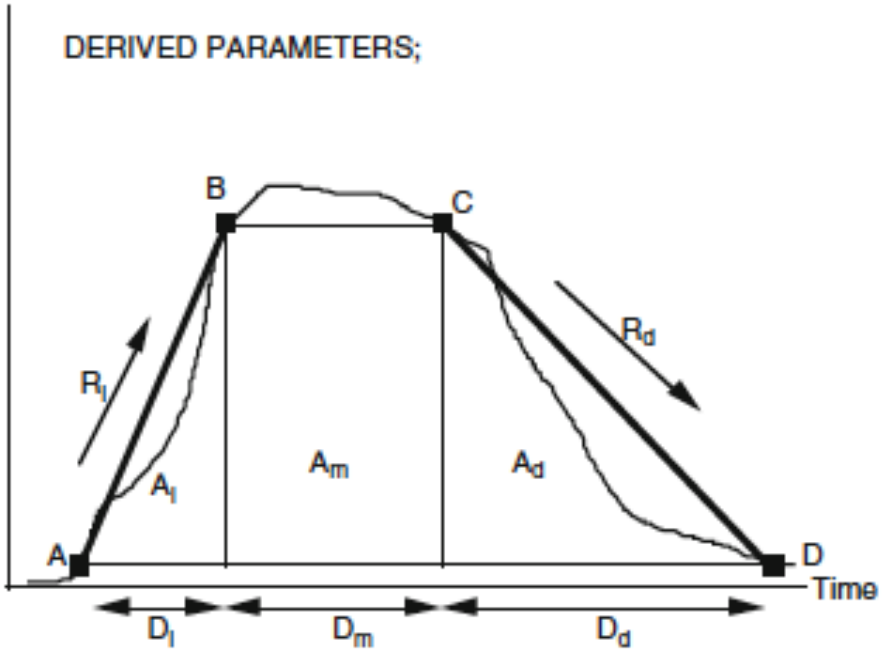


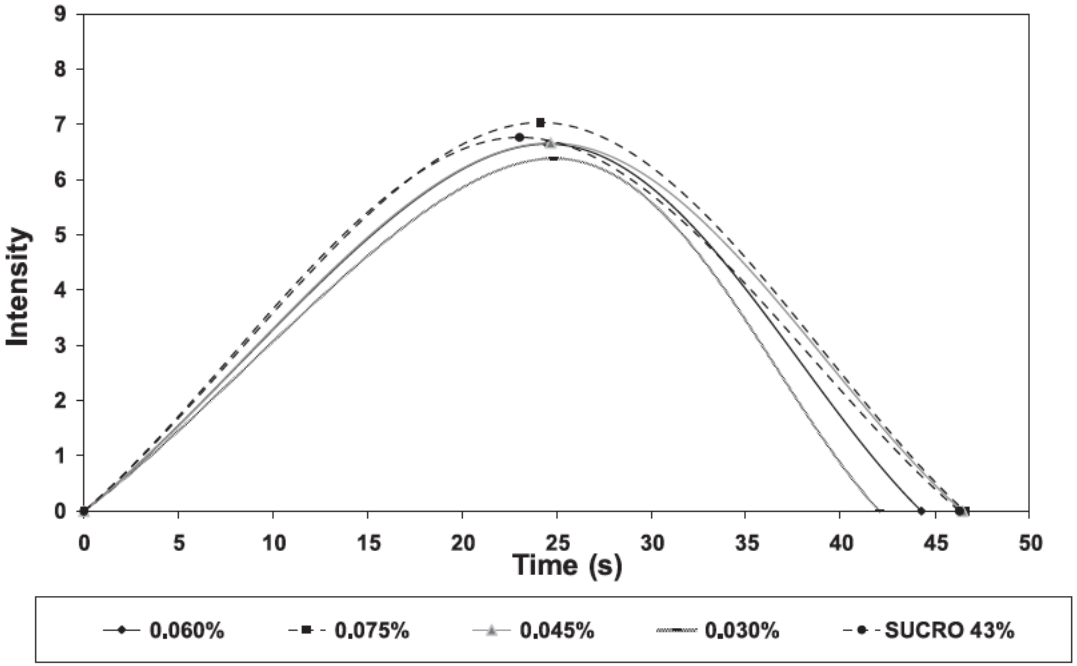
Fig. 8.6 Response artifacts in TI records. The *solid line* shows some perhaps unintended mouse movement (muscle spasm?) near the peak intensity. The *dashed line* shows a bump in the mouse after sensation ceased and returned to zero. The *dotted line* illustrates an issue in determining at what point the intensity plateau has ended. The short segment between *T*1 and *T*2 may have simply been an adjustment of the mouse after the sudden rise, when the panelist felt they overshot the mark. The actual end of the plateau might more reasonably be considered to occur at *T*3. (see Lallemand et al. 1999).

Método del trapezoide para calcular parámetros individuales
(Lallemand et al., 1999)





Ejemplo – Edulcorantes en chocolate (Palazzo et al., 2011).



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Ejemplo – Evaluación de astringencia en vino Tannat (Vidal et al., 2017).

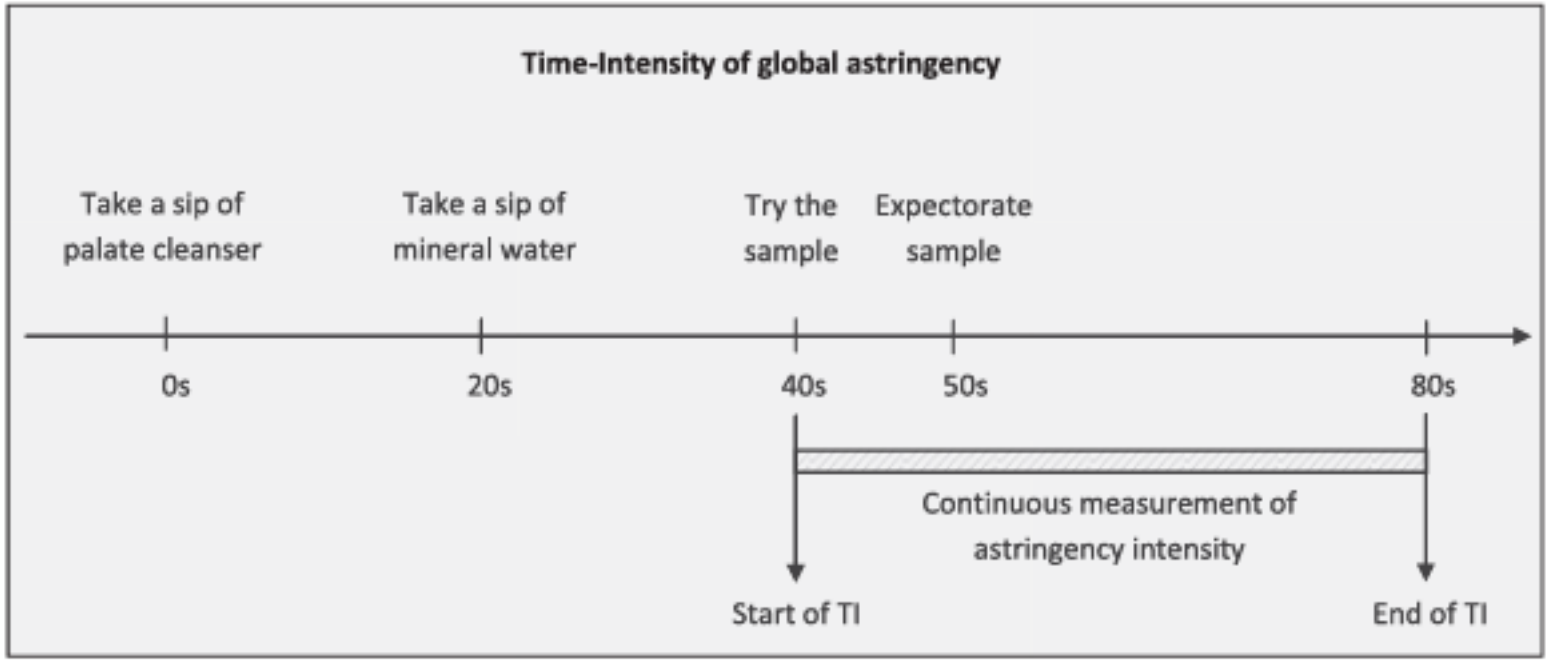


Table 3
Definition of the parameters extracted from time-intensity curves.

Abbreviation	Parameter	Definition
Imax	Maximum intensity	Maximum observed intensity during the evaluation
Iend	Intensity at the end	Intensity observed at the end of the evaluation
tstart	Starting time	First time at which intensity is > 0
tmax	Time of maximum intensity	Time at which maximum intensity is first reached
tdec	Decline time	Time at which the curve starts to decline from Imax; last time at which Imax is registered
dur	Duration	Total time from tstart until the finish of the test
auc	Area under the curve	Area under the curve
inc.auc	Increase area	Area under the ascending portion of the curve, from tstart to tmax.
dec.acu	Decrease area	Area under the descending portion of the curve, from tdec to the finish of the test.
plat.auc	Area under the plateau	Area under the plateau

Table 5
Descriptive statistics (mean, standard deviation –SD-, minimum, 1st quartile, 3rd quartile and maximum) of the average time-intensity parameters of Tannat wine samples, and p-values from the Analysis of Variance results for the sample effect.

Parameter	Mean ± SD	Minimum	1st quartile	3rd quartile	Maximum	p-Value*
Imax (0 – 10)	6.4 ± 0.7	5.1	5.9	6.9	8.1	**0.0000**
Iend (0–10)	2.9 ± 0.6	1.9	2.5	3.1	4.6	**0.0000**
tstart (s)	46.9 ± 0.9	45.7	46.4	47.3	50.7	**0.0057**
tmax (s)	56.4 ± 1.7	53.3	55.5	57.3	61.8	0.4655
tdec (s)	61.8 ± 1.8	59.6	60.5	62.7	65.7	0.3817
dur (s)	33.0 ± 0.9	29.3	32.7	33.5	34.3	**0.0134**
auc	146.2 ± 20.1	110.7	131.2	159.5	202.1	**0.0000**
inc.auc	43.3 ± 9.9	25.5	38.0	47.4	68.1	**0.0499**
dec.acu	67.6 ± 9.8	50.2	59.9	76.3	90.5	0.1330
plat.auc	35.3 ± 13.2	13.8	24.9	44.1	74.0	**0.0316**

Imax: maximum intensity; Iend: intensity at the end; tstart: starting time; tmax: time of maximum intensity; tdec: decline time; dur: duration; auc: area under the curve; inc.auc: increase area; dec.auc: decrease area; plat.auc: area under the plateau.

* Values in bold are significant at a significance level of 5%.

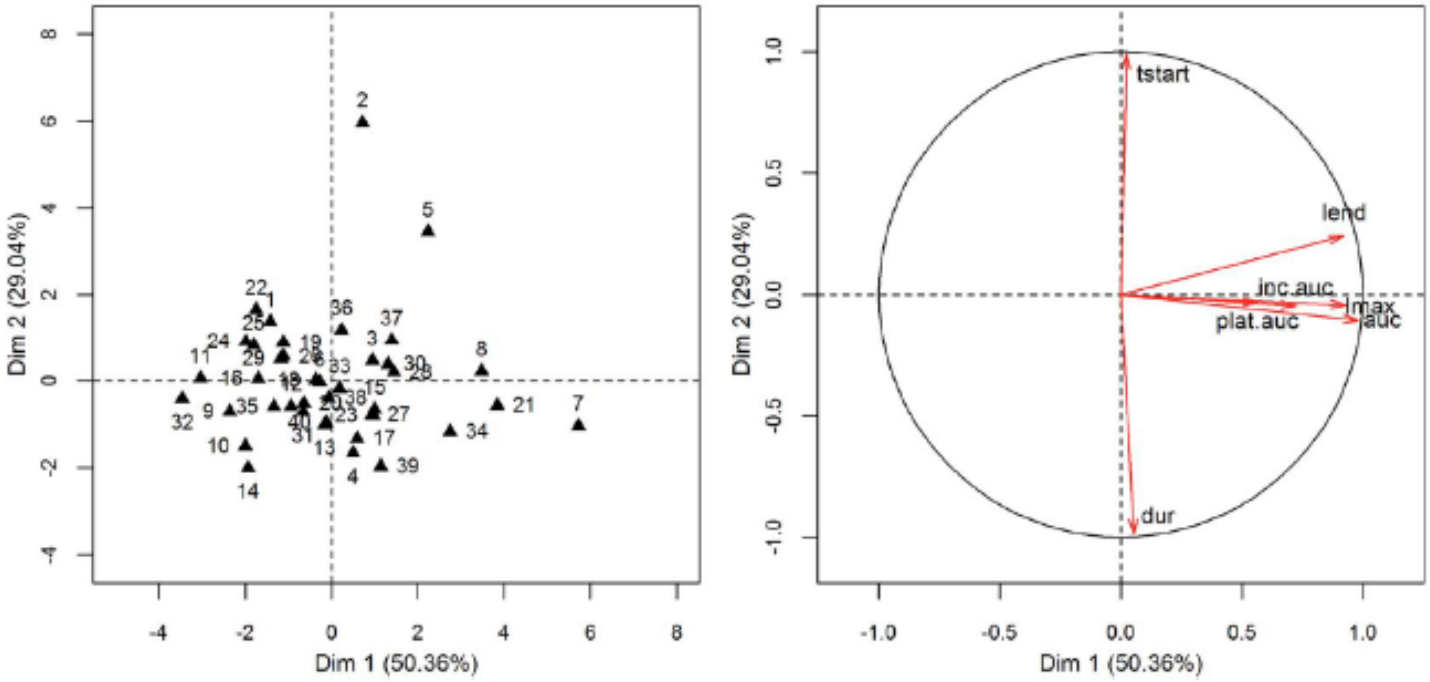
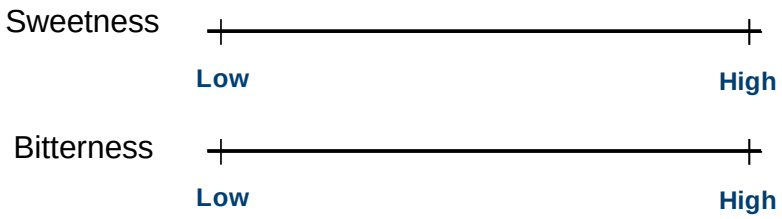
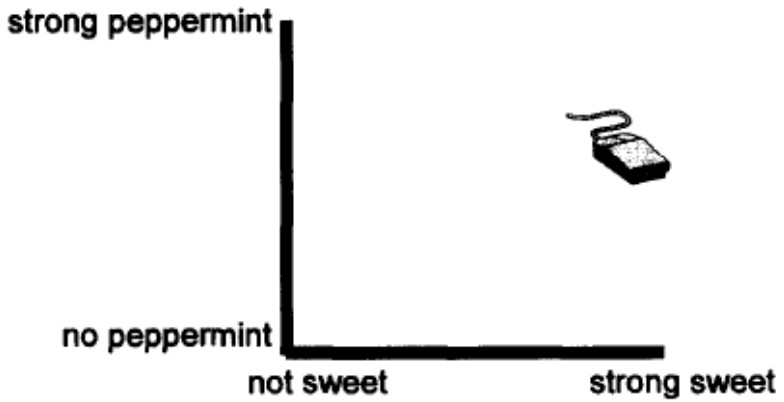


Fig. 2. Representation of wine samples (right) and time-intensity parameters (left) in the first two dimensions of Principal Component Analysis performed on data from total astringency evaluation.

Tiempo-intensidad multi-atributo (MATI)

- Se evalúan varios atributos al mismo tiempo (Kuesten et al., 2013).





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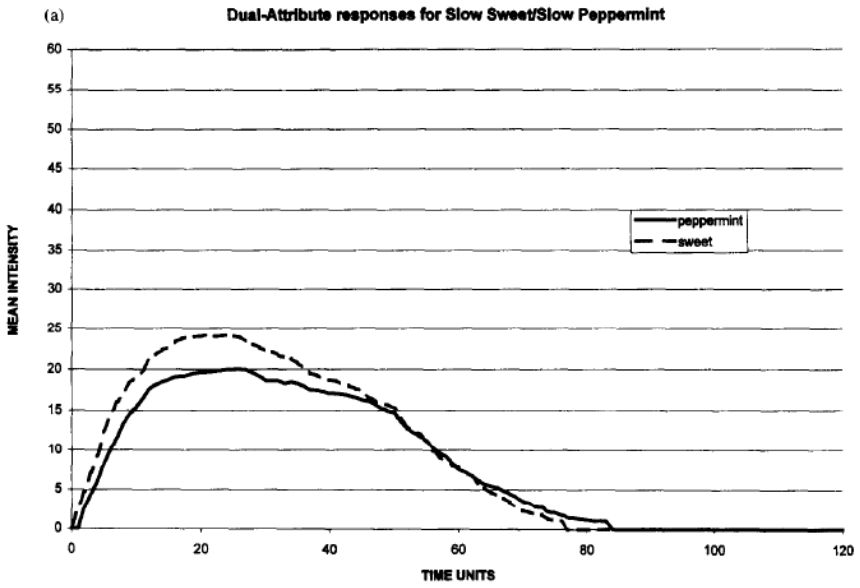
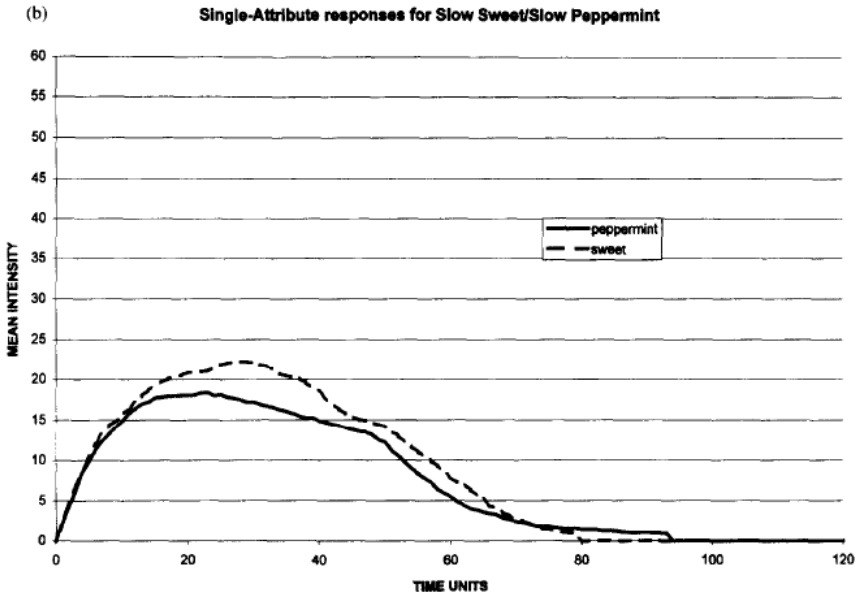
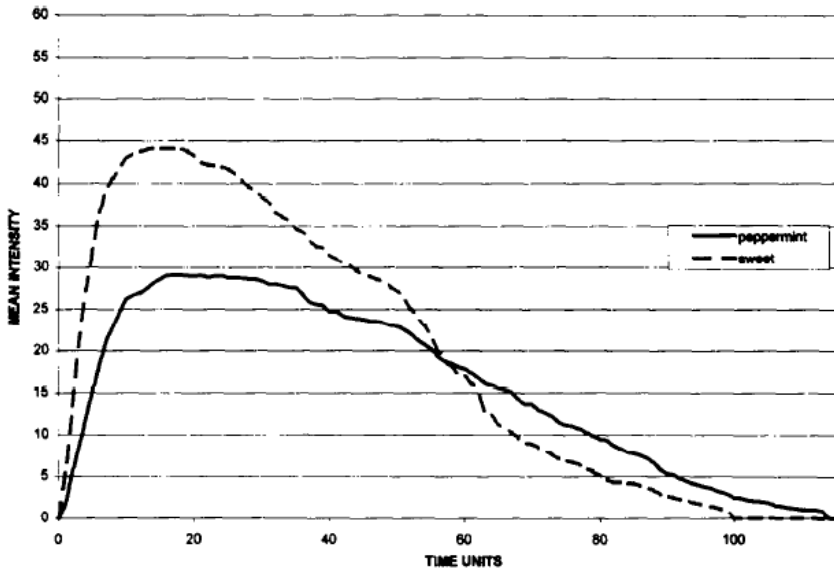
Ejemplo – Evaluación de chicles con TI de uno o dos atributos (Duizer et al., 1995).

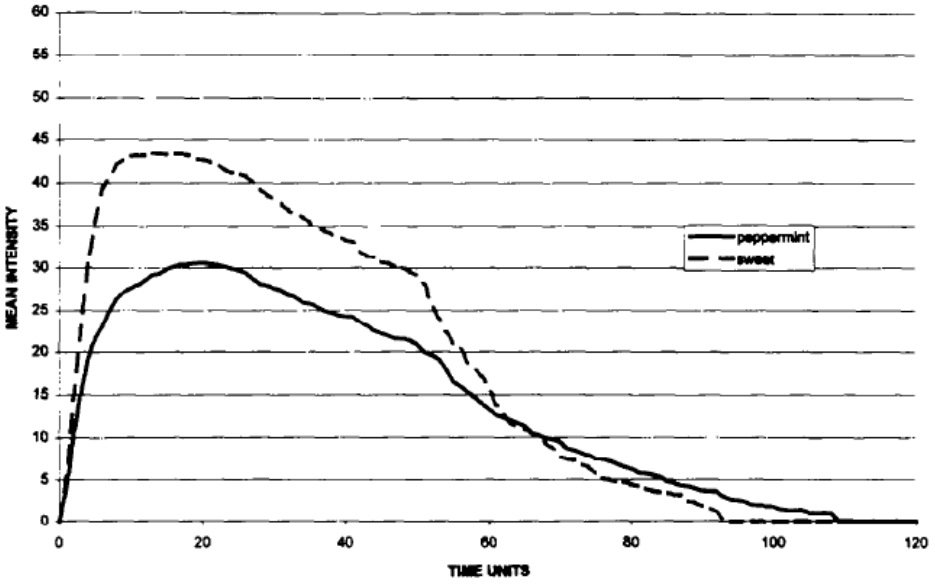




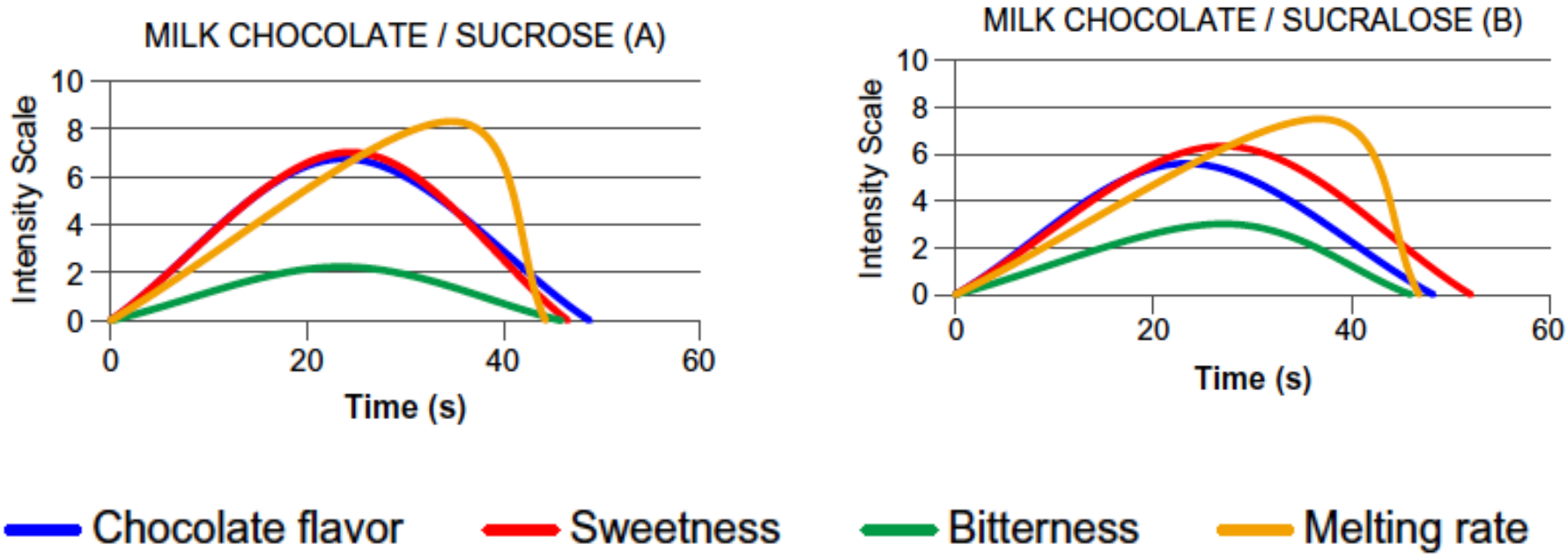
(a)


Dual-Attribute responses for Fast Sweet/Fast Peppermint
MEAN INTENSITY
TIME UNITS
peppermint
sweet
0
5
10
15
20
25
30
35
40
45
50
55
60
0
20
40
60
80
100

(b)


Single-Attribute responses for Fast Sweet/Fast Peppermint
MEAN INTENSITY
TIME UNITS
peppermint
sweet
0
5
10
15
20
25
30
35
40
45
50
55
60
0
20
40
60
80
100
120

Ejemplo – Influencia de reemplazo de azúcar en el perfil sensorial dinámico de chocolate (Palazzo et al., 2014).



Limitaciones

- Se necesitan evaluadores altamente entrenados
  - Evaluación de intensidad
  - Complejidad de la tarea
- Diferencias individuales en las respuestas (patrones individuales)
- Generalmente se evalúa un único atributo.
- Elevado tiempo de implementación.

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Dominancia Temporal de Sensaciones (TDS)

35

Dominancia Temporal de Sensaciones

- Método dinámico multi-atributo que se basa en la identificación de la característica sensorial dominante en cada momento de la evaluación (Pineau et al., 2003).

- Su aplicación ha crecido rápidamente en los últimos años.

- Puede aplicarse tanto con jueces entrenados como con consumidores.

- Existen aplicaciones en diversos tipos de productos, pero la mayoría se limita a una única modalidad sensorial.

Recolección de datos

Moist	Sweet	Garlic
Soft	Smokey	Firm
Chewy	Sour/Acidic	Savoury

¿Qué es la dominancia?

- La sensación más intensa (Labbe et al. 2009).
- La sensación de mayor impacto (Pineau et al. 2009).
- La sensación que sobresale, no necesariamente la más intensa (Pineau et al. 2009).
- La sensación que capta la atención en un determinado momento (Pineau 2013).

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What is dominance? An exploration of the concept in TDS tests with trained assessors and consumers

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- Heterogeneidad en la conceptualización de dominancia:

  Captura atencional: "*Lo primero que me llamó la atención fue la suavidad”*

  Nuevas sensaciones que “aparecen”: ”*De repente sentí que se volvía jugoso”*

  La sensación más intensa: ”*Muy suave” “Se vuelve muy jugoso”*

- Heterogeneidad en la conceptualización de dominancia.

- Importancia del procesamiento oral.

- Competencia entre modalidades.

- Sesgos de respuesta por la limitación en el número de atributos que se presentan y que pueden seleccionarse.

> *“Es un pan con muchas cosas ocurriendo simultáneamente. Es difícil decidir qué atributo seleccionar como dominante”*
>
> *“Es jugoso y esponjoso, pero también muy sabroso al mismo tiempo. Es difícil selecccionar algo"*

Question	Categories	Consumers (%)
i) Why did the attributes you selected catch your attention during the test?	The most intense sensation	34
	The most striking sensation	20
	Sensations that "popped up"	19
	Sensations that did not fit previous expectations	15
	Liked/disliked sensations	11
	Common sensations in the product	1
ii) Did you perceive any other sensations simultaneously with the sensation that caught your attention? Why did you not select them?	No	28
	Yes...	
	but they were less intense	32
	but the test only allowed me to select one, so I had to choose	21
	but they did not catch attention	13
	but they lasted less than the one I selected	2
	but they did not suddenly appear	2
	but they were not relevant for describing liked/disliked aspects of the product	2
iii) What made you change your selection of attributes during the task?	Changes in the product during mastication	76
	Changes in attribute intensity	20
	Sudden changes	3
	The appearance of sensations I disliked	1

Lista de atributos

- La lista de atributos es uno de los pasos clave de la implementación del TDS.
- El máximo número de atributos a incluir es 10 (Pineau et al., 2012).
- Los términos se presentan en orden balanceado entre los evaluadores.
- El orden es constante para cada evaluador para facilitar la tarea.
- Pueden incluirse términos vinculados a una única modalidad sensorial o a varias.

- Se presenta la lista de atributos y los evaluadores indican en cada momento cuál de los atributos se percibe como dominante.
- Los evaluadores pueden:
  - Elegir un único atributo en cada instante.
  - Seleccionar un atributo en varios momentos de la evaluación.
  - No seleccionar un atributo en ningún momento de la evaluación.
  - No seleccionar ningún atributo.
- La evaluación finaliza cuando no se perciben más propiedades de los productos o cuando se llega al tiempo máximo previsto.

Número de evaluadores

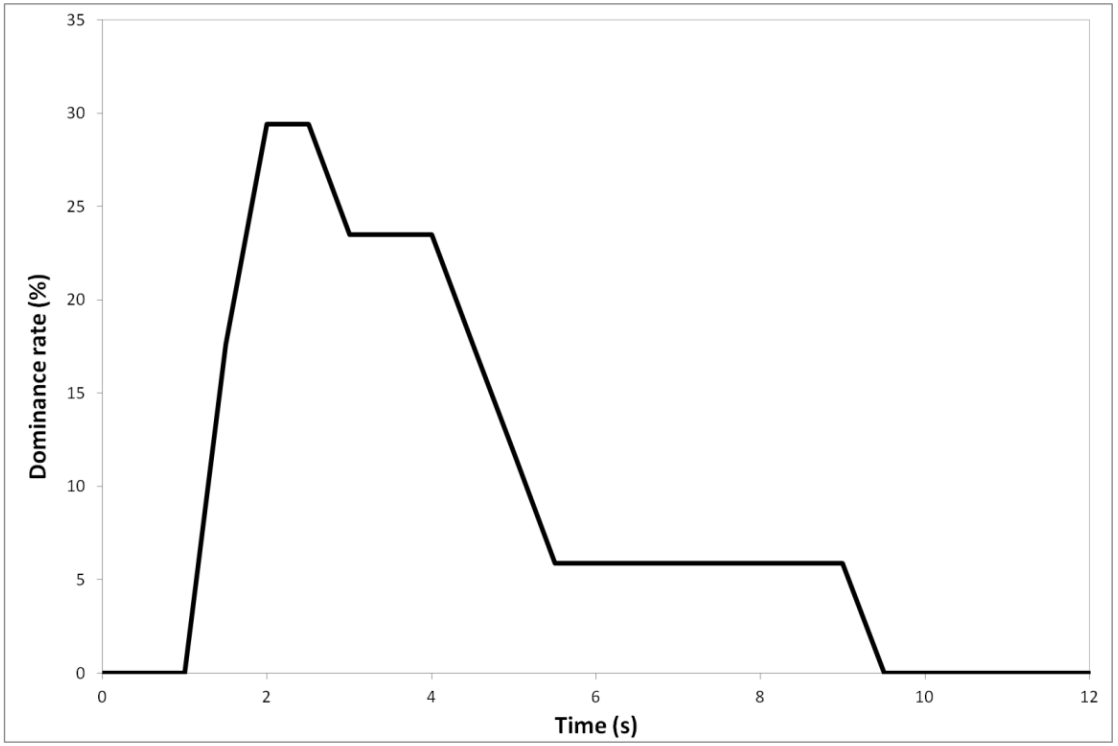
- El número de jueces para TDS es similar al utilizado para Análisis Descriptivo (8-12).
- El número recomendado por Pineau et al. (2012) es 16.
- Generalmente se realizan las evaluaciones por duplicado o triplicado.
- Cuando se utilizan evaluadores no entrenados el número debe aumentarse: 30-50 como mínimo.

Análisis de datos

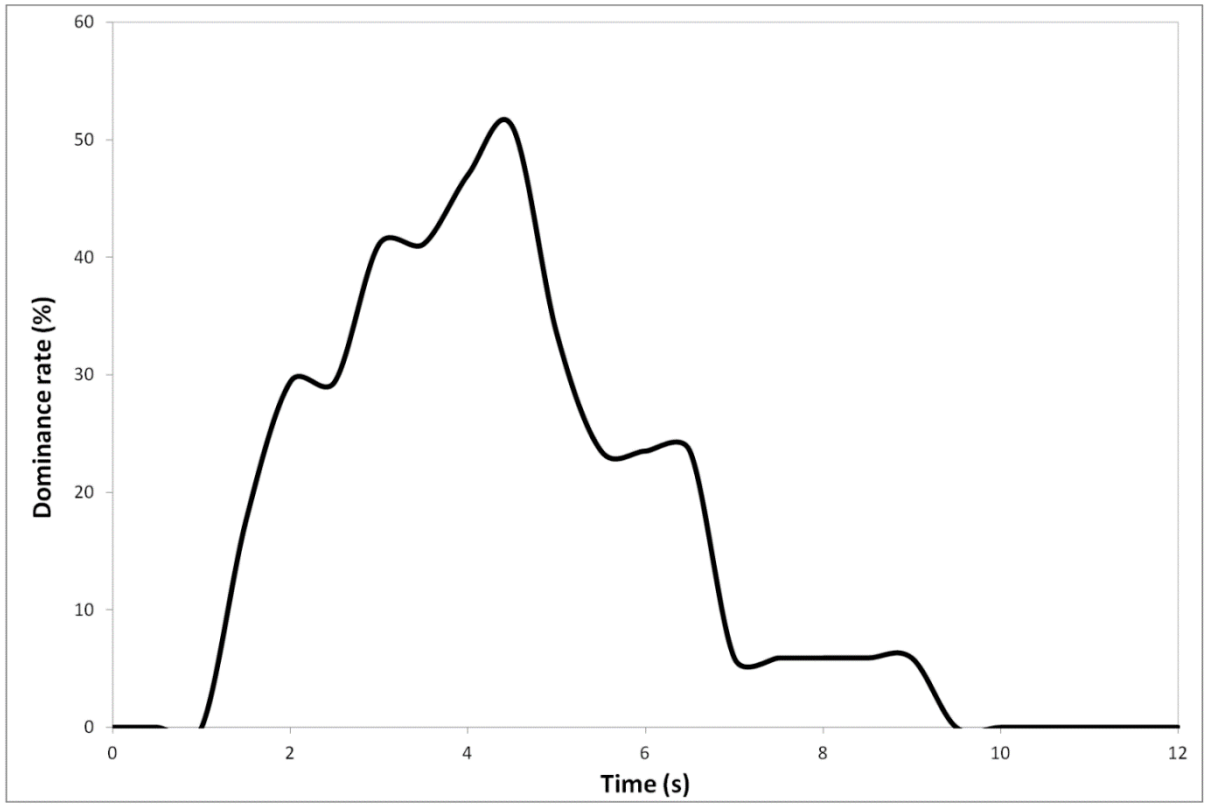
- Los datos son binarios (0/1) e indican si cada evaluador seleccionó cada uno de los atributos para cada muestra, en cada momento de la evaluación

Evaluador	Muestra	Atributo	0 s	1 s	2 s	3 s
1	452	Sabor a naranja	0	0	0	0
1	452	Ácido	0	0	0	1
1	452	Dulce	0	0	0	0
1	452	Sabor extraño	0	0	0	0
1	452	Astringente	0	0	0	0
1	452	Amargo	0	0	0	0
1	238	Sabor a naranja	0	0	0	0
1	238	Ácido	0	0	0	0
1	238	Dulce	0	0	1	1
1	238	Sabor extraño	0	0	0	0
1	238	Astringente	0	0	0	0
1	238	Amargo	0	0	0	0
1	726	Sabor a naranja	0	0	0	0
1	726	Ácido	0	0	0	1

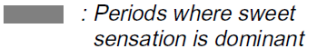
• Tasa de dominancia (Dominance rate): Proporción o porcentaje de evaluadores que seleccionan un atributo como dominante en cada momento de la evaluación

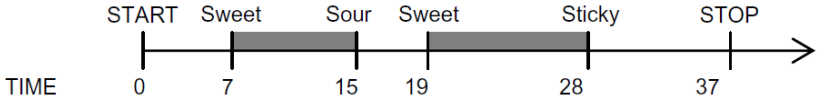


- Las curvas de TDS se obtienen suavizando las curvas de dominancia utilizando un polinomio del tipo spline

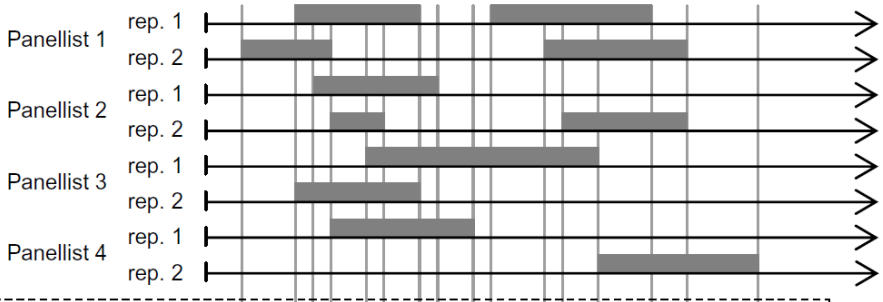


Data for one evaluation by one panellist

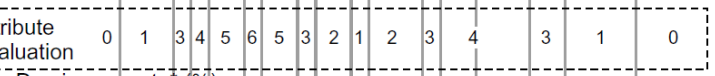




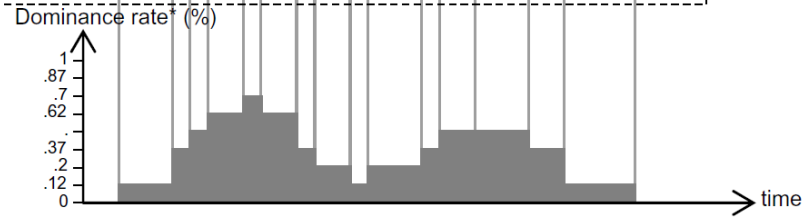
Periods where sweet sensation is dominant for one product at panel level
(4 panellists x 2 replications in this example)



number of evaluations, NE, where the attribute Sweet is dominant in the course of the evaluation

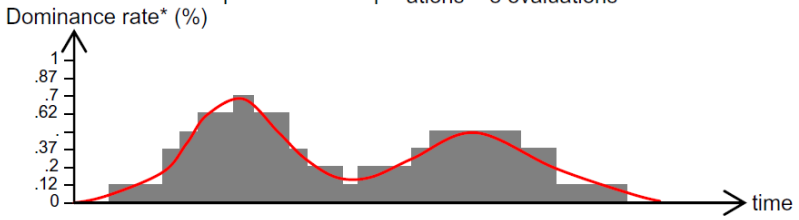


Computation of the dominance rates for the panel

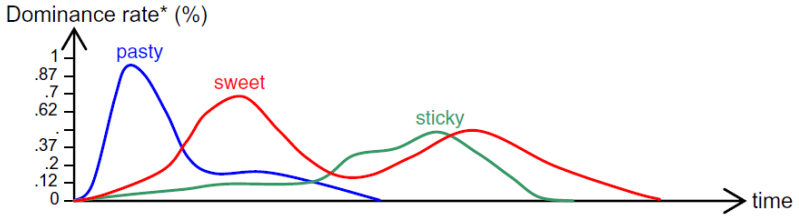


* Dominance rate = NE / NEmax
NEmax = 4 panellists x 2 replications = 8 evaluations

TDS curve : smoothing of the dominance rates for Sweet
(TRANSREG, SAS ®)



Superimposition of the different attributes



Pineau et al. / Food Quality and Preference 20 (2009) 450-455.

- Las curvas pueden estandarizarse en el tiempo para compensar diferencias entre evaluadores

- Para interpretar las curvas se utilizan los niveles de azar (P0) y significancia (Ps).

- P0 es el nivel de dominancia que puede alcanzarse por azar, considerando todos los atributos que se evalúan.

- P0 puede calcularse como 1/n o 1/(n+1), donde n es el número de atributos que se consideran en la lista.

- El nivel de significancia (Ps) es el mínimo valor de la tasa de dominancia que tiene que alcanzarse para que un atributo sea significativamente dominante.

- Se calcula mediante el intervalo de confianza de una distribución binomial, suponiendo una aproximación normal.

$$P_s = P_0 + 1.645\sqrt{\frac{P_0(1-P_0)}{n}}$$

- Esta aproximación es válida si el número de evaluadores es alto:

$$n.P_0(1-P_0) > 5$$

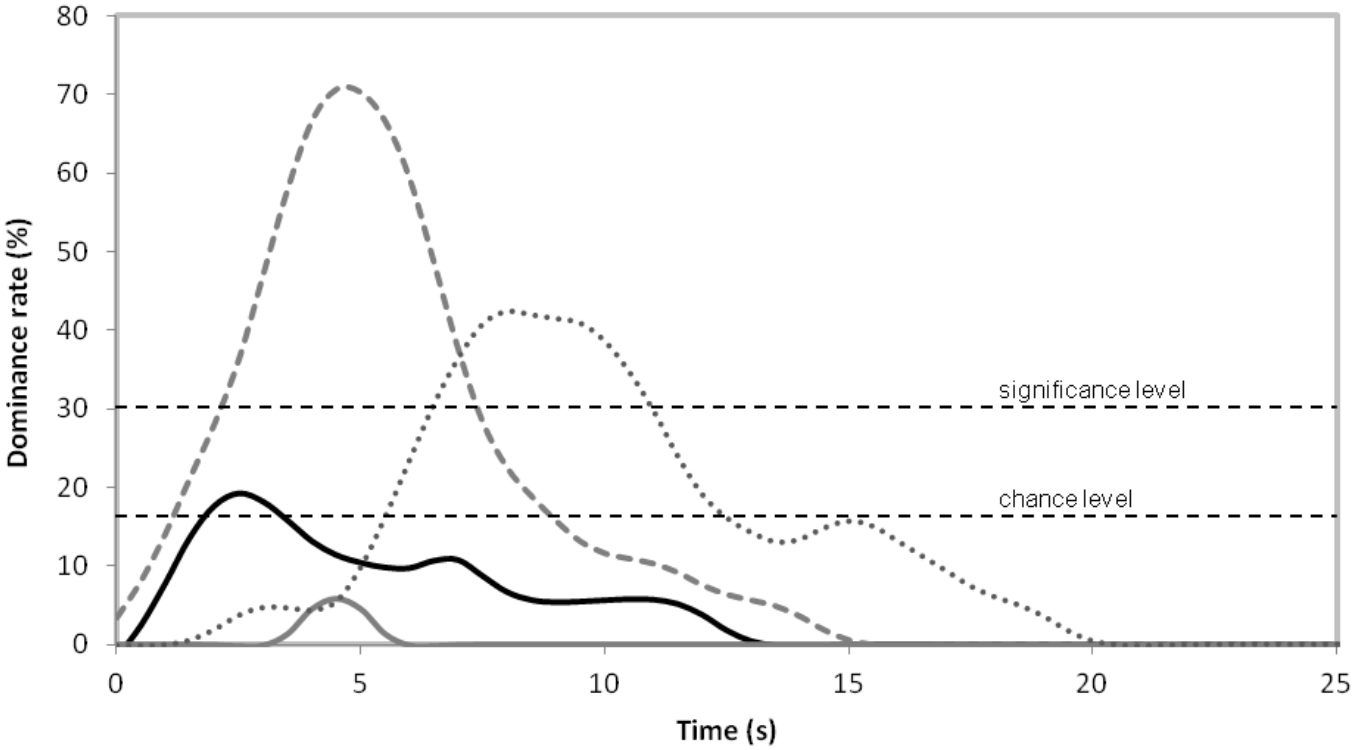
- Si el número de evaluaciones es bajo y la aproximación no es válida, el nivel de significación puede calcularse mediante un test exacto para una distribución binomial.

- Se puede calcular el mínimo valor para el cual la distribución binomial es mayor que el nivel de azar para un nivel de significación del 95%.

- Esto puede hacerse mediante la función BINOM.CRIT de Excel

$$\mathbf{P_s = (1 + BINOM.CRIT(n, P_0, 0.95))/n}$$

• Los niveles de azar y significación se representan en las curvas de TDS como líneas horizontales.



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Did assessors select attributes by chance alone in your TDS study, and how relevant is it to know?

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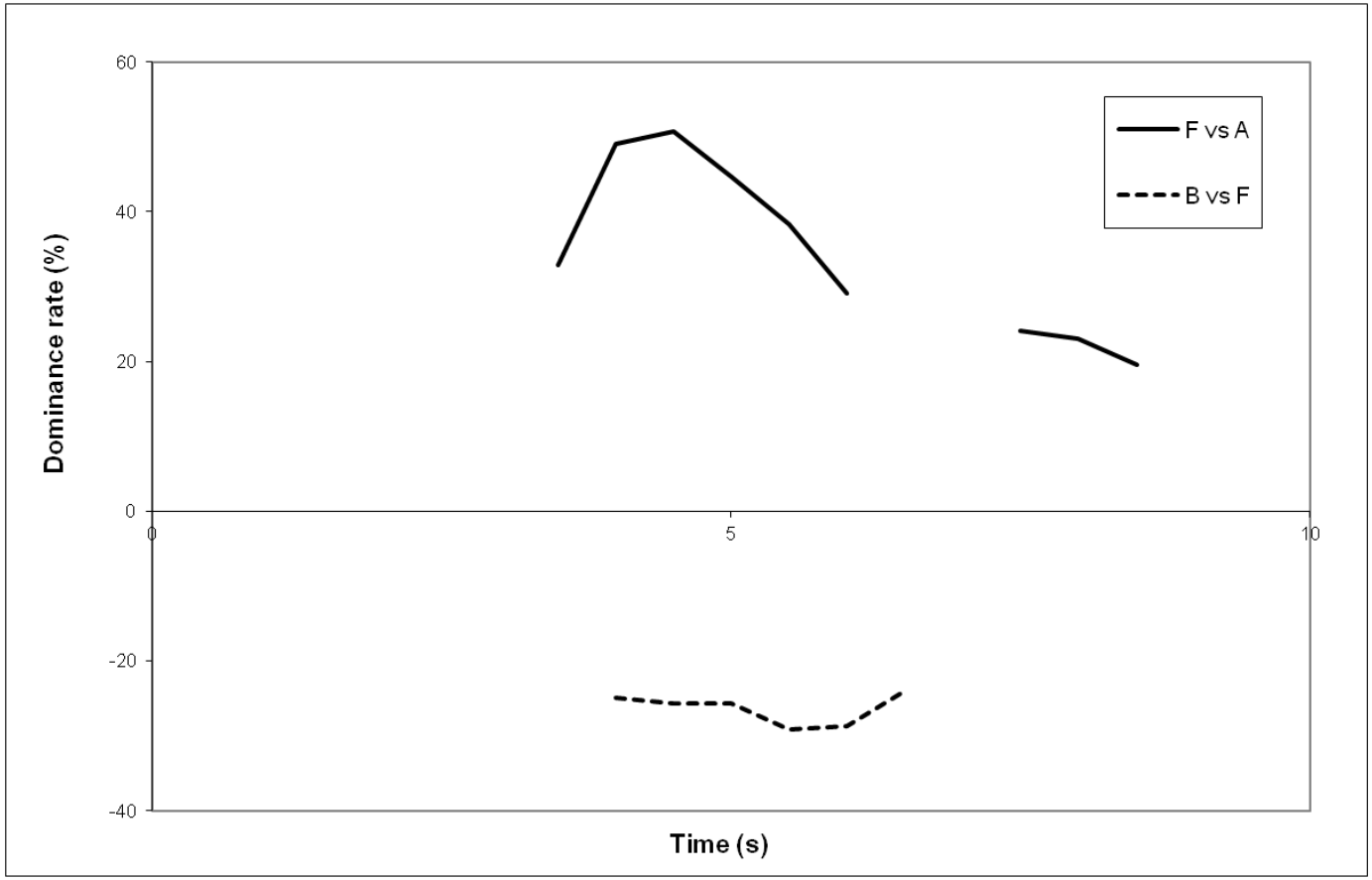
- Para evaluar diferencias entre productos se calculan curvas TDS de diferencia, restando las curvas TDS de cada par de muestras.

- Se compara la diferencia con el valor de la menor diferencia significativa para un 95% de diferencia, calculado mediante las siguientes ecuaciones:

$$P_{diff,t} = 1.96\sqrt{\left(\frac{1}{n_1}+\frac{1}{n_2}\right)P_{average,t}\left(1-P_{average,t}\right)}$$

$$P_{average,t} = \frac{P_{1,t}n_1 + P_{2,t}n_2}{n_1 + n_2}$$


60
40
20
0
-20
-40
0
5
10
Dominance rate (%)
Time (s)
F vs A
B vs F

Ejemplo de aplicación

- Jugos de naranja con distintos edulcorantes (concentración equivalente de dulzor).

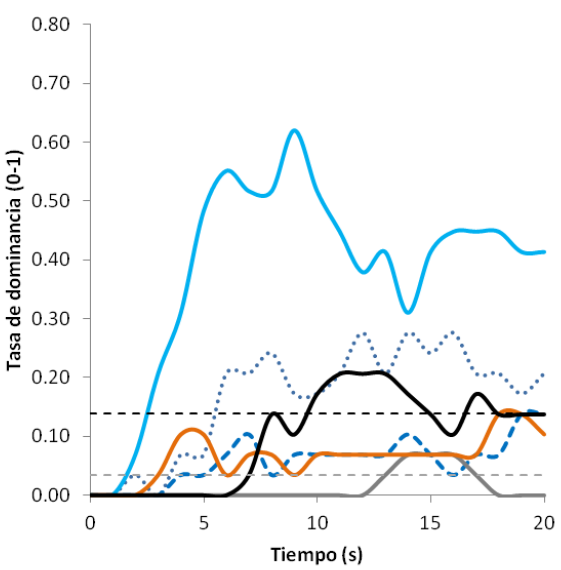
Edulcorante	Concentración (g/100mL)
Sacarosa	10
Sucralosa	0.025
Taumatina	0.091
Stevia 1	0.064
Stevia 2	0.155
Stevia 3	0.199
Stevia 4	0.151

- 12 evaluadores, 3 repeticiones.

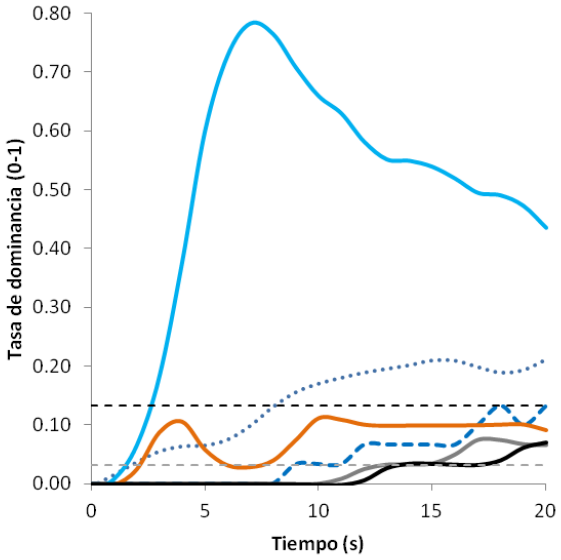
- 6 términos: *dulce*, *ácido*, *sabor a naranja*, *amargo*, *astringente* y *sabor extraño*.

- Tiempo de evaluación: 20 segundos.

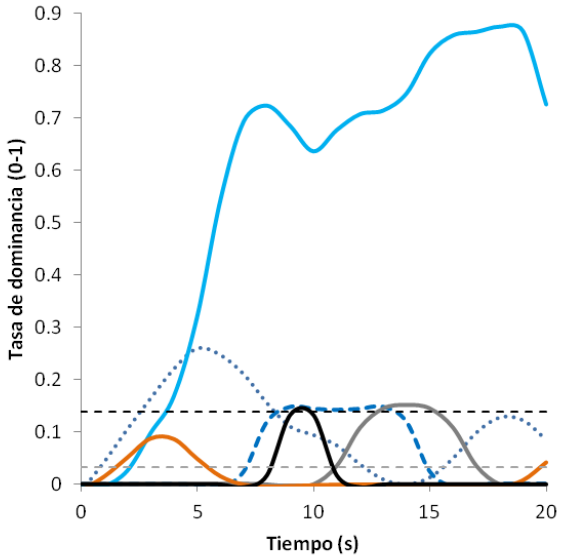
Sacarosa

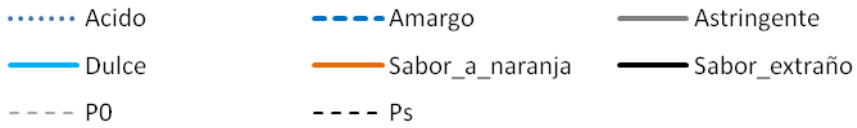


Sucralosa



Taumatina





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Advances in representation and analysis of mono and multi-intake Temporal Dominance of Sensations data

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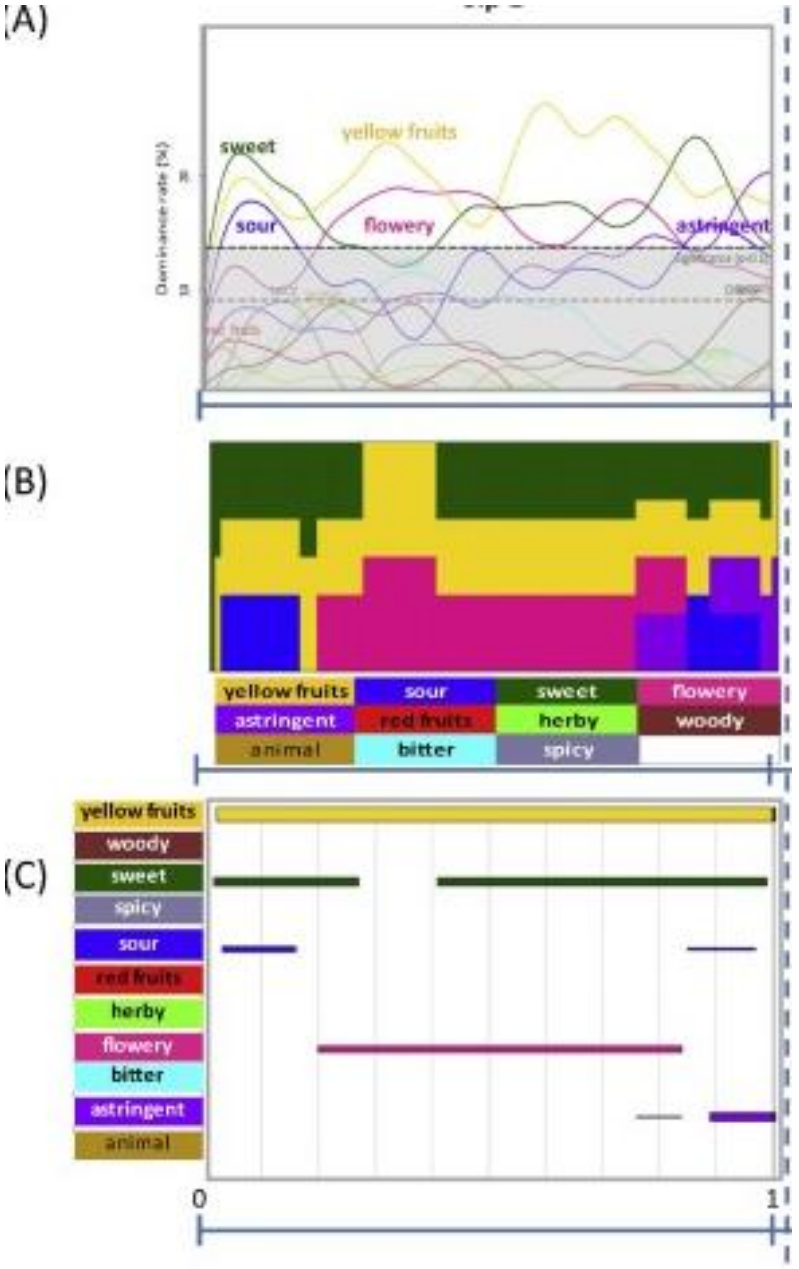
Gráficos de bandas

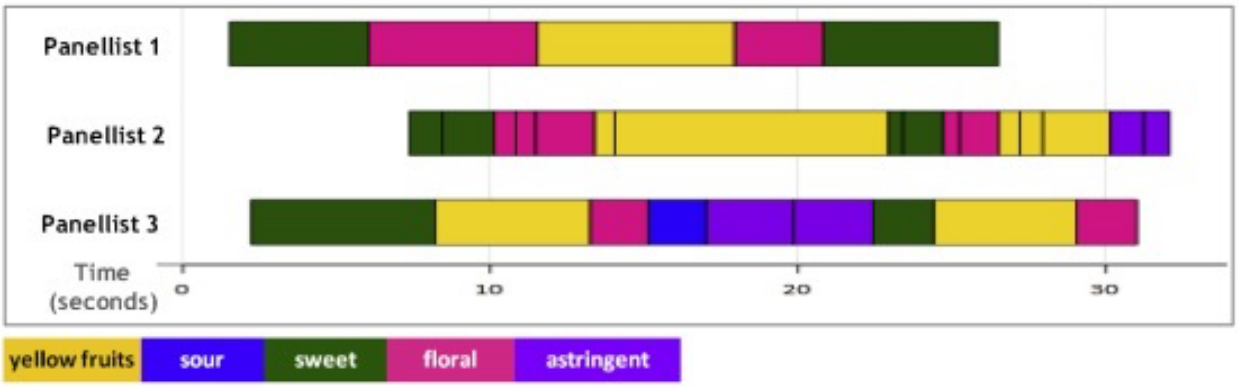
Para cada producto, se representa la secuencia de dominancia como bandas de colores de largo proporcional a la duración de la dominancia.



Duración de la dominancia

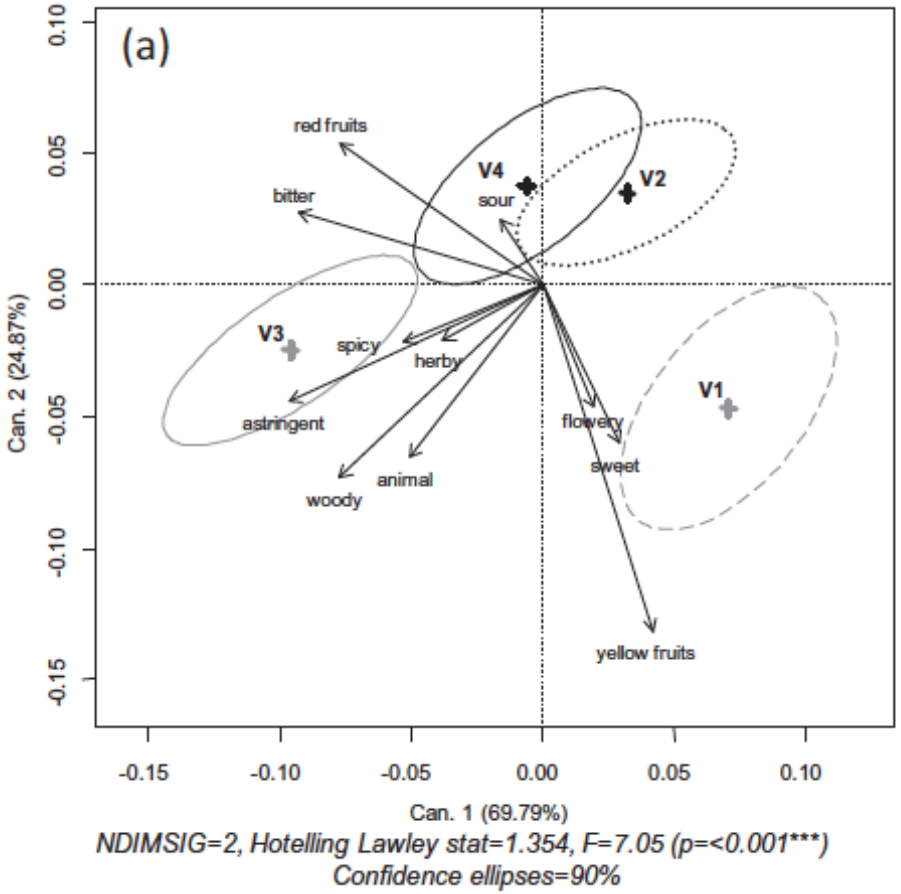
- Se calcula la duración de la dominancia para cada atributo y evaluador.
- Posibilidad de estandarizar los datos previo al análisis.
- Los datos se pueden analizar utilizando ANOVA/MANOVA

(A)

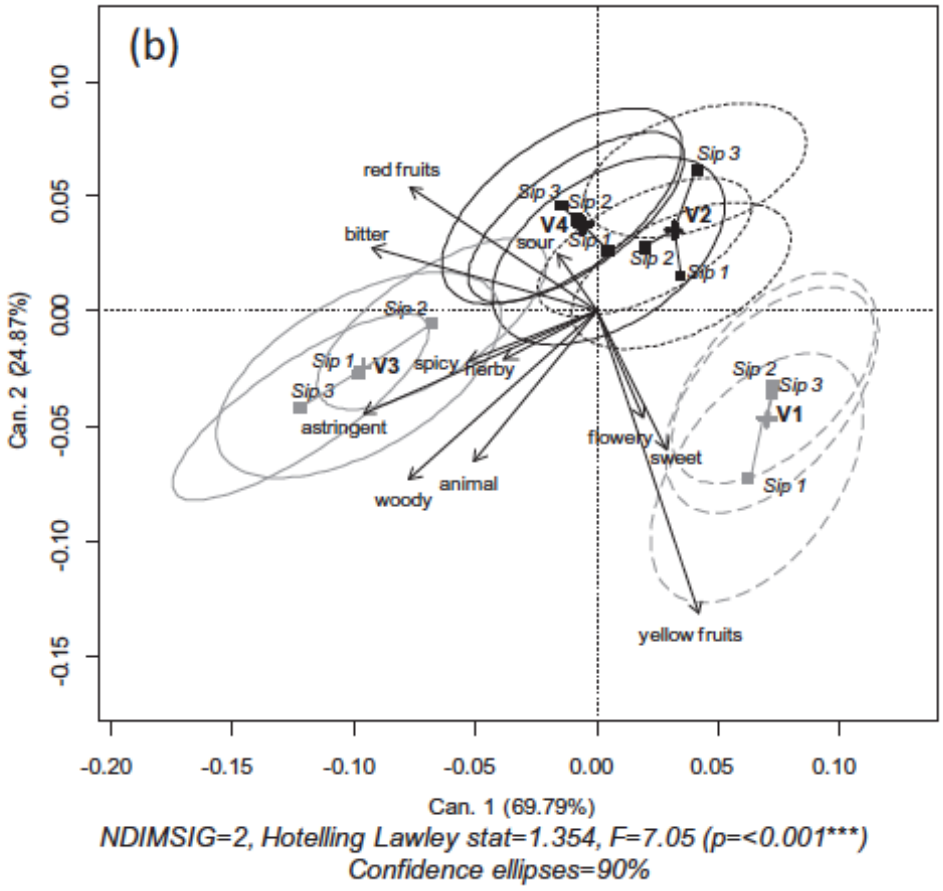


(B)

Panellist	Yellow fruits	Sour	Sweet	Flowery	Astringent
Panellist 1	6.4	0	10.2	8.4	0
Panellist 2	13.2	0	4.6	5.1	1.9
Panellist 3	9.7	1.9	7.9	3.8	5.4



*NDIMSIG=2, Hotelling Lawley stat=1.354, F=7.05 (p=<0.001***)*
Confidence ellipses=90%

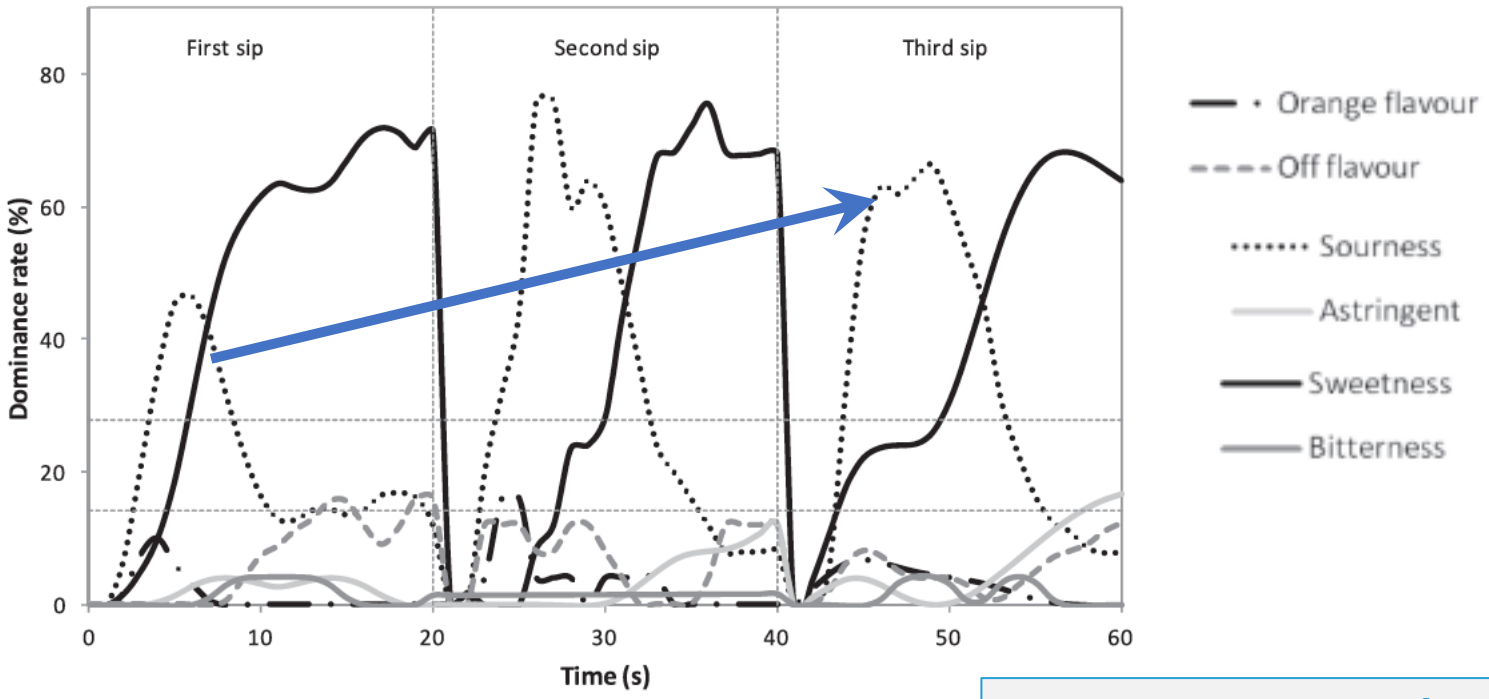


*NDIMSIG=2, Hotelling Lawley stat=1.354, F=7.05 (p=<0.001***)*
Confidence ellipses=90%

Evaluaciones en múltiples sorbos/bocados (multi-sip/bite TDS)

- Los alimentos en general son consumidos mediante ingestas múltiples y rápidas:
  - La forma en que los productos son percibidos cambia debido a efectos de adaptación o contraste (Köster, 2003)
  - El primer sorbo o bocado de una muestra puede no ser representativo de la experiencia del consumidor.

- TDS puede ser implementado para evaluar múltiples sorbos o bocados de la muestra, mediante la concatenación de evaluaciones



La dominancia de *ácido* aumentó entre el primer sorbo y los dos siguientes.

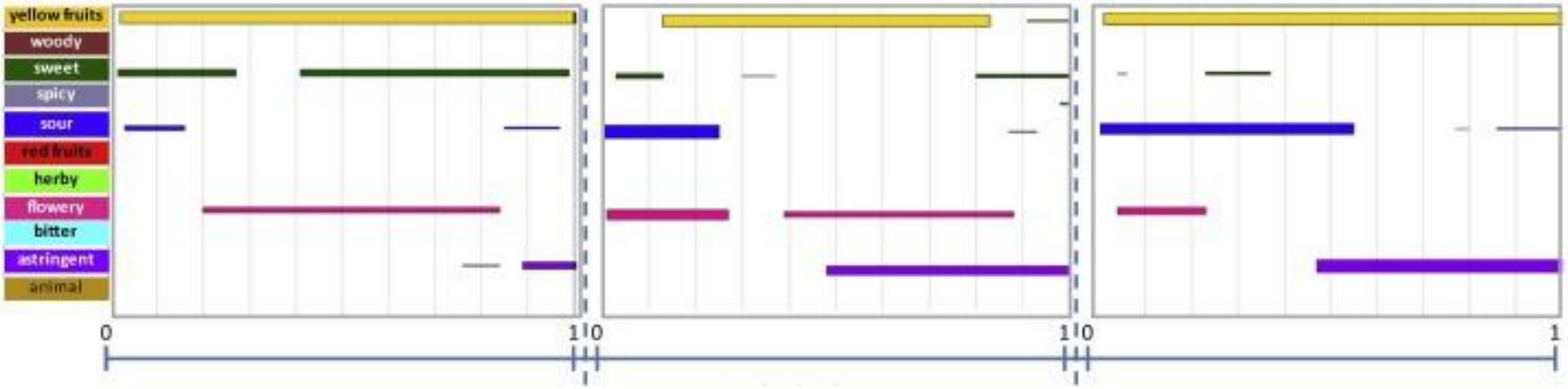

yellow fruits
woody
sweet
spicy
sour
red fruits
herby
flowery
bitter
astringent
animal
0
1
0
1
0
1

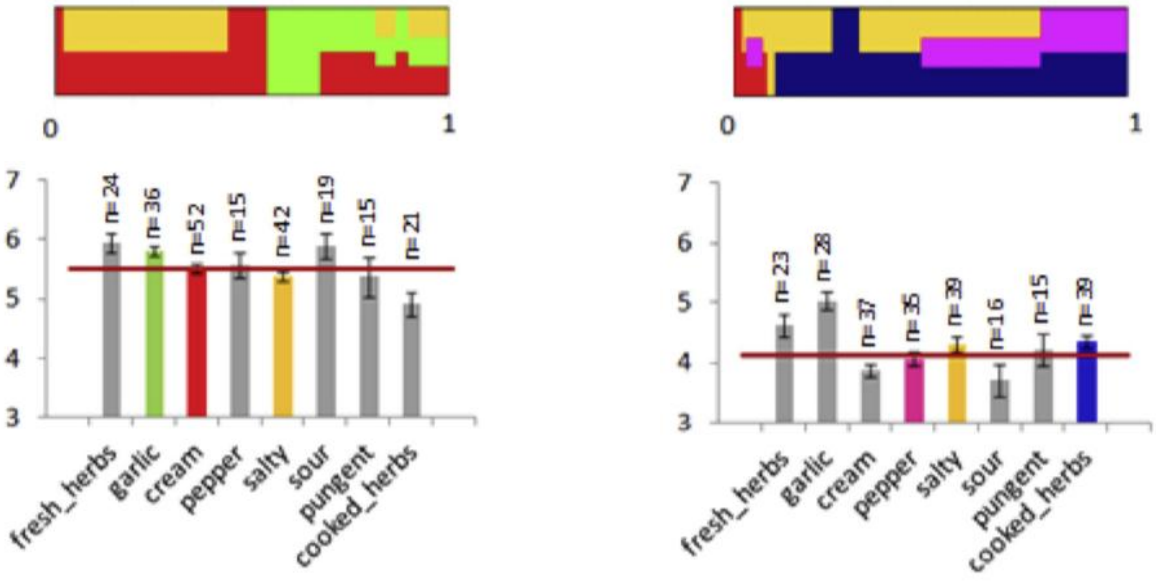
Table 4
ANOVA/MANOVA results for the duration of dominance of each attribute (in seconds) for the wine V2 over the different sips.

V2	F-Sip	Sip 1	Sip 2	Sip 3
Flowery	6.46**(−)	4.61 ± 0.56 (b)	2.45 ± 0.56 (a)	1.93 ± 0.56(a)
Astringent	4.26*(+)	4.05 ± 0.64 (a)	6.70 ± 0.64 (b)	5.21 ± 0.64 (ab)
Sweet	3.73*(−)	2.34 ± 0.35 (b)	1.06 ± 0.35 (a)	1.33 ± 0.35 (ab)
Sour	3.41*(−)	6.40 ± 0.60 (b)	4.18 ± 0.60 (a)	5.29 ± 0.60 (ab)
Animal	2.35	1.02 ± 0.39	1.1 ± 0.39	0.55 ± 0.39
Bitter	1.32	2.53 ± 0.58	3.19 ± 0.58	3.87 ± 0.58
Spicy	1.28	1.38 ± 0.34	2.09 ± 0.34	1.49 ± 0.34
Herby	0.77	0.9 ± 0.44	1.2 ± 0.44	0.62 ± 0.44
Yellow_fruits	0.71	1.52 ± 0.25	1.25 ± 0.25	1.10 ± 0.25
Woody	0.54	2.32 ± 0.40	1.75 ± 0.40	1.96 ± 0.40
Red_fruits	0.05	1.80 ± 0.27	1.68 ± 0.27	1.72 ± 0.27
Overall (MANOVA)	3.06***			

Significance levels: (.)10%, *5%, **1%, ***0.1%. Different letters identify product groups according to Tukey HSD. Symbols +/− indicate an increasing or decreasing linear trend.

Aceptabilidad temporal y TDS (Thomas et al., 2015)

Thomas et al. (2015) introdujo el concepto de aceptabilidad durante la dominancia (“liking while dominant”) para identificar atributos que contribuyen positiva o negativamente a la aceptabilidad.



Desventajas del TDS

- Una única característica puede ser dominante en cada momento de la evaluación
  - Percepción simultánea de varias características
  - Productos complejos
  - Evaluación de múltiples modalidades sensoriales
- Heterogeneidad en la conceptualización de dominancia
  - Dificultades para alcanzar el nivel de significación
  - ¿Qué pasa con las características no dominantes?

CATA TEMPORAL (TCATA)

69

TCATA

- Extensión de las preguntas CATA para considerar aspectos temporales.

- Se centra en la descripción de los productos.

- Los evaluadores deben seleccionar todos los términos que se aplican para describir las sensaciones que perciben en cada momento de la evaluación.

- Los evaluadores deben marcar los atributos cuando los perciben y desmarcarlos cuando dejan de percibirlos.

0:00

Firm	Sour/Acidic	Soft
Savoury	Sweet	Chewy
Moist	Smokey	Garlic

Número de atributos

- Usualmente se usan 6-10 términos, aunque el uso de hasta 15 términos no tiene efecto negativo.

Table 2
Summary of results pertaining to citation proportions and sample discrimination for the four studies evaluating the influence of list length ("short" vs. "long"; 9 vs. 15 terms) on results from Temporal check-all-that-apply (TCATA) (Studies 1 and 3) and TCATA Fading (Studies 2 and 4). Results given are for the 9 attributes that were found on both the "short" and "long" lists.

Results for	Parameter	List length*	Study 1 TCATA (canned pineapple)	Study 2 TCATA Fading (canned pineapple)	Study 3 TCATA (crackers)	Study 4 TCATA Fading (crackers)
Citation proportions	(i) Average term citation proportion across samples**	"Short"	0.24[a]	0.21[a]	0.35[a]	0.23[a]
		"Long"	0.21[b]	0.17[b]	0.27[b]	0.18[b]
	(ii) Maximum term citation proportion for individual samples	"Short"	0.63–0.68	0.53–0.74	0.82–0.98	0.75–0.88
		"Long"	0.55–0.59	0.41–0.63	0.67–0.92	0.58–0.81
Sample discrimination	(iii) Number of terms for which significant differences were found for at least one pair of samples at some point in time during the task	"Short"	9	9	9	9
		"Long"	9	9	9	9
	(iv) Average number of pairwise comparisons for which significant differences among samples were found for individual terms	"Short"	4.8	4.1	2.6	2.6
		"Long"	4.8	5.6	2.4	2.6
	(v) Average number of terms with significant differences for individual pairwise comparisons between samples	"Short"	7.2	6.2	7.7	7.7
		"Long"	7.2	8.3	7.4	7.7
	(vi) Percentage of all possible comparisons between pairs of samples that were significant at some point in time during the task	"Short"	37%	29%	29%	37%
		"Long"	36%	20%	37%	31%

* Data for the "long" list were analyzed considering only the terms included in the "short" list.

** Different superscripts within a column indicate that the citation proportions for the "short" and "long" list can be regarded as significantly different according to Cochran–Mantel–Haenszel test ($p < 0.05$).

Table 3

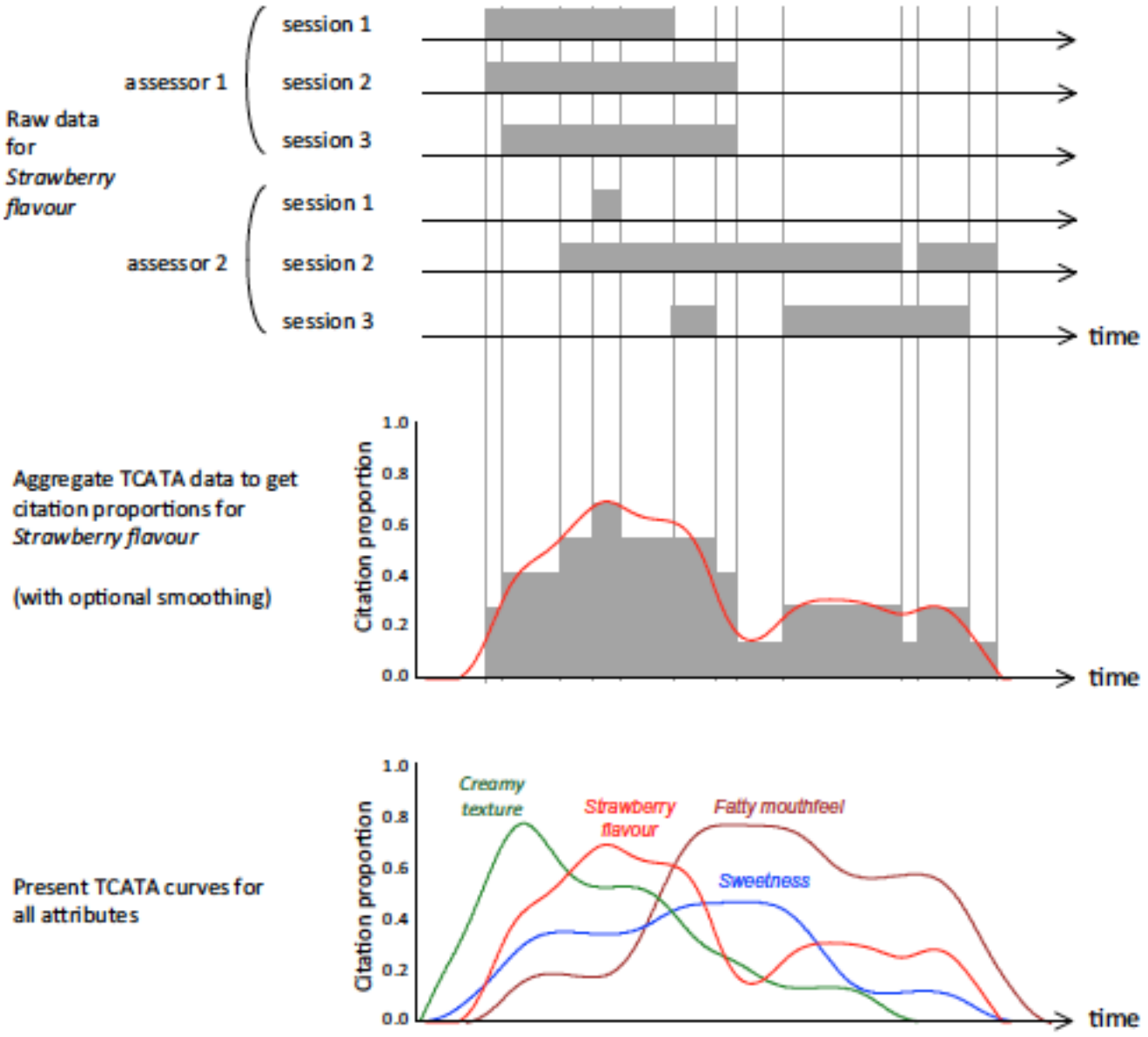
Average task perception ratings (and standard deviations) for Temporal check-all-that-apply (TCATA) tasks involving "short" and "long" lists of CATA terms (9 and 15 terms, respectively (1 = "disagree extremely", 7 = "agree extremely").

Statement about task perception	List length	Study 1 TCATA (canned pineapple)	Study 2 TCATA Fading (canned pineapple)	Study 3 TCATA (crackers)	Study 4 TCATA Fading (crackers)
It was easy to answer the questions	"Short"	5.7 (1.1)	5.7 (0.9)	6.0 (0.9)	5.9 (0.9)
	"Long"	5.3 (0.9)	5.6 (1.1)	5.8 (0.9)	5.9 (1.1)
	p-value	0.70	0.57	0.28	0.74
It was tedious to answer the questions	"Short"	2.6 (1.2)	2.6 (1.1)	2.2 (0.9)	2.4 (1.1)
	"Long"	2.8 (1.1)	2.6 (1.2)	2.2 (0.9)	2.4 (1.2)
	p-value	0.27	0.94	0.92	0.82

Análisis de datos

- El análisis de datos se realiza de forma similar al TDS.

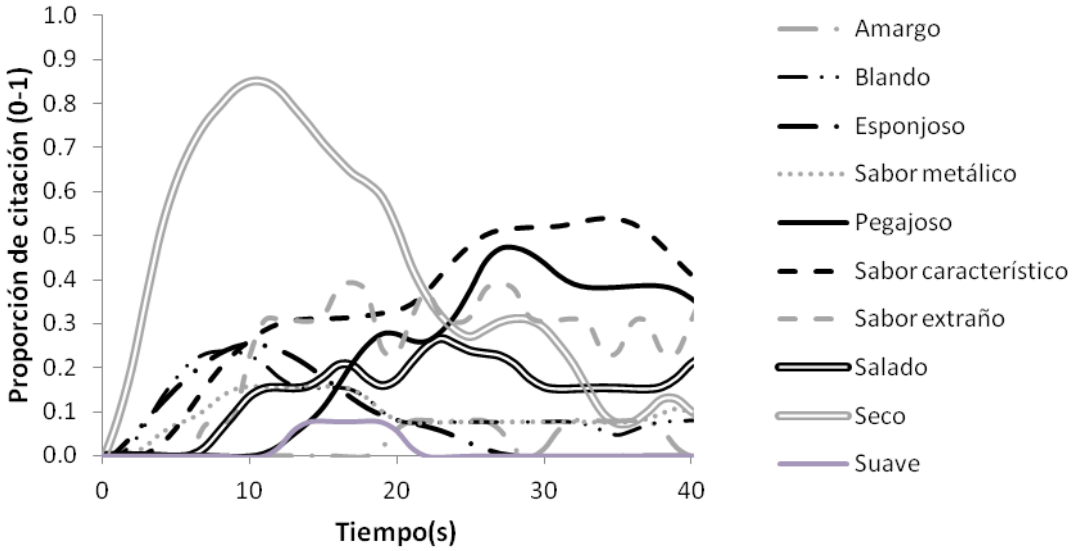
Evaluador	Muestra	Atributo	0 s	1 s	2 s	3 s
1	452	Sabor a naranja	0	0	1	1
1	452	Ácido	0	0	0	1
1	452	Dulce	0	0	0	0
1	452	Sabor extraño	0	0	0	0
1	452	Astringente	0	0	0	0
1	452	Amargo	0	0	0	0
1	238	Sabor a naranja	0	0	1	1
1	238	Ácido	0	0	0	0
1	238	Dulce	0	0	1	1
1	238	Sabor extraño	0	0	0	0
1	238	Astringente	0	0	0	0
1	238	Amargo	0	0	0	0
1	726	Sabor a naranja	0	0	0	0
1	726	Ácido	0	0	0	1

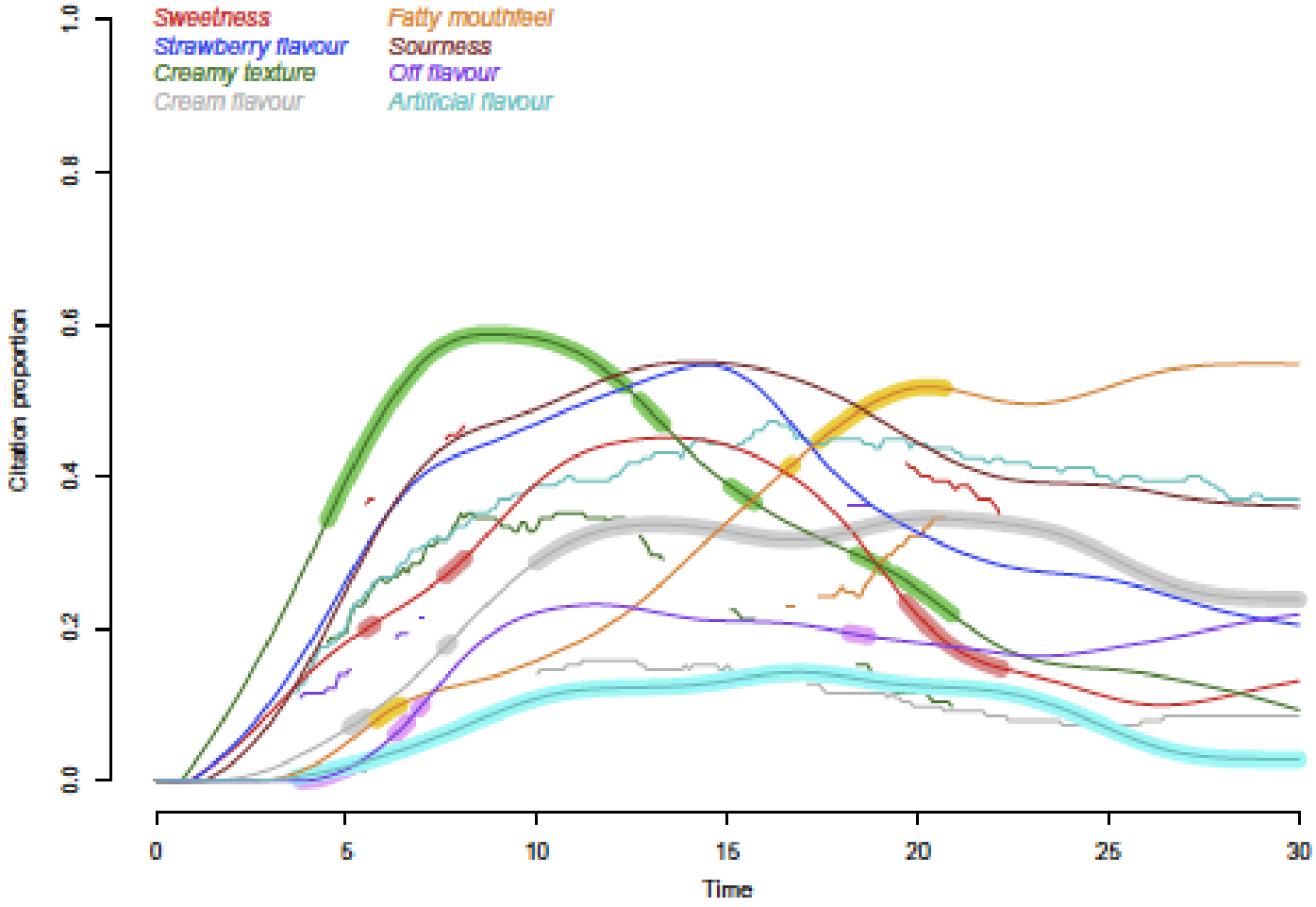

Raw data for *Strawberry flavour*
assessor 1
session 1
session 2
session 3
assessor 2
session 1
session 2
session 3
time
Aggregate TCATA data to get citation proportions for *Strawberry flavour*
(with optional smoothing)
Citation proportion
1.0
0.8
0.6
0.4
0.2
0.0
time
Present TCATA curves for all attributes
Creamy texture
Strawberry flavour
Fatty mouthfeel
Sweetness
Citation proportion
1.0
0.8
0.6
0.4
0.2
0.0
time

- Se obtienen curvas que muestran la frecuencia de mención de cada característica a cada momento de la evaluación.

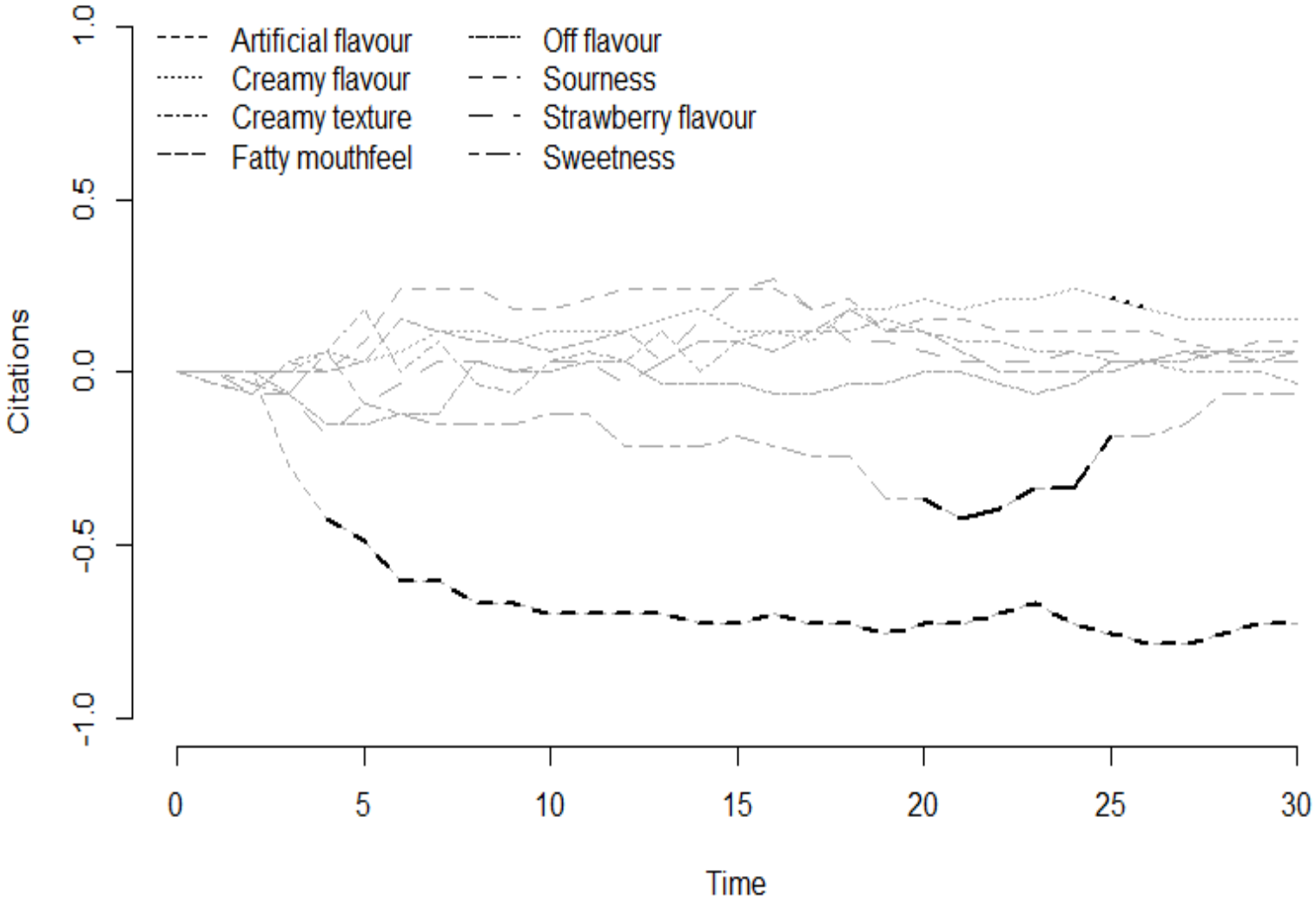
- Se construyen curvas de diferencia entre muestras.

- Pueden determinarse características que son percibidas simultáneamente durante la evaluación.

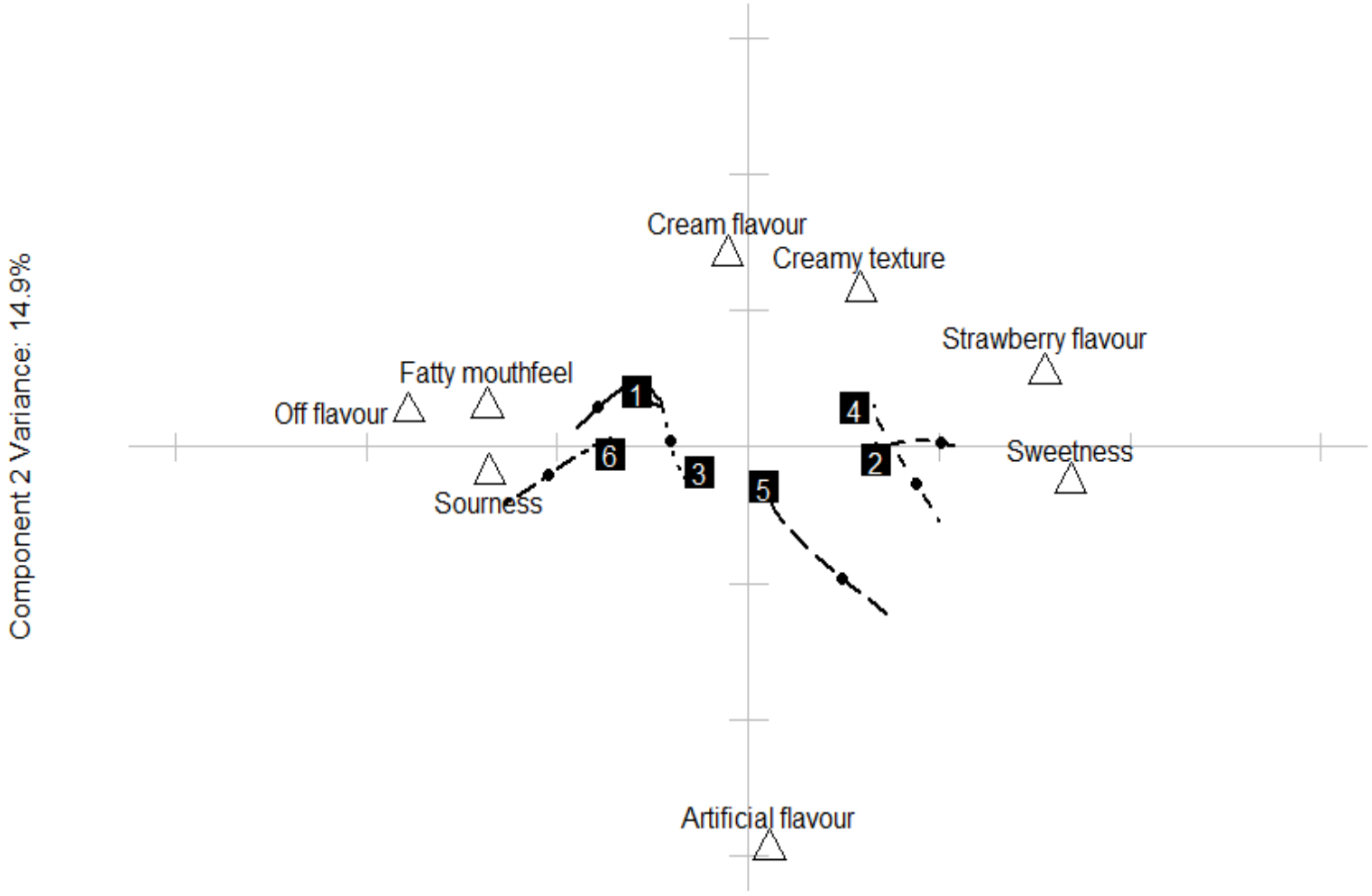



Sweetness
Strawberry flavour
Creamy texture
Cream flavour
Fatty mouthfeel
Sourness
Off flavour
Artificial flavour
Citation proportion
0.0
0.2
0.4
0.6
0.8
1.0
0
5
10
15
20
25
30
Time

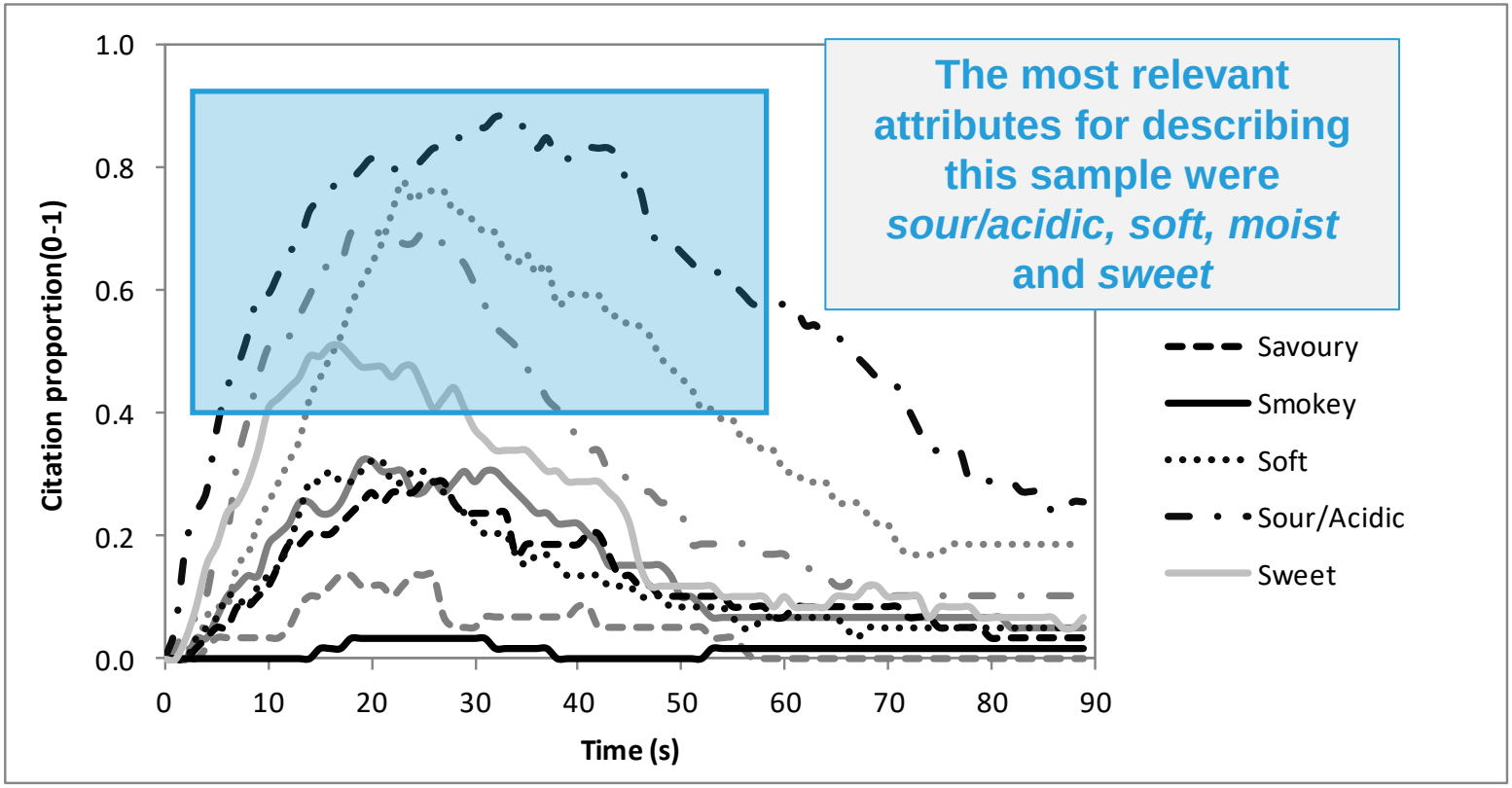
Curvas de diferencia de TCATA



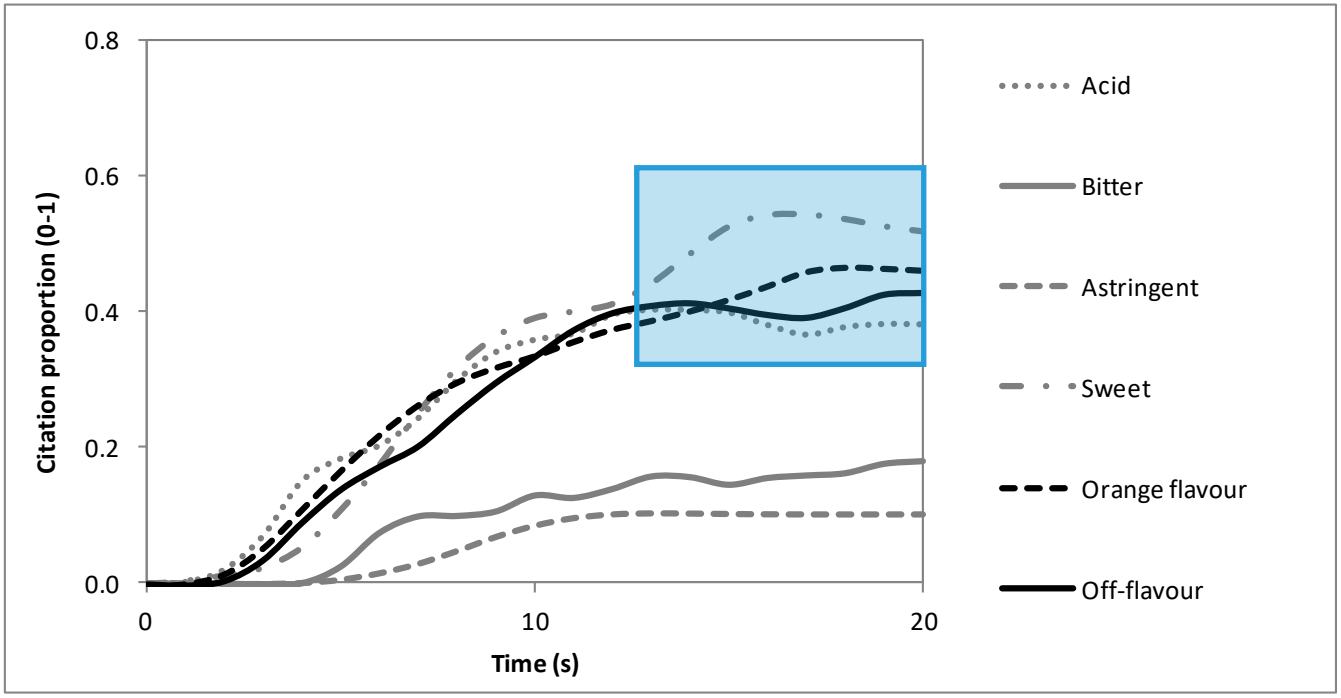
Análisis de correspondencia



Ejemplo – Caracterización sensorial dinámica de calamares



Evaluación de jugo de naranja con estevia



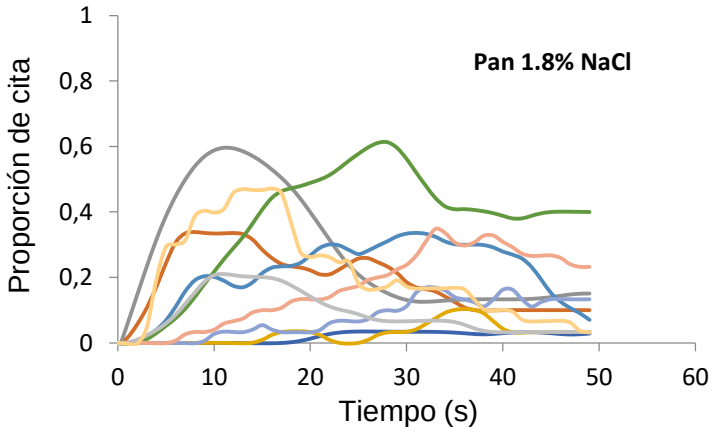
Evaluación de sustitución parcial de NaCl por KCl en pan

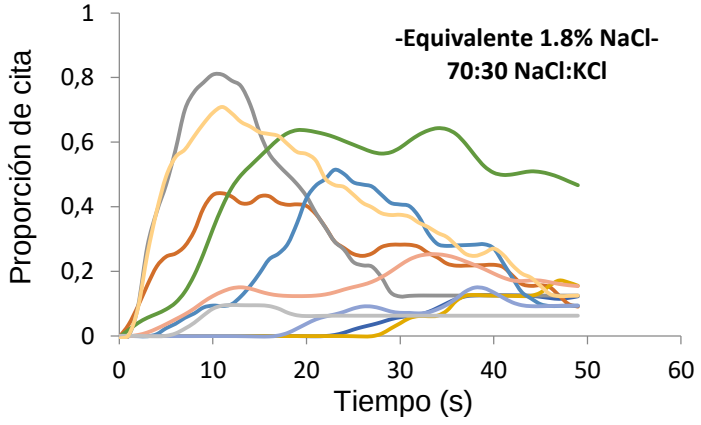
- Se consideraron tres mezclas de NaCl y KCl:
  - 30:70 KCl:NaCl
  - 40:60 KCl:NaCl
  - 50:50 KCl:NaCl

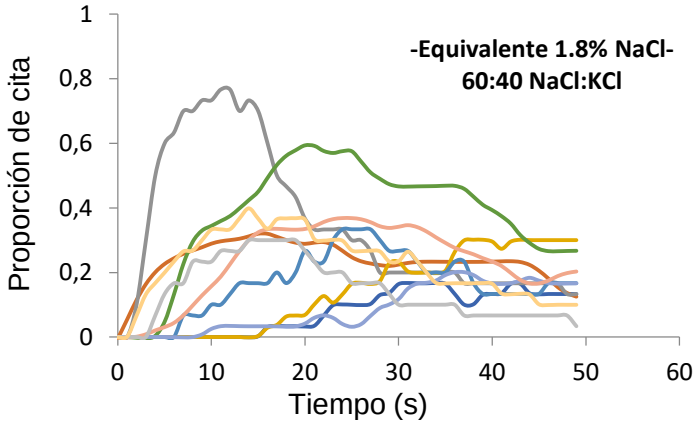
- Para cada mezcla se determinó la concentración equivalente en su sabor salado a un pan elaborado con 1.8% de NaCl.

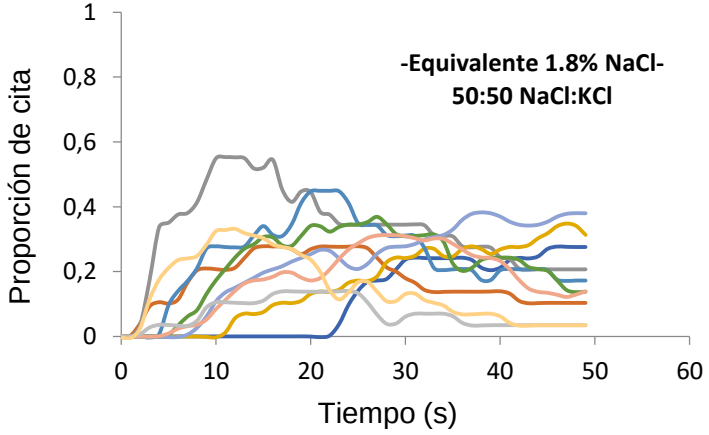
- Se comparó el perfil sensorial dinámico de panes elaborados con NaCl y mezclas de KCl:NaCl.

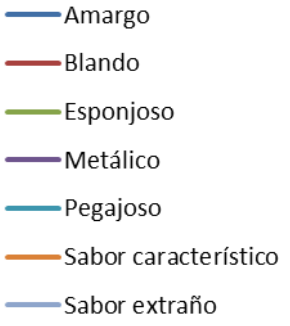
Perfil sensorial dinámico de los panes



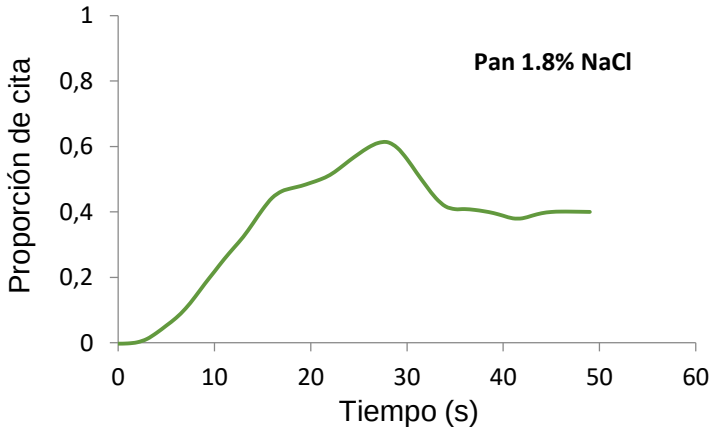


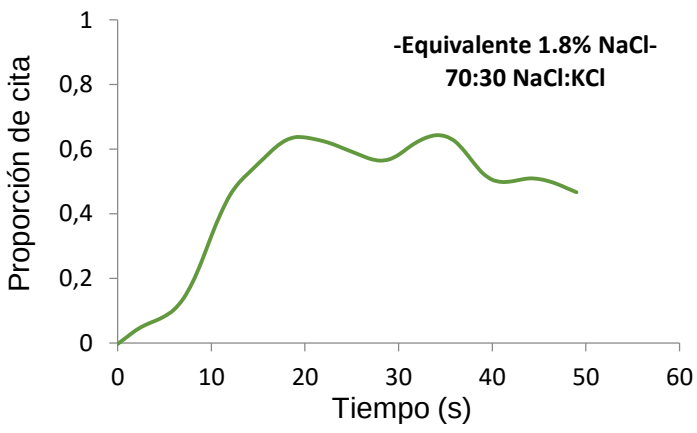


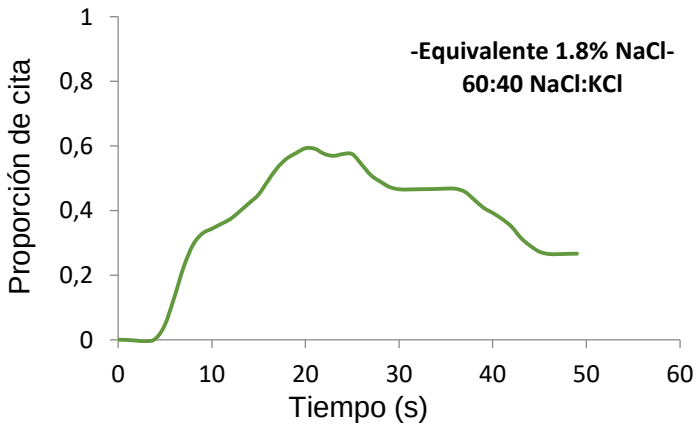


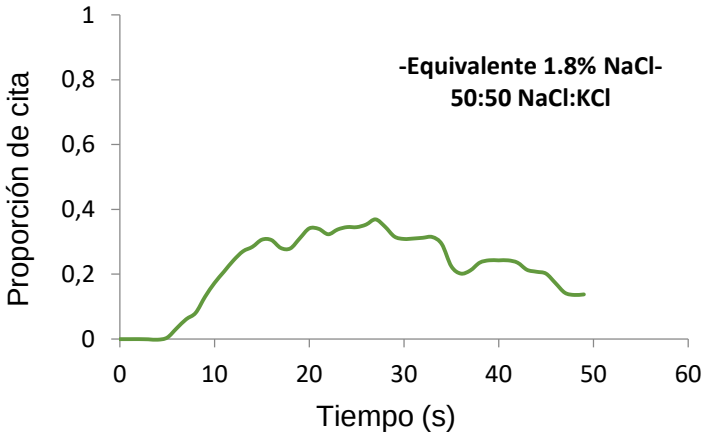


Evolución del sabor característico

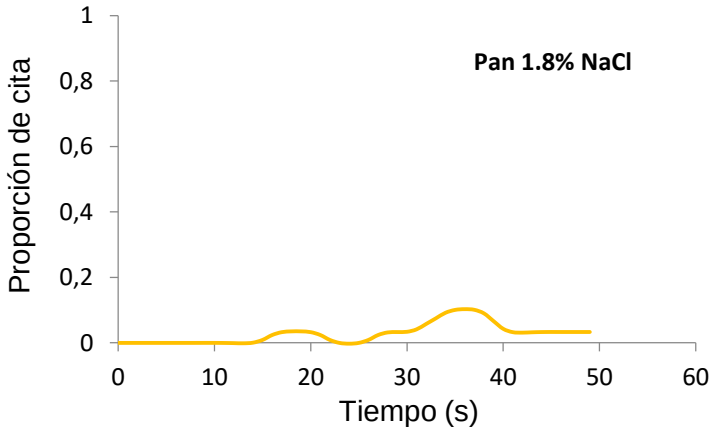


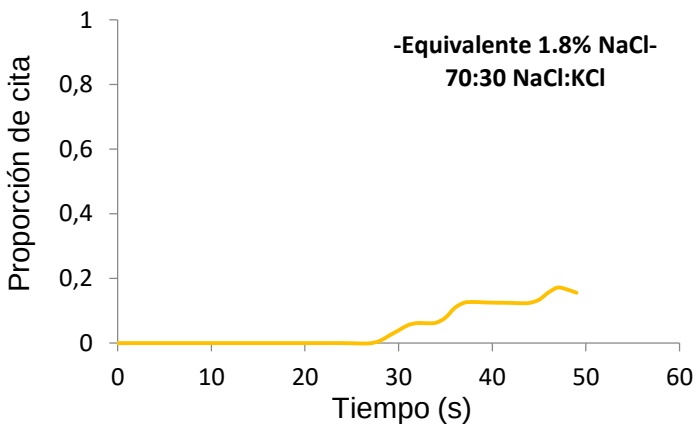


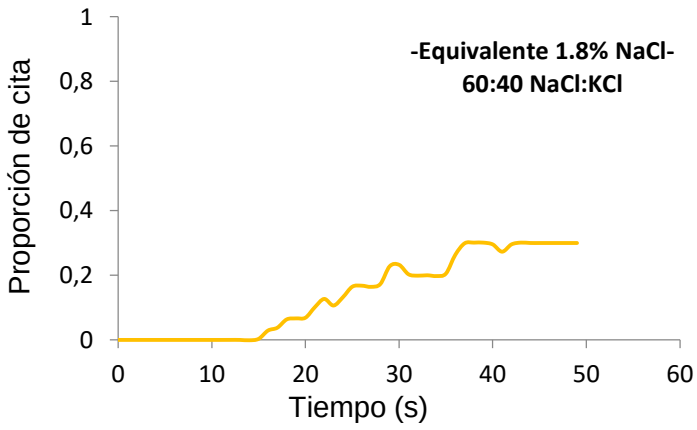


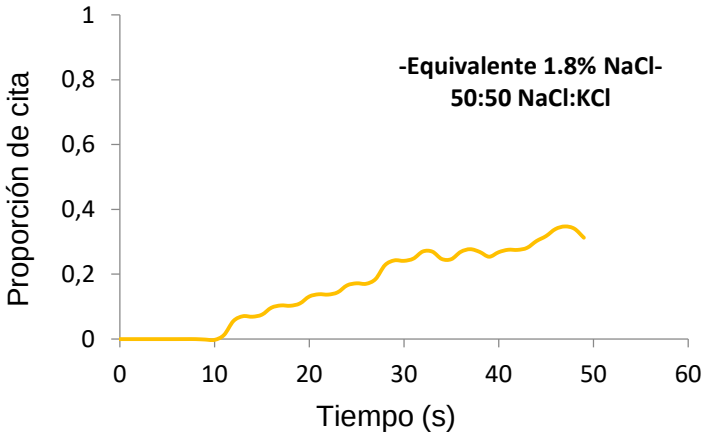


Evolución del sabor extraño

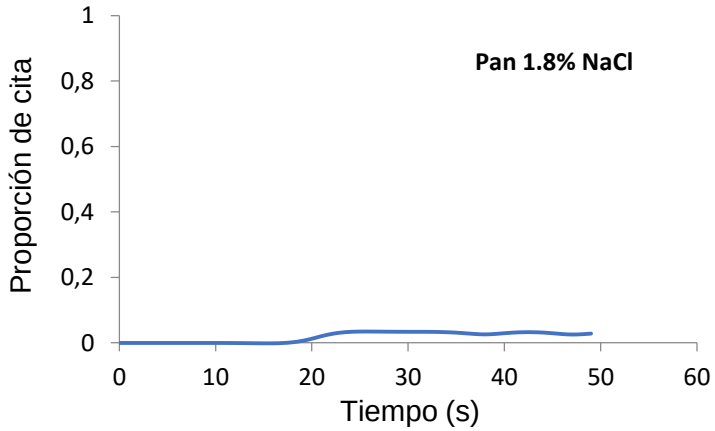


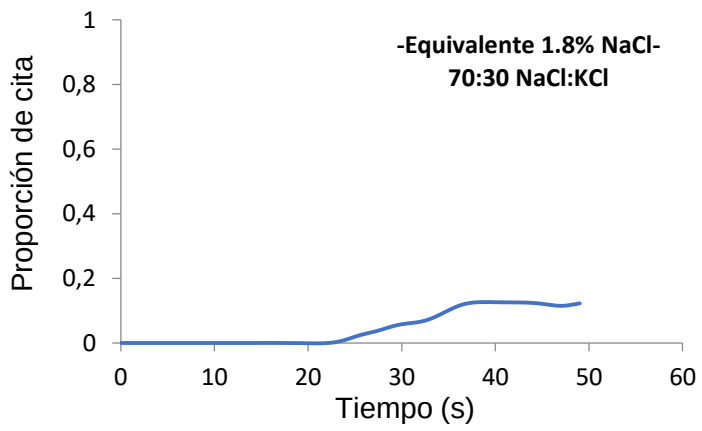


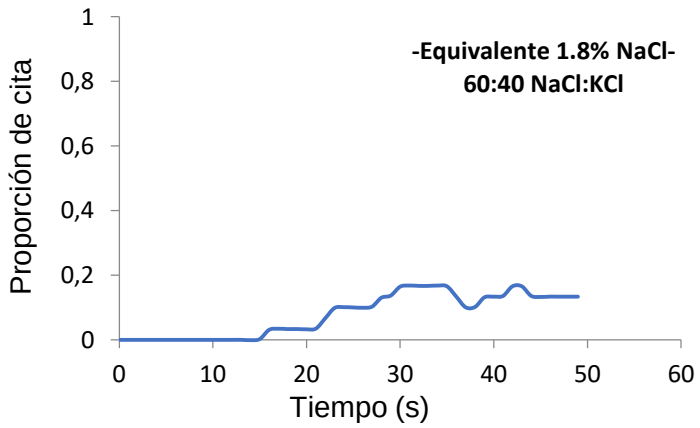


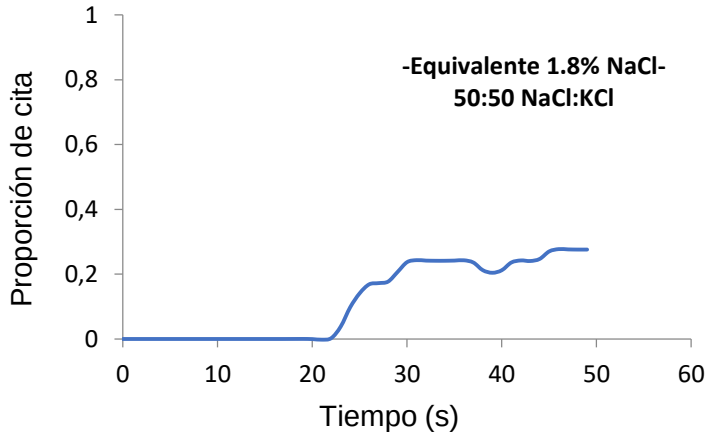


Evolución del sabor metálico



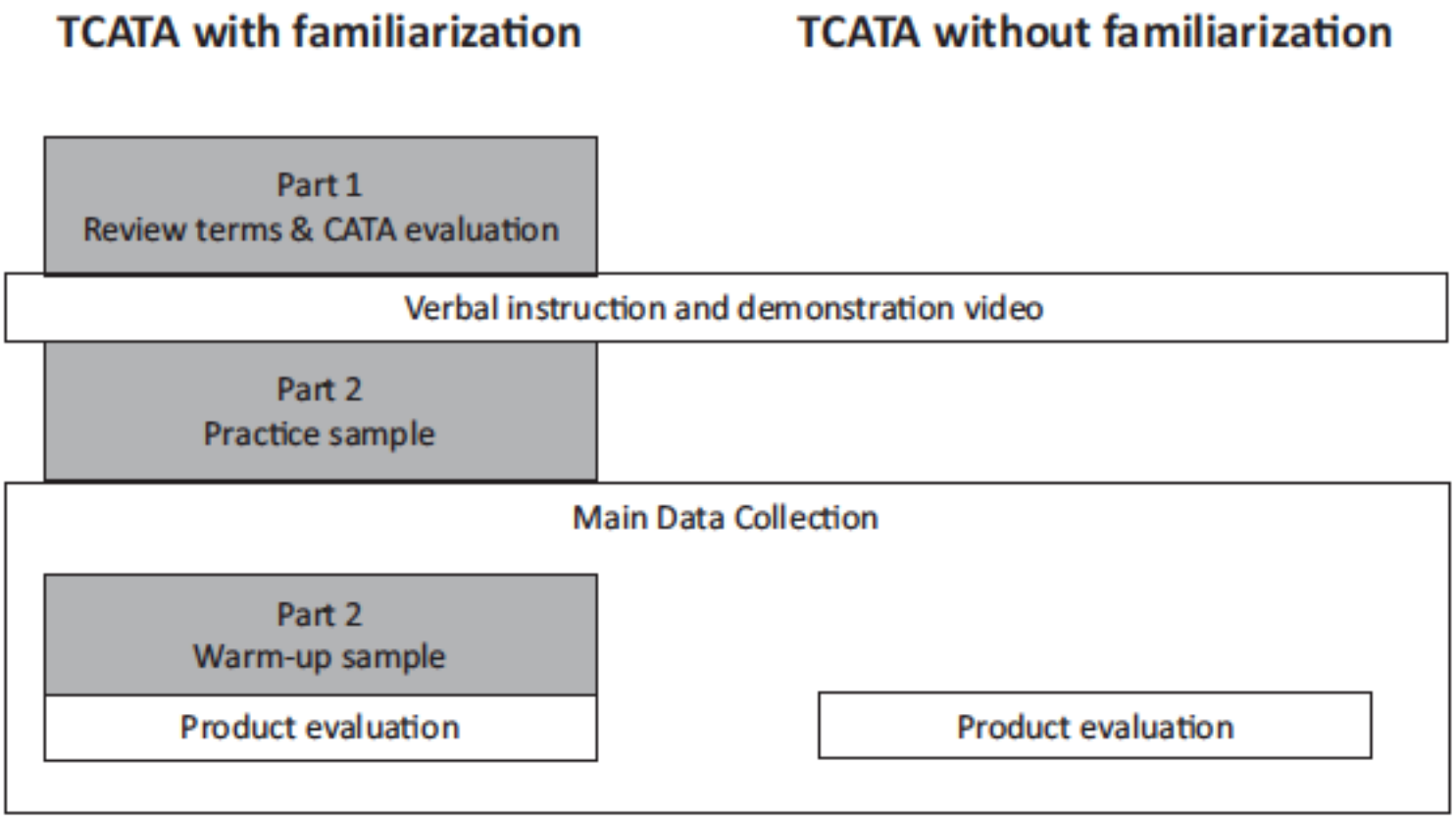






Aparición de sabores no característicos, especialmente para mezclas 60:40 y 50:50

Efecto de la familarización



Jaeger et al. (2017) *Food Quality and Preference*, 55, 91-97

Table 2
Summary of results pertaining to citation proportions and sample discrimination for the three studies evaluating the influence of a familiarization step on results from TCATA.

Results pertaining to	Parameter	Experimental condition	Study 1 (dried apricots)	Study 2 (peanuts)	Study 3 (chocolate)
Citation proportions	(i) Average term citation proportion across samples*	Without familiarization	0.31[a]	0.18[a]	0.34[a]
		With familiarization	0.32[a]	0.23[b]	0.34[a]
	(ii) Maximum term citation proportion for individual samples	Without familiarization	0.70–0.96	0.83–0.86	0.66–0.94
		With familiarization	0.74–0.98	0.80–0.92	0.70–0.88
	(iii) Average term citation proportion across samples at the last evaluation time*	Without familiarization	0.23[a]	0.17[a]	0.24[a]
		With familiarization	0.24[a]	0.17[a]	0.25[a]
	(iv) Maximum term citation proportion across samples at the last evaluation time for individual samples	Without familiarization	0.30–0.54	0.44–0.46	0.44–0.54
		With familiarization	0.48–0.66	0.28–0.50	0.34–0.42
Sample discrimination	(v) Percentage of all possible comparisons between pairs of samples that were significant at some point during the task	Without familiarization	48%	38%	49%
		With familiarization	61%	59%	48%
	(vi) Number of terms with significant differences for pairwise comparisons between samples	Without familiarization	6–9	4–8	0–9
		With familiarization	5–9	9–10	4–9

* Citation proportions within a column with different superscripts are significantly different according to Fisher's exact test ($p < 0.05$).

Jaeger et al. (2017) *Food Quality and Preference*, 55, 91-97

TCATA Fading

- Es una alternativa de TCATA.

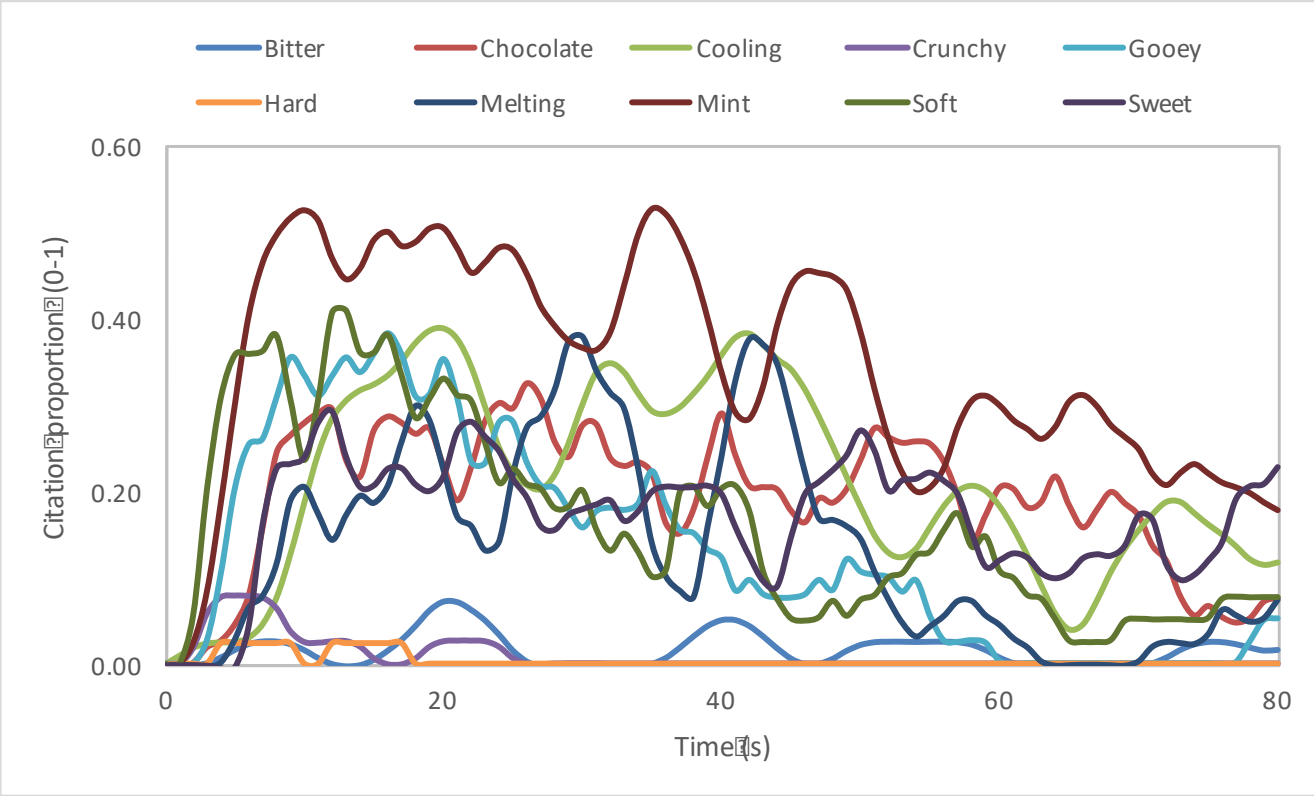
- Los términos seleccionados por los evaluadores se des-seleccionan automáticamente después de unos segundos.

- Los evaluadores deben volver a seleccionar los términos si es que todavía los perciben.

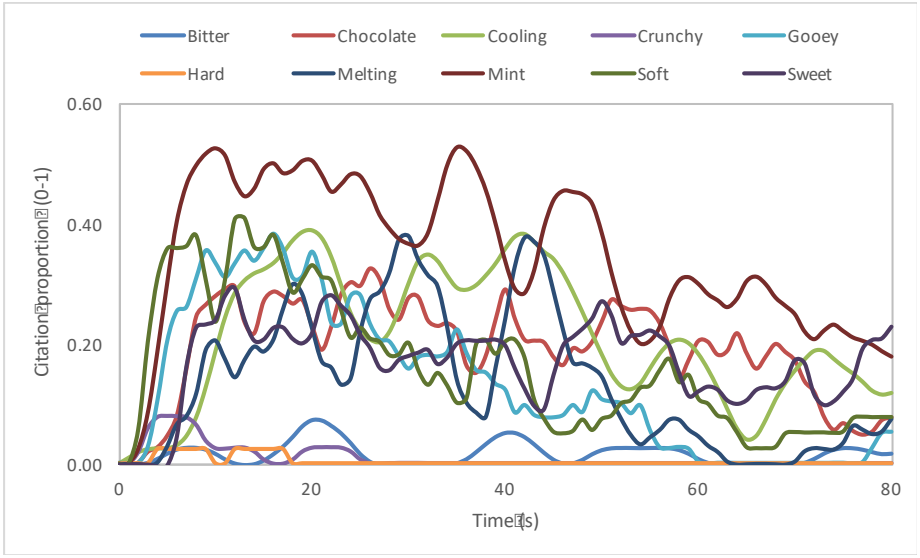
Sample: 266

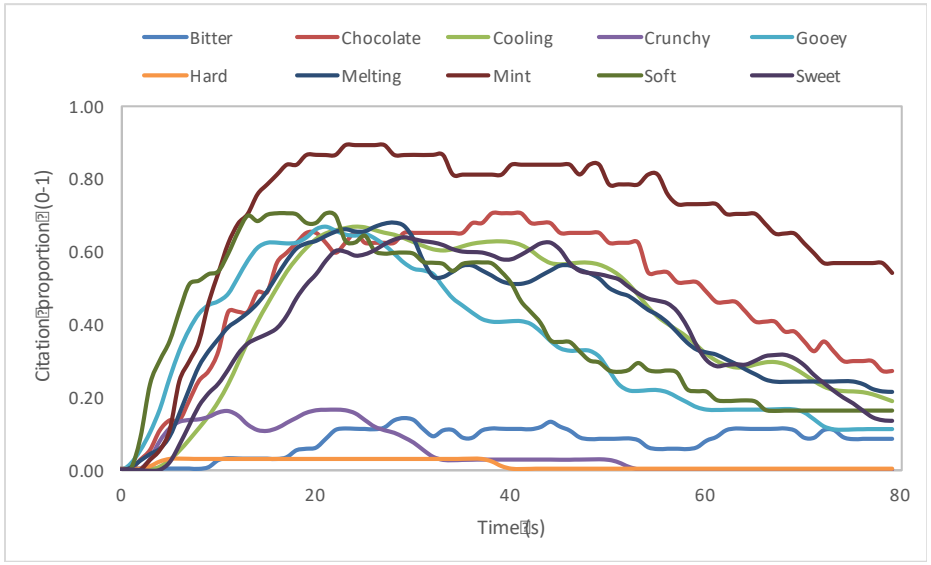
Cooling	Chocolate	Crunchy
Bitter	Gooey	Sweet
Hard	Soft	Melting
Mint		

Caracterización dinámica de chocolate usando TCATA fading



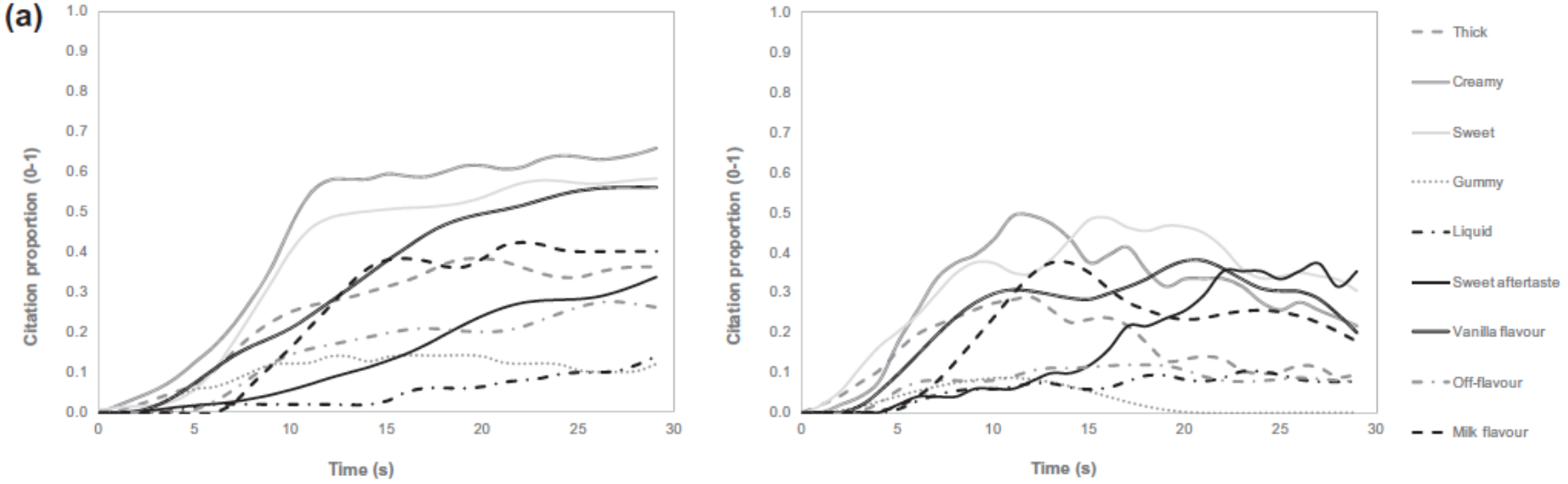
Comparación de TCATA y TCATA fading





Las proporciones de uso son más bajas en TCATA fading pero las características sensoriales más relevantes son similares

(a)


Citation proportion (0-1)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
5
10
15
20
25
30
Time (s)
Thick
Creamy
Sweet
Gummy
Liquid
Sweet aftertaste
Vanilla flavour
Off-flavour
Milk flavour

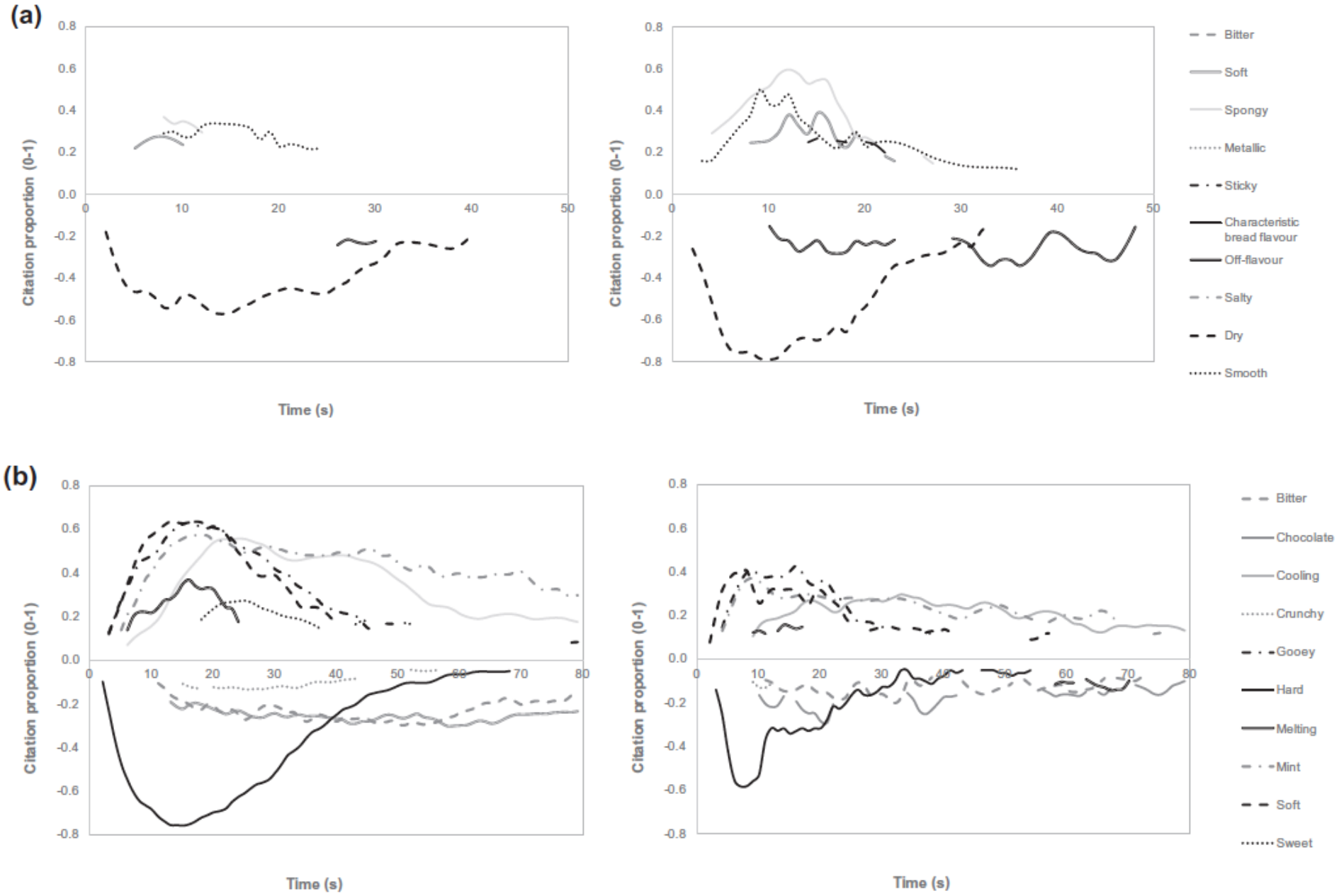

(a)
Citation proportion (0-1)
Time (s)
Bitter
Soft
Spongy
Metallic
Sticky
Characteristic bread flavour
Off-flavour
Salty
Dry
Smooth
(b)
Citation proportion (0-1)
Time (s)
Bitter
Chocolate
Cooling
Crunchy
Gooey
Hard
Melting
Mint
Soft
Sweet

Table 3
Summary of results pertaining to citation proportions and sample discrimination for the three studies comparing TCATA and TCATA Fading with trained panellists (Studies 1–3).

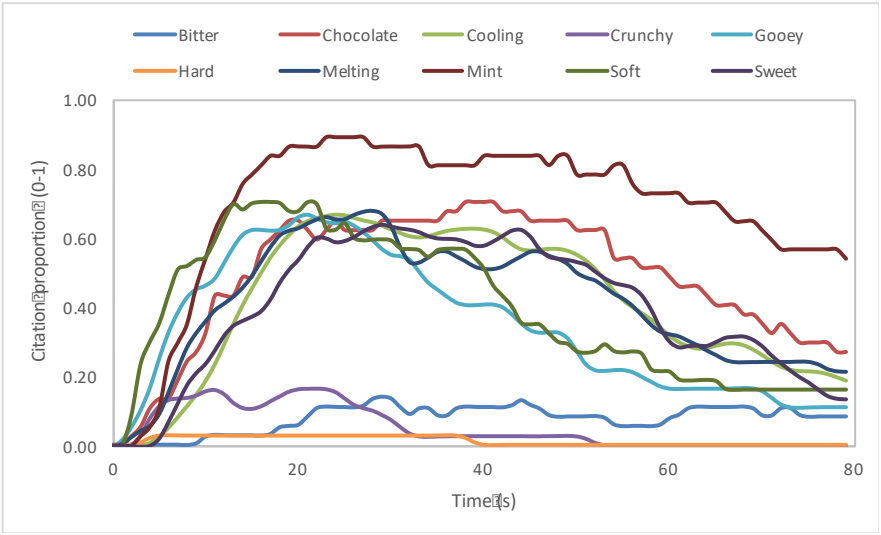
Results pertaining to	Parameter	Methodology	Study 1 (bread)	Study 2 (salami)	Study 3 (Pategrás cheese)
Citation proportions	(i) Average term citation proportion across samples (*)	TCATA	0.30 [a]	0.25 [a]	0.17 [a]
		TCATA Fading	0.26 [b]	0.16 [b]	0.15 [b]
	(ii) Maximum term citation proportion for individual samples	TCATA	0.70-0.88	0.66-0.78	0.53-0.77
		TCATA Fading	0.60-0.69	0.52-0.75	0.31-0.47
	(iii) Average term citation proportion across samples at the last evaluation time	TCATA	0.13	0.40	0.29
		TCATA Fading	0.08	0.26	0.15
	(iv) Maximum term citation proportion across samples at the last evaluation time for individual samples	TCATA	0.30-0.40	0.64-0.82	0.63-0.74
		TCATA Fading	0.20-0.42	0.49-0.57	0.31-0.47
Sample discrimination	(v) Percentage of all possible comparisons between pairs of samples that were significant throughout the task duration	TCATA	11%	16%	4%
		TCATA Fading	18%	6%	3%
	(vi) Number of terms with significant differences for pairwise comparisons between samples	TCATA	0–4	5–7	3–7
		TCATA Fading	1–8	3–6	3–7

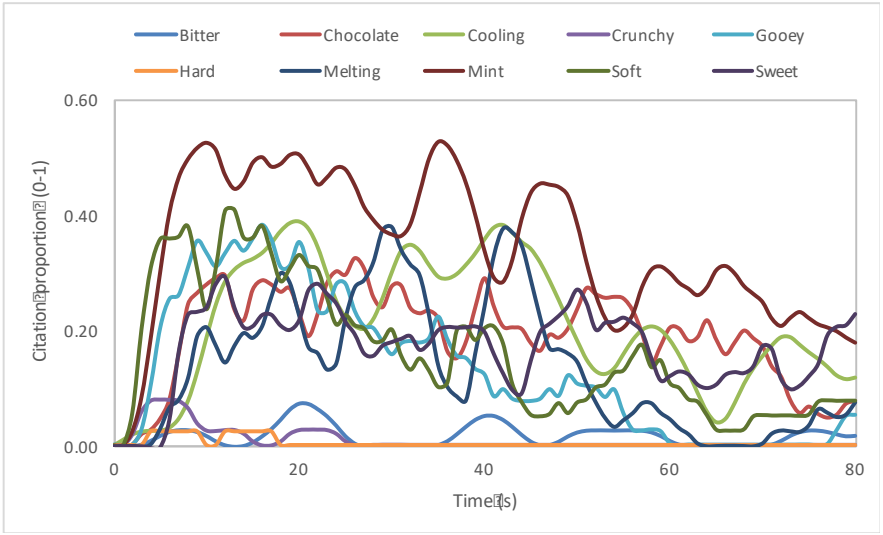
* Term citations with different superscripts are significantly different according to Fisher's exact test ($p < 0.05$).

Table 4
Summary of results pertaining to citation proportions and sample discrimination for the five studies comparing TCATA and TCATA Fading with consumers (Studies 4–8).

Results pertaining to	Parameter	Methodology	Study 4 (milk desserts)	Study 5 (chocolate)	Study 6 (mussels)	Study 7 (cheese)	Study 8 (cheese)
Citation proportions	(i) Average term citation proportion across samples (*)	TCATA	0.23[a]	0.31[a]	0.32[a]	0.22[a]	0.25[a]
		TCATA Fading	0.17[b]	0.15[b]	0.13[b]	0.10[b]	0.12[b]
	(ii) Maximum term citation proportion for individual samples	TCATA	0.56–0.70	0.81–0.92	0.74–0.89	0.74–0.90	0.75–0.90
		TCATA Fading	0.38–0.49	0.47–0.60	0.49–0.62	0.42–0.66	0.49–0.72
	(iii) Average term citation proportion across samples at the last evaluation time	TCATA	0.37	0.17	0.22	0.14	0.21
		TCATA Fading	0.18	0.06	0.04	0.03	0.06
	(iv) Maximum term citation proportion across samples at the last evaluation time for individual samples	TCATA	0.52–0.70	0.39–0.55	0.30–0.56	0.26–0.37	0.42–0.49
		TCATA Fading	0.30–0.42	0.15–0.19	0.08–0.14	0.08–0.13	0.13–0.25
Sample discrimination	(v) Percentage of all possible comparisons between pairs of samples that were significant throughout the task duration	TCATA	8%	48%	25%	51%	58%
		TCATA Fading	4%	33%	20%	39%	39%
	(vi) Number of terms with significant differences for pairwise comparisons between samples	TCATA	0–5	8–10	4–6	8–10	7–10
		TCATA Fading	2–7	9–10	7–8	10	9–10

* Term citations for a study with different superscripts are significantly different according to Fisher's exact test ($p < 0.05$).





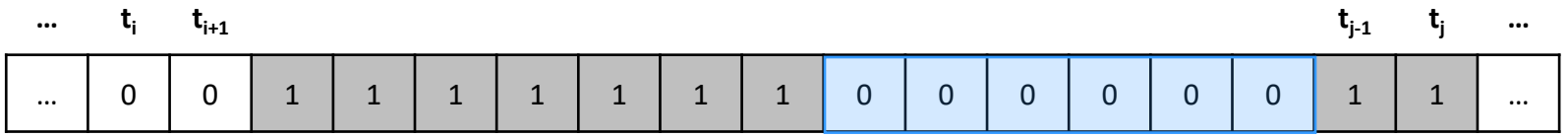
Aparecen “agujeros” en las curvas

Identificación de “agujeros” en los perfiles

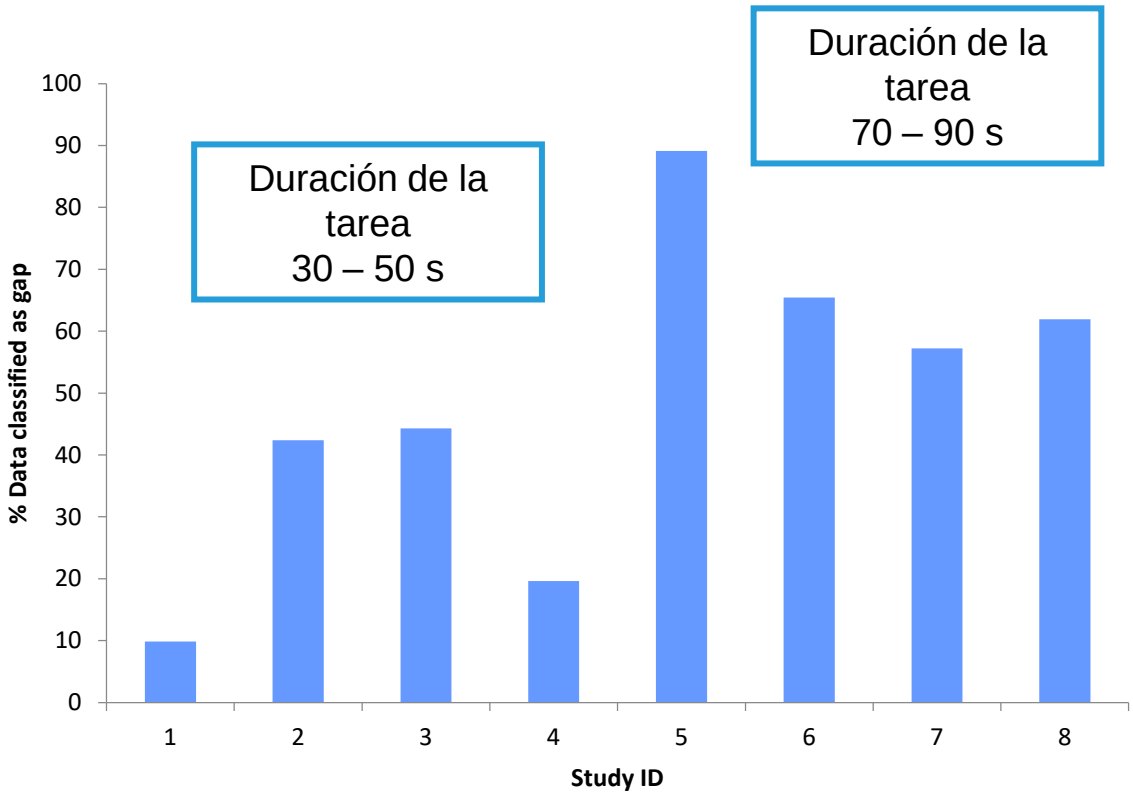
Assessor	Sample	Attribute	t 0 s	t 0.1 s	t 0.2 s	t 0.3 s	t 0.4 s	…	t 70 s
1	1	Dry	0	0	1	1	1	…	0
1	1	Firm	0	0	0	1	1	…	0
1	1	Mild flavour	0	1	1	1	1	…	1
1	1	Rubbery	0	0	0	0	0	…	1
1	1	Salty	0	0	0	1	1	…	0
1	1	Sharp	0	0	0	0	0	…	1
1	1	Soft	0	0	0	0	0	…	0
…	…	…	…	…	…	…	…	…	…

98

Identificación de “agujeros” en los perfiles



99


Duración de la tarea
30 – 50 s
Duración de la tarea
70 – 90 s
% Data classified as gap
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
Study ID

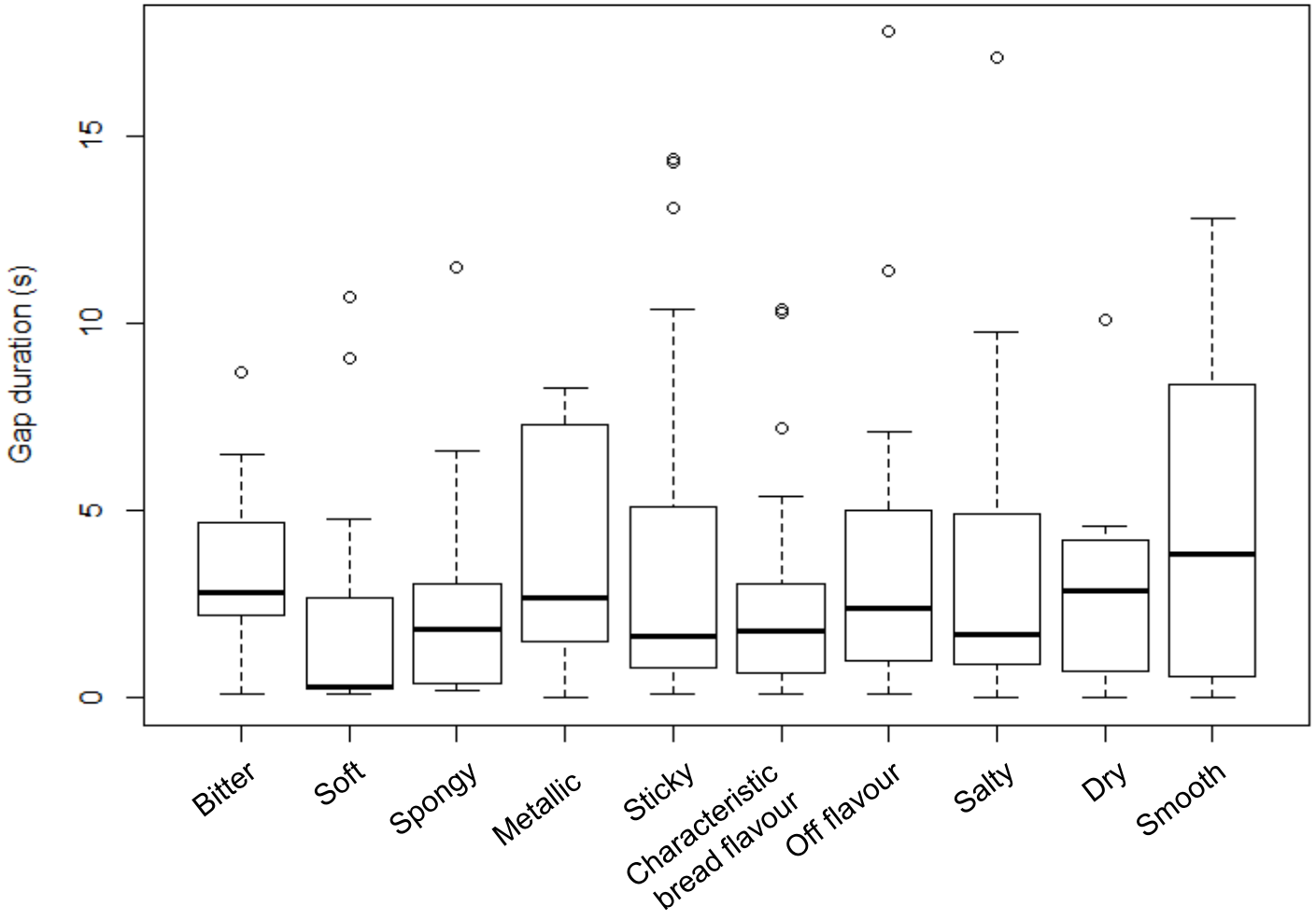
100

Duración de los “agujeros”

Study ID	Min	1rs. Q	Median	Mean	3rd.Q	Max
1	0.1	0.6	1.9	3.1	4.1	17.8
2	0.1	1.2	3.0	4.2	5.8	24.3
3	0.1	0.9	2.6	4.5	6.3	33.4
4	0.1	1.1	3.1	3.9	5.6	17.6
5	0.1	1.8	4.5	7.0	9.2	60.5
6	0.1	1.6	4.1	6.6	8.5	72.2
7	0.1	1.7	4.4	6.7	9.0	59.3
8	0.1	1.7	4.1	6.5	8.3	56.5

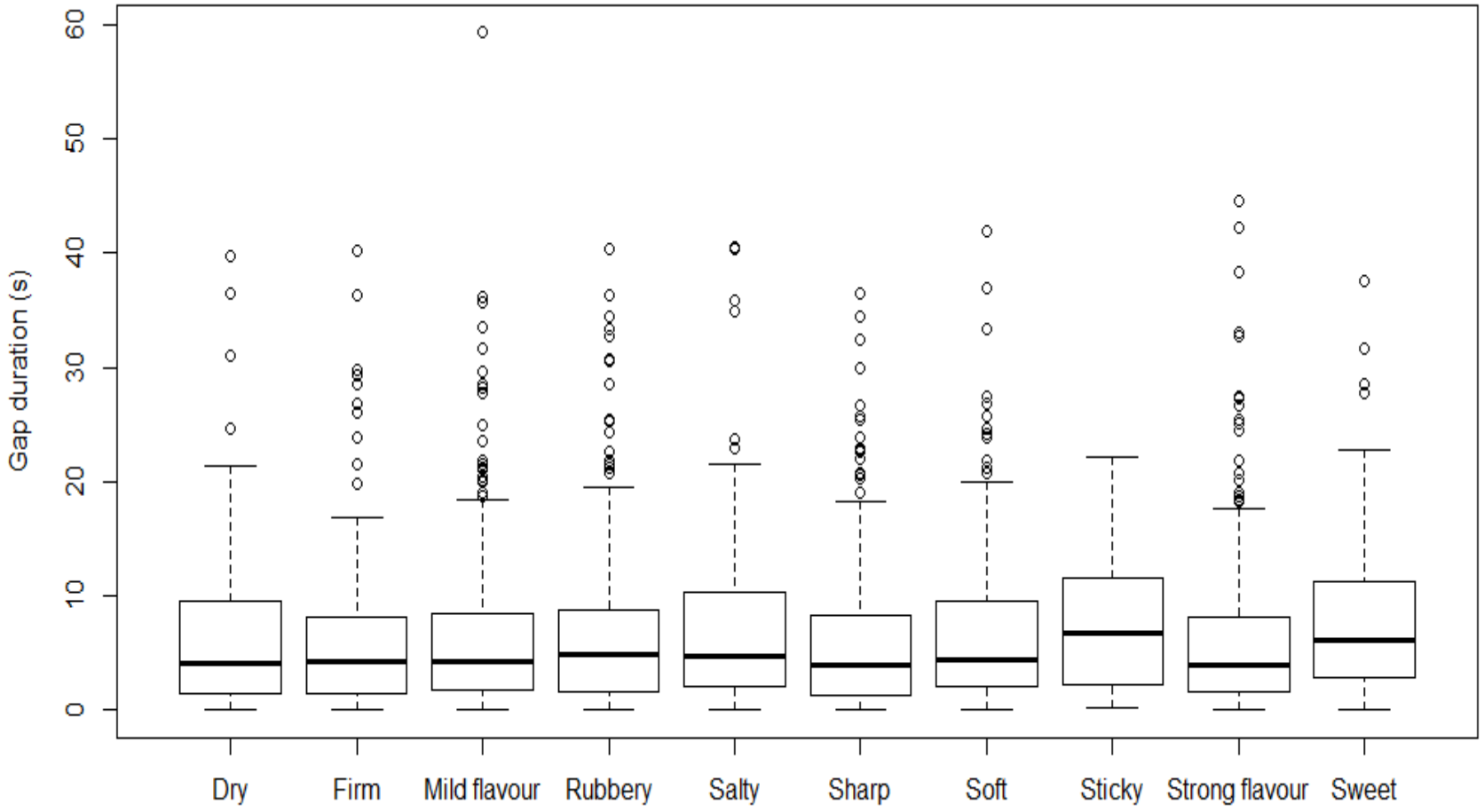
101

Pan (evaluadores entrenados)



102

Queso (consumidores)



103

Imputación de datos

Evaluación de dos duraciones

- 3er cuartil de la duración → 75% de los “agujeros” sustituídos por 1
- Máxima duración → 100% de los “agujeros” sustituídos por 1

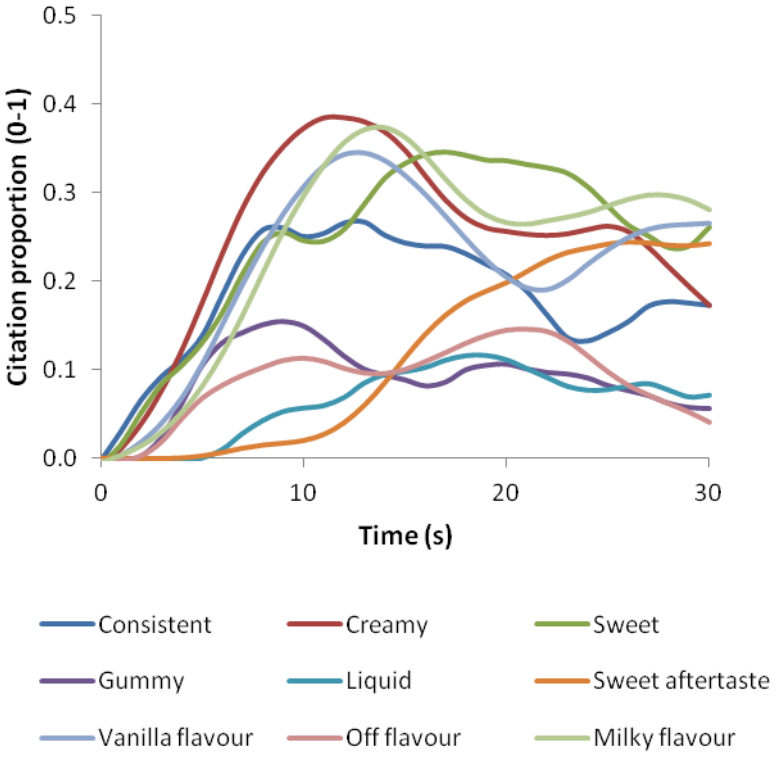
Comparado con el análisis sin “imputar”

- Mayor frecuencia de uso
- Curvas más “suaves”

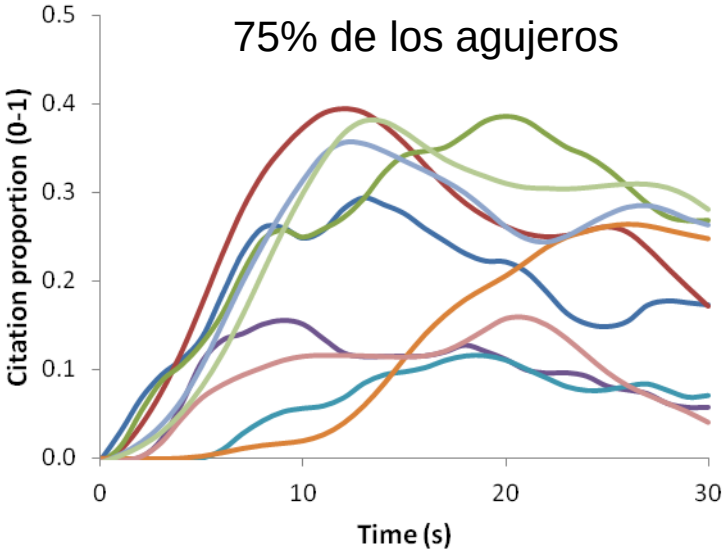
105

Postres lácteos (consumidores)

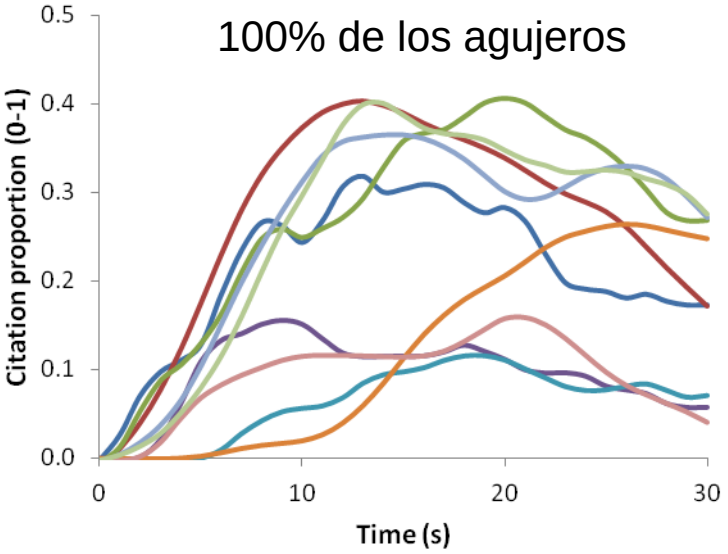
Datos crudos



75% de los agujeros



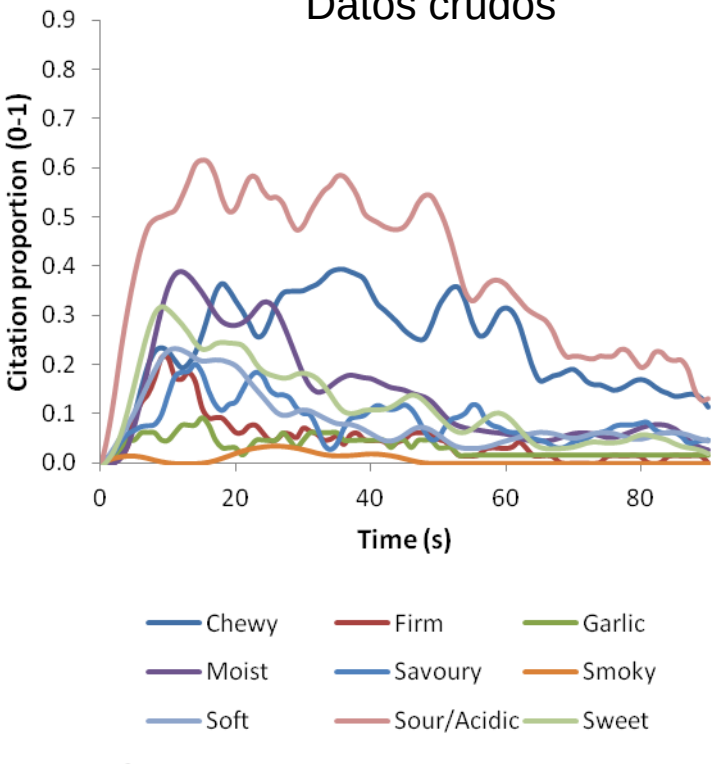
100% de los agujeros



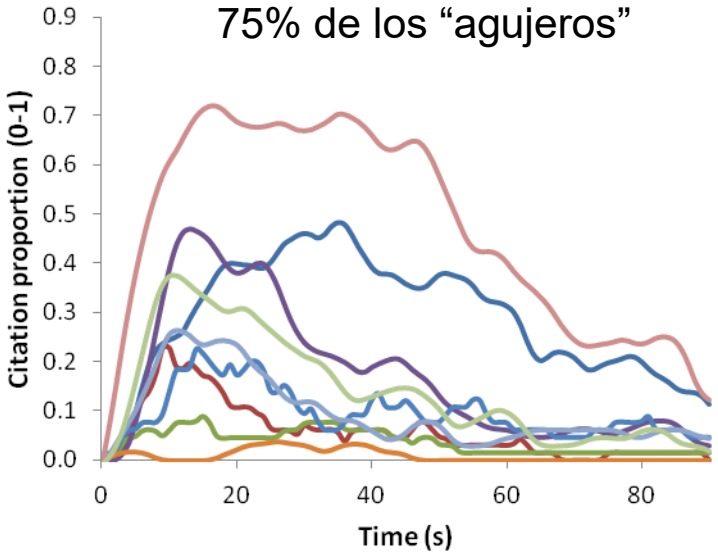
106

Calamares (consumidores)

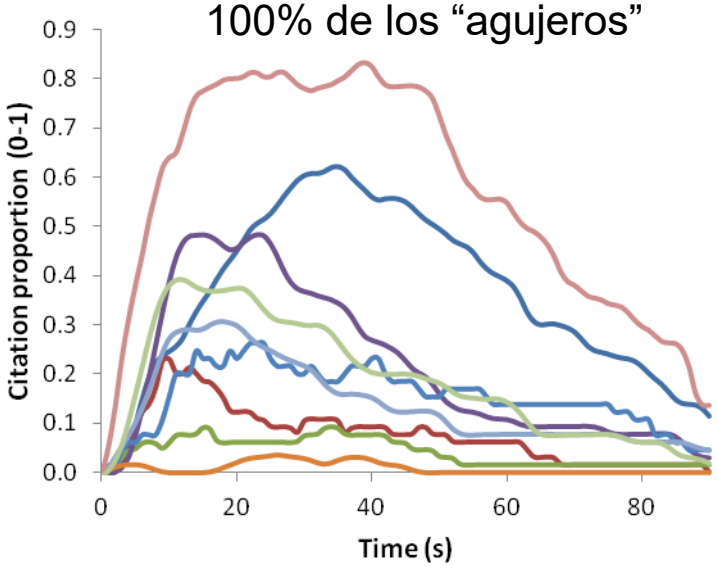
Datos crudos



75% de los “agujeros”



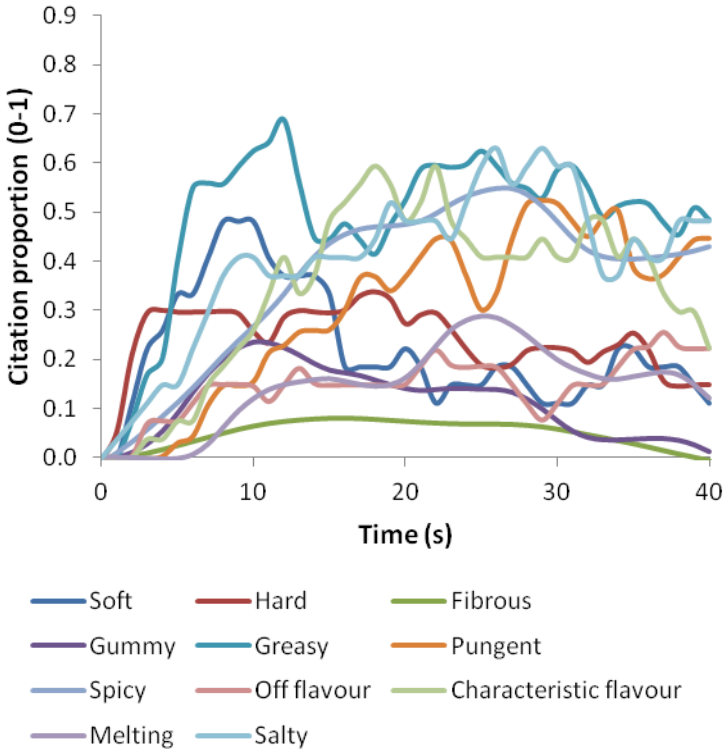
100% de los “agujeros”



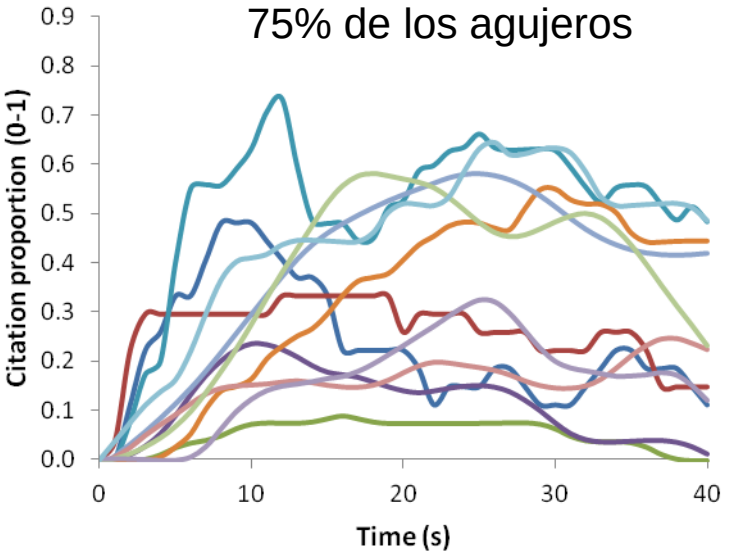
107

Salame (entrenados)

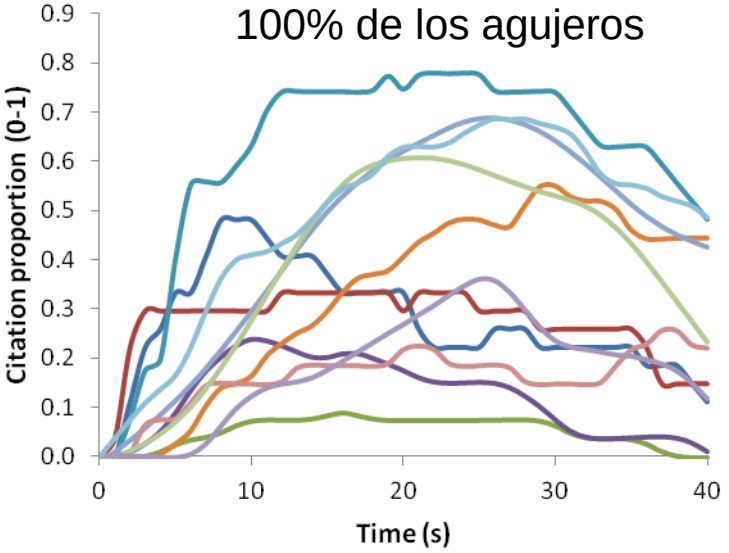
Datos crudos



75% de los agujeros



100% de los agujeros



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Comparado con el análisis sin “imputar”

- Mayor frecuencia de uso
- Curvas más “suaves”
- Resultados más “coherentes”

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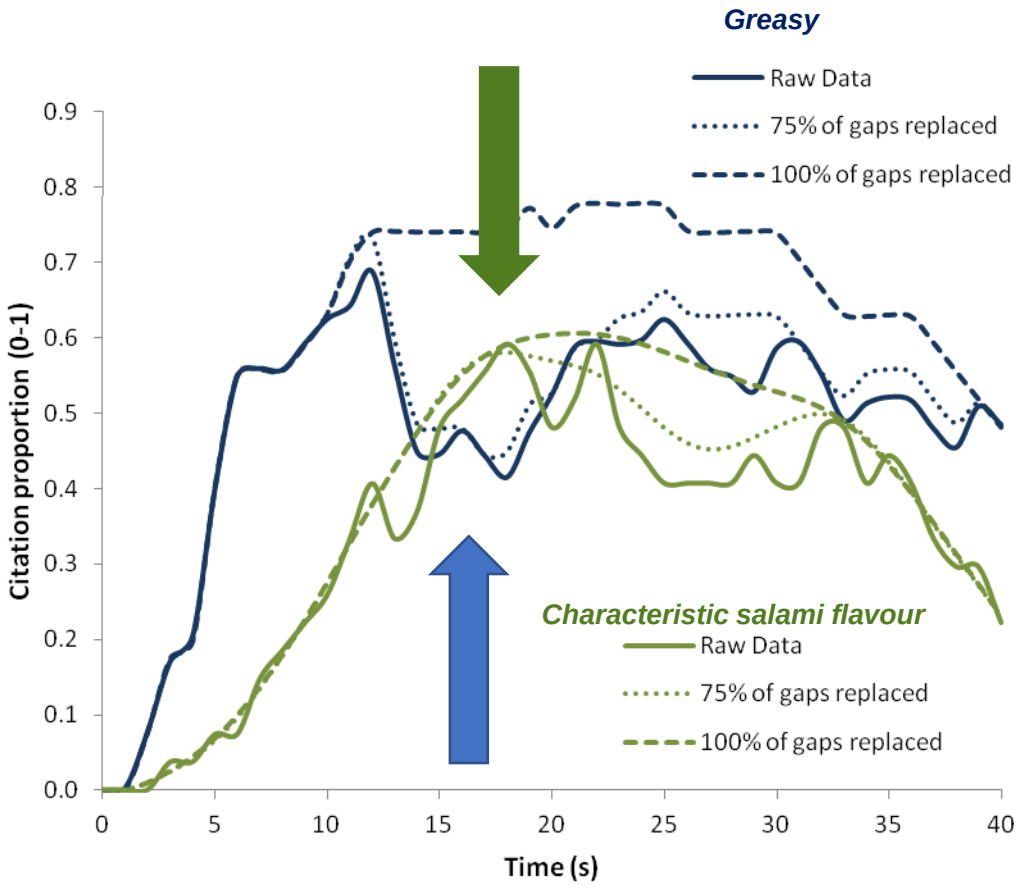
Salame (Evaluadores entrenados



110

Comparado con el análisis sin “imputar”

- Mayor frecuencia de uso
- Curvas más “suaves”
- Resultados más “coherentes”
- Ligero aumento de la discriminación

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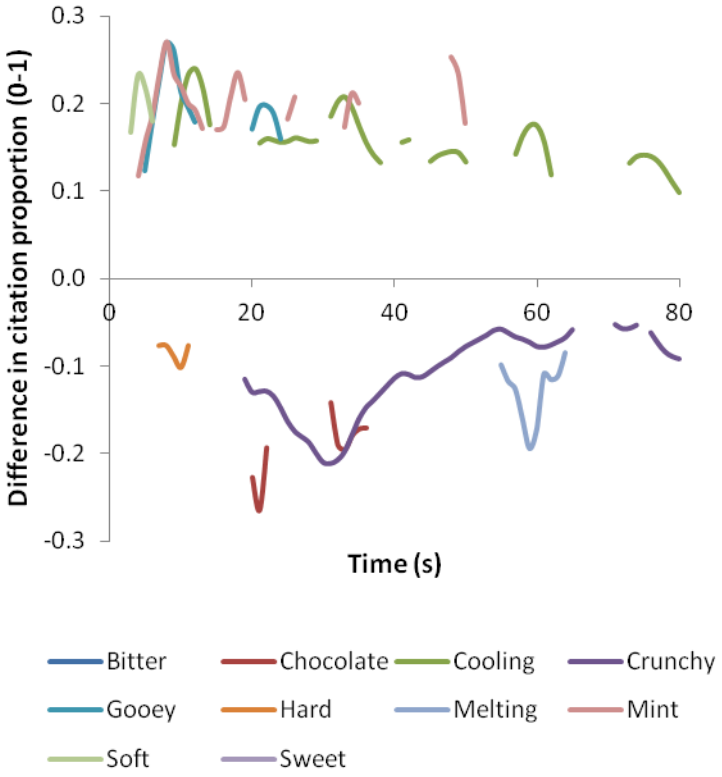
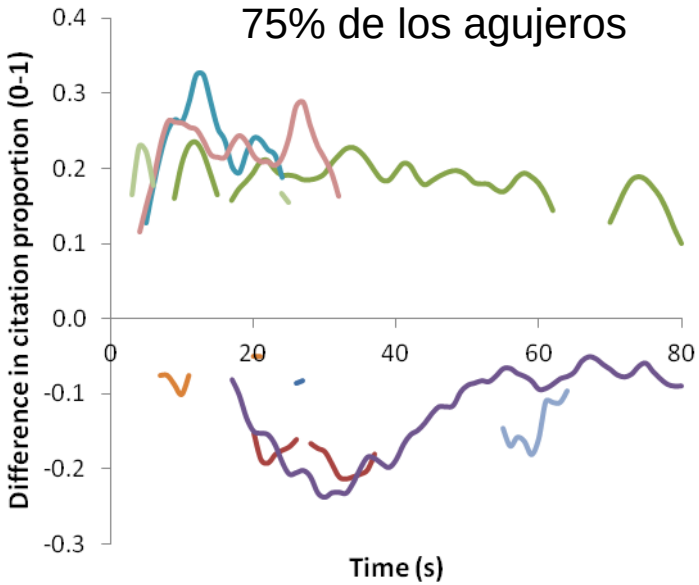
Chocolate con menta (consumidores)

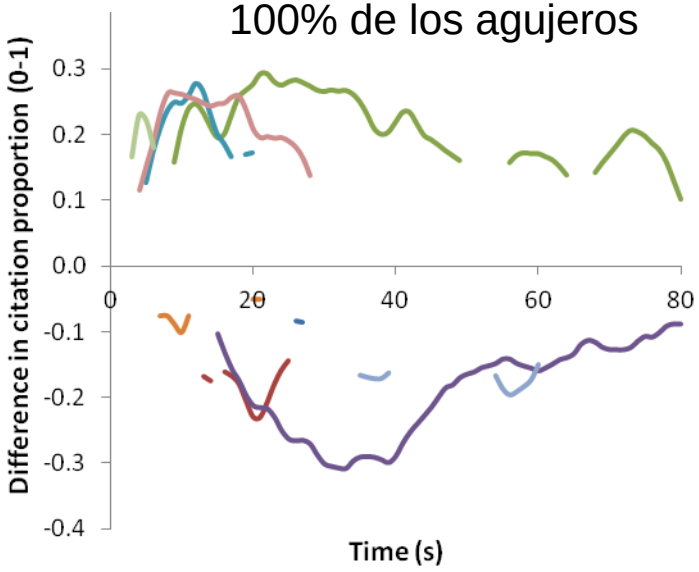
Datos crudos



75% de los agujeros



100% de los agujeros



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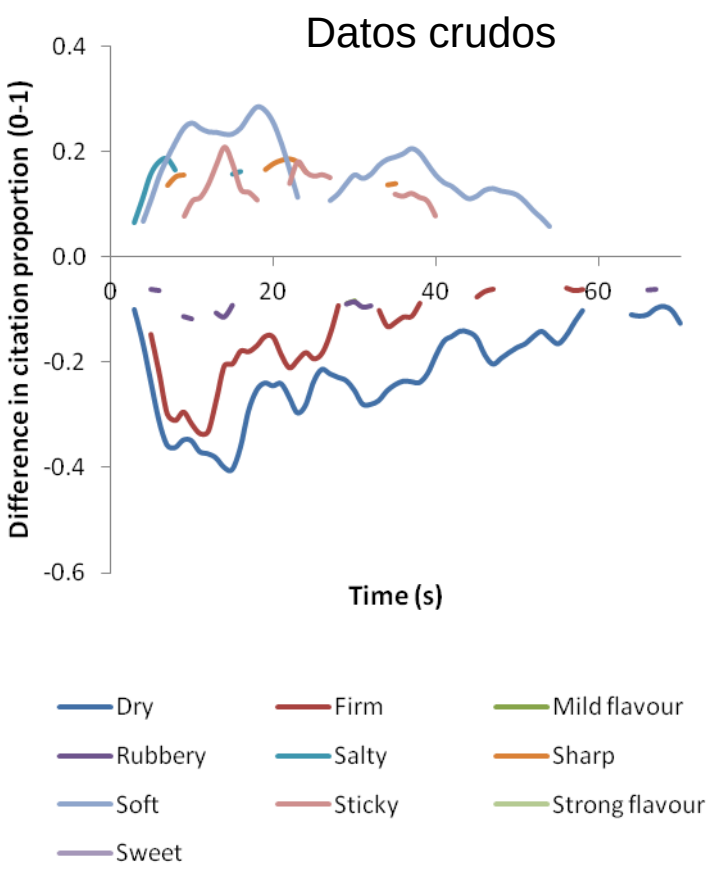
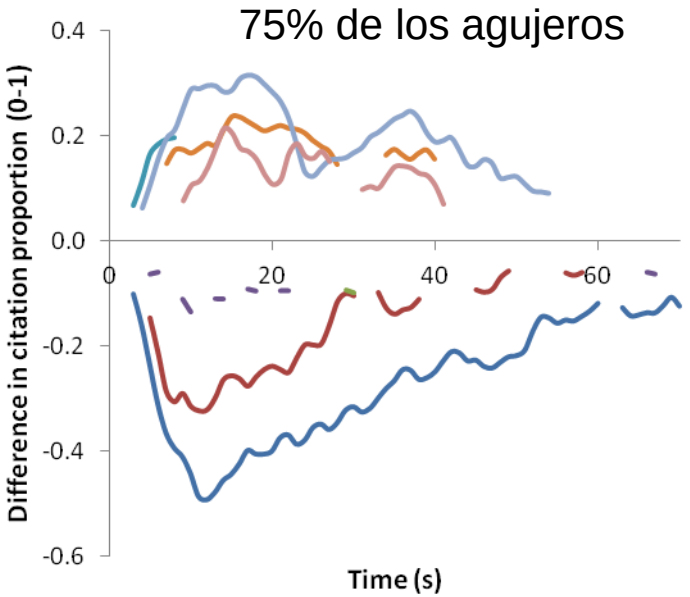
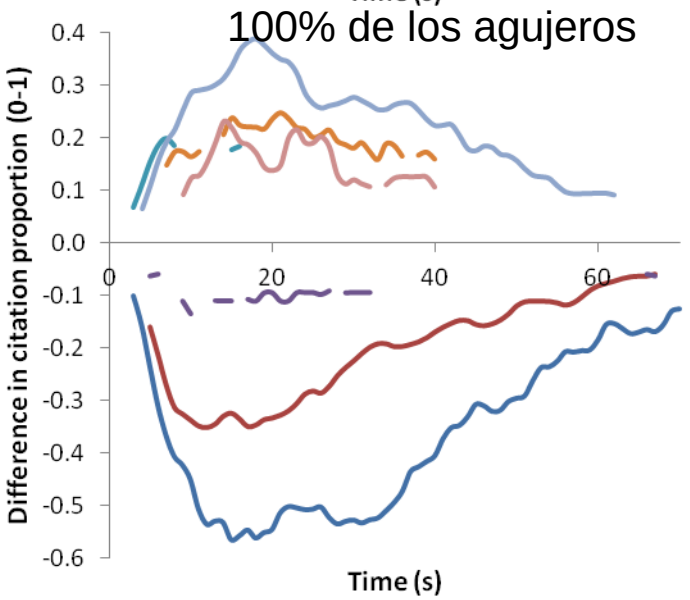
Queso (consumidores)







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En resumen

- TCATA fading podría dar mejores resultados que TCATA

- La imputación de datos debe utilizarse cuando se analizan los datos de TCATA fading

- Rellenar todos los “agujeros” da los mejores resultados

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TCATA proporciona información adicional a CATA?

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Food Research International 97 (2017) 215–222

Contents lists available at ScienceDirect

Food Research International

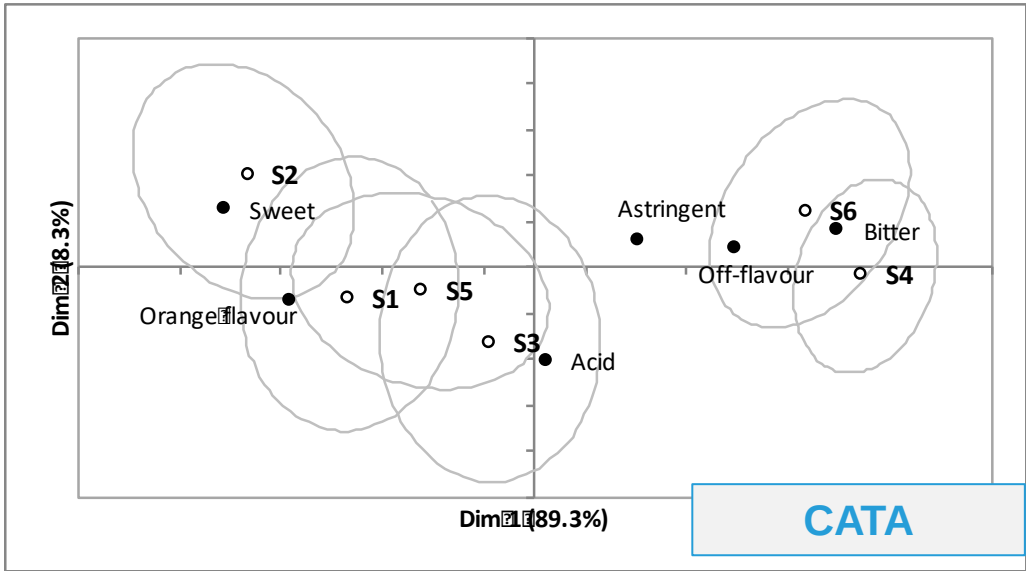
journal homepage: www.elsevier.com/locate/foodres

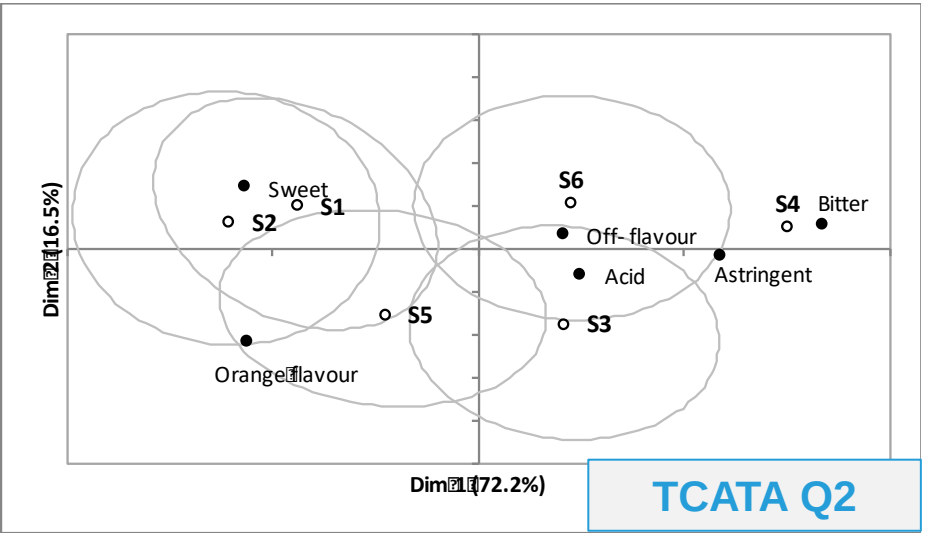
Comparison of static and dynamic sensory product characterizations based on check-all-that-apply questions with consumers

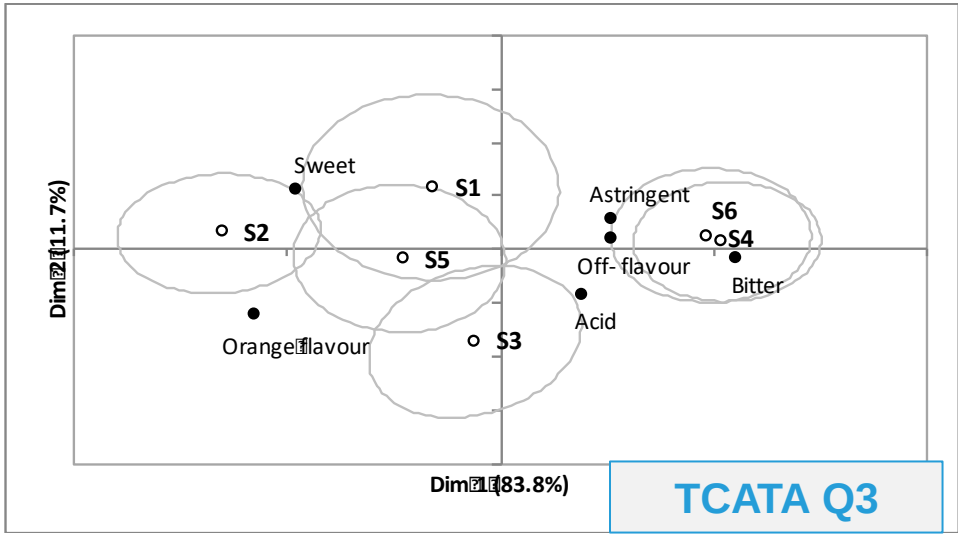
Florencia Alcaire[a], Lucía Antúnez[a], Leticia Vidal[a], Shari Zorn[a], Ana Giménez[a], John C. Castura[b], Gastón Ares[a,*]

Ejemplo – jugo de naranja

		TCATA as CATA			
	CATA	**Q1**	**Q2**	**Q3**	**Q4**
Average citation proportion	0.31	0.10	0.25	0.36	0.37
Maximum citation proportion	0.72	0.32	0.66	0.76	0.80
Percentage of attributes with significant differences (%)	83	50	67	83	67
Percentage of significant pairwise comparisons (%)					
Global	43	17	34	42	37
Acid	33	0	0	0	0
Bitter	53	27	53	53	53
Astringent	0	0	0	40	0
Sweet	73	40	67	47	47
Orange flavour	53	33	53	73	67
Off-flavour	47	0	33	40	53
Percentage of variance explained by the first/second dimension of Correspondence Analysis (%)	94/4	72/17	84/12	92/3	93/4
RV between sample configurations obtained using CATA questions	-	0.84	0.93	0.96	0.86
RV between term configurations obtained using CATA questions	-	0.86	0.93	0.84	0.88

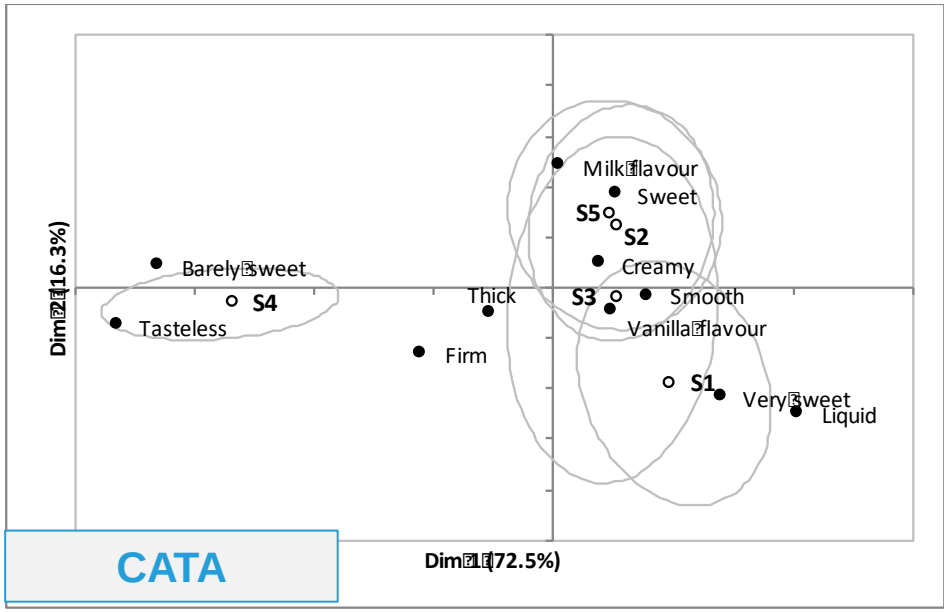

S2
Sweet
S1
S5
Orange flavour
S3
Acid
Astringent
S6
Bitter
Off-flavour
S4
Dim 2 (18.3%)
Dim 1 (89.3%)
CATA

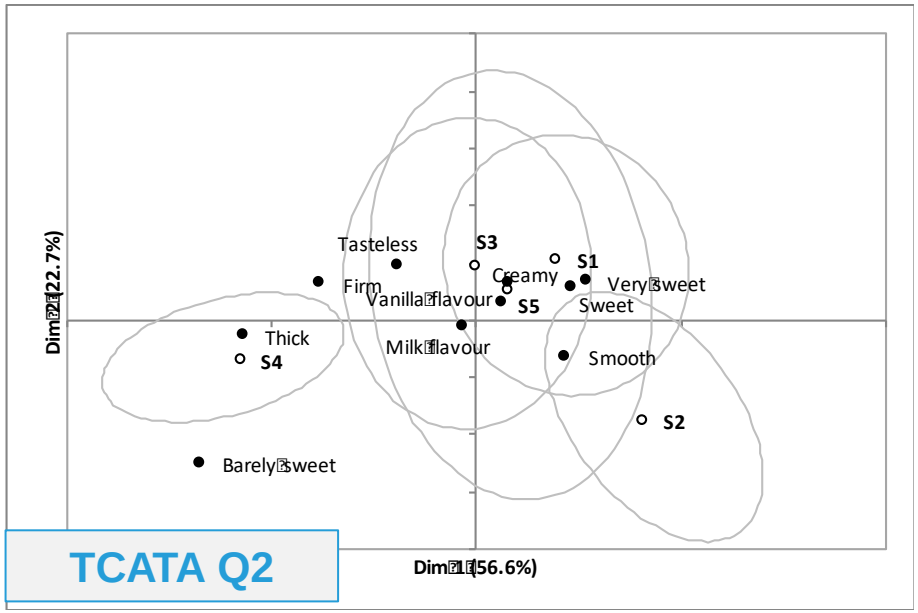

Sweet
S1
S2
S6
S4
Bitter
Off- flavour
Acid
Astringent
S5
S3
Orange flavour
Dim 2 (16.5%)
Dim 1 (72.2%)
TCATA Q2

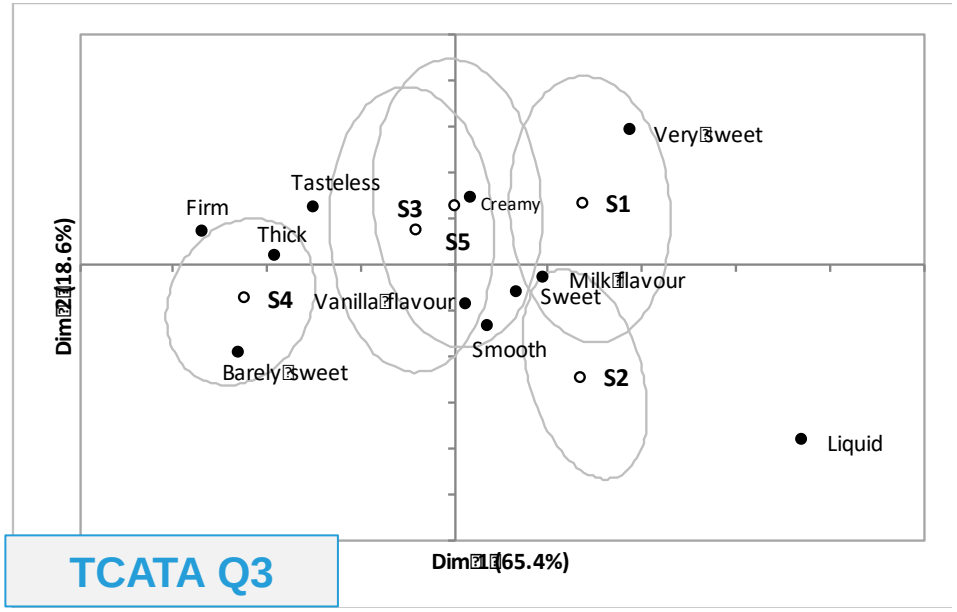

Sweet
S1
S2
Astringent
S6
S4
S5
Off- flavour
Bitter
Acid
Orange flavour
S3
Dim 2 (11.7%)
Dim 1 (83.8%)
TCATA Q3

Ejemplo – Postres de vainilla

		TCATA as CATA			
	CATA	**Q1**	**Q2**	**Q3**	**Q4**
Average citation proportion	0.33	0.11	0.25	0.31	0.34
Maximum citation proportion	0.71	0.32	0.58	0.72	0.70
Percentage of attributes with significant differences (%)	45	27	64	64	55
Percentage of significant pairwise comparisons (%)					
Global	17	7	20	32	28
Thick	0	30	30	50	40
Creamy	0	0	0	0	0
Sweet	60	0	20	30	30
Firm	0	0	30	40	40
Liquid	0	20	40	40	40
Very sweet	40	0	30	60	60
Barely sweet	40	30	50	40	40
Tasteless	40	0	20	50	60
Milk flavour	0	0	0	0	0
Vanilla flavour	0	0	0	20	0
Smooth	0	0	0	0	0
Percentage of variance explained by the first/second dimension of Correspondence Analysis (%)	73/16	57/22	65/21	65/19	72/16
RV between sample configurations obtained using CATA questions	-	0.83	0.80	0.77	0.87
RV between term configurations obtained using CATA questions	-	0.53	0.67	0.62	0.63


Milk flavour
Sweet
S5
S2
Creamy
Barely sweet
S4
Thick
S3
Smooth
Tasteless
Vanilla flavour
Firm
S1
Very sweet
Liquid
Dim 2 (16.3%)
Dim 1 (72.5%)
CATA


Tasteless
S3
S1
Creamy
Firm
Very sweet
Vanilla flavour
S5
Sweet
Thick
S4
Milk flavour
Smooth
S2
Barely sweet
Dim 2 (22.7%)
Dim 1 (56.6%)
TCATA Q2


Very sweet
Tasteless
Firm
S3
Creamy
S1
Thick
S5
Milk flavour
S4
Vanilla flavour
Sweet
Smooth
Barely sweet
S2
Liquid
Dim 2 (18.6%)
Dim 1 (65.4%)
TCATA Q3

¿TDS y TCATA dan la misma información?

Food Research International 78 (2015) 148–158

Contents lists available at ScienceDirect

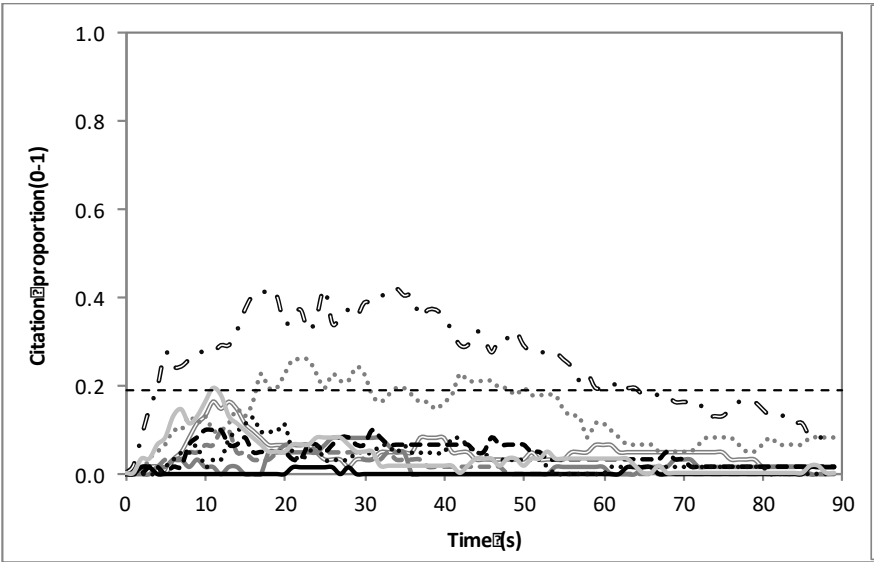
Food Research International

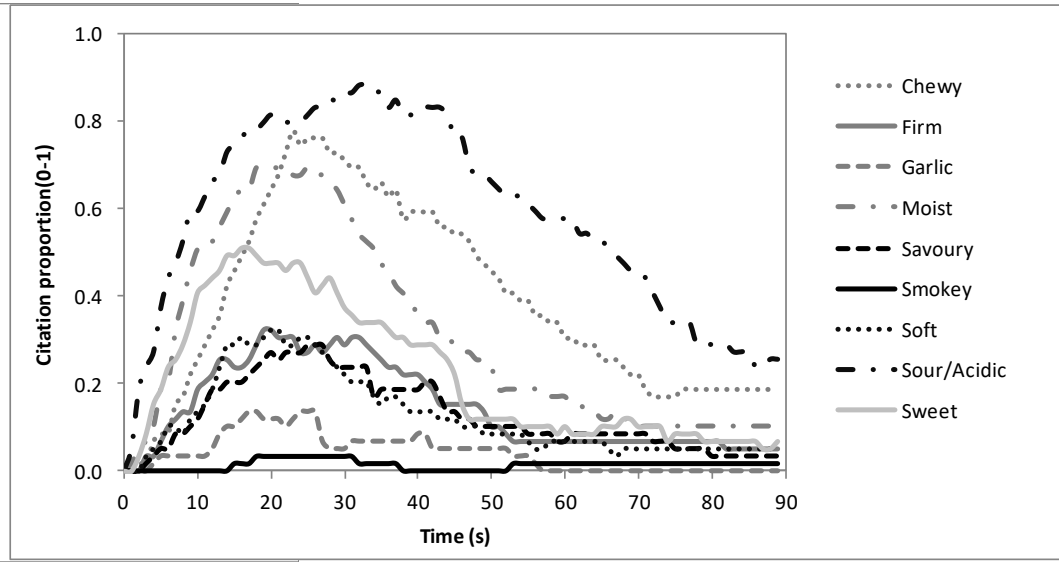
journal homepage: www.elsevier.com/locate/foodres

Comparison of TCATA and TDS for dynamic sensory characterization of food products

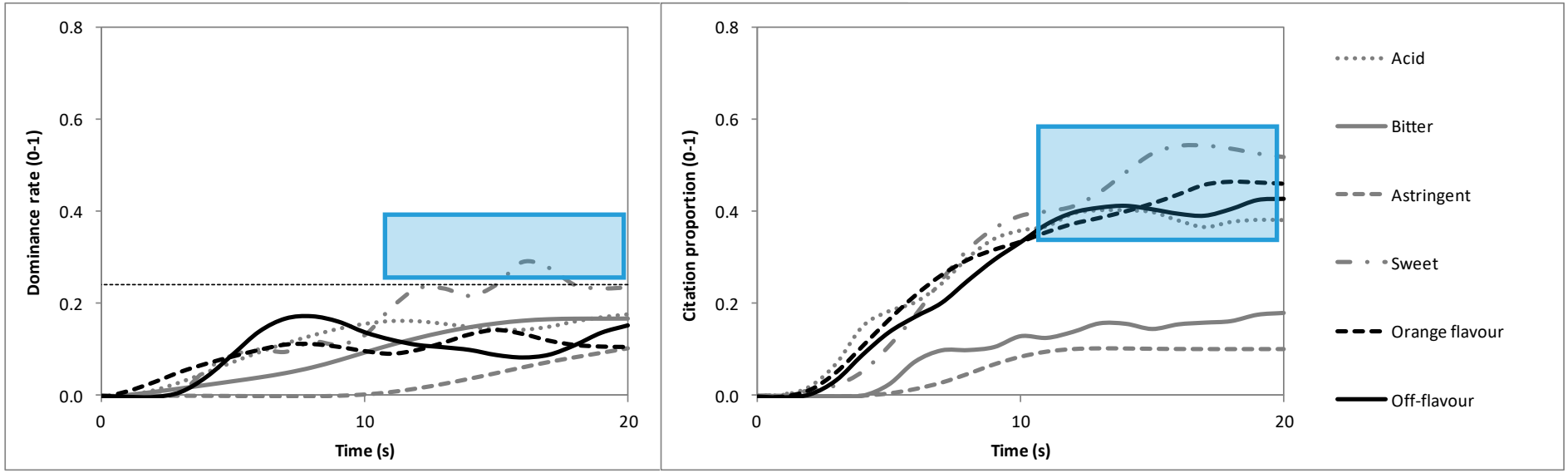
Gastón Ares [a,*], Sara R. Jaeger [b], Lucía Antúnez [a], Leticia Vidal [a], Ana Giménez [a], Beatriz Coste [c], Alejandra Picallo [c], John C. Castura [d]

Evaluación de calamares



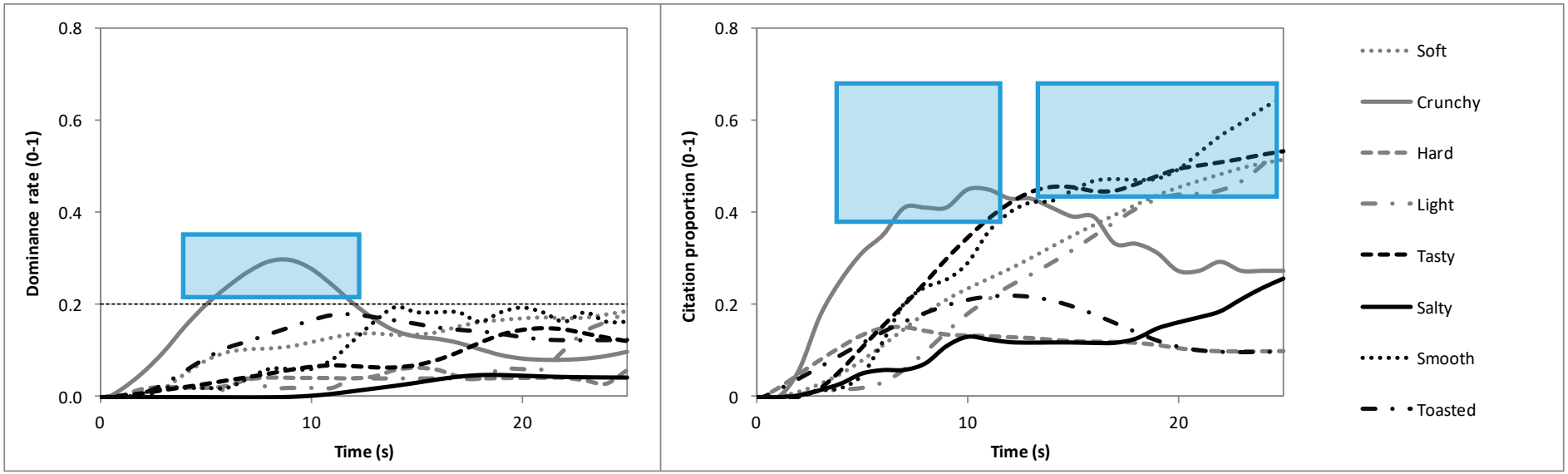


Evaluación de jugo de naranja

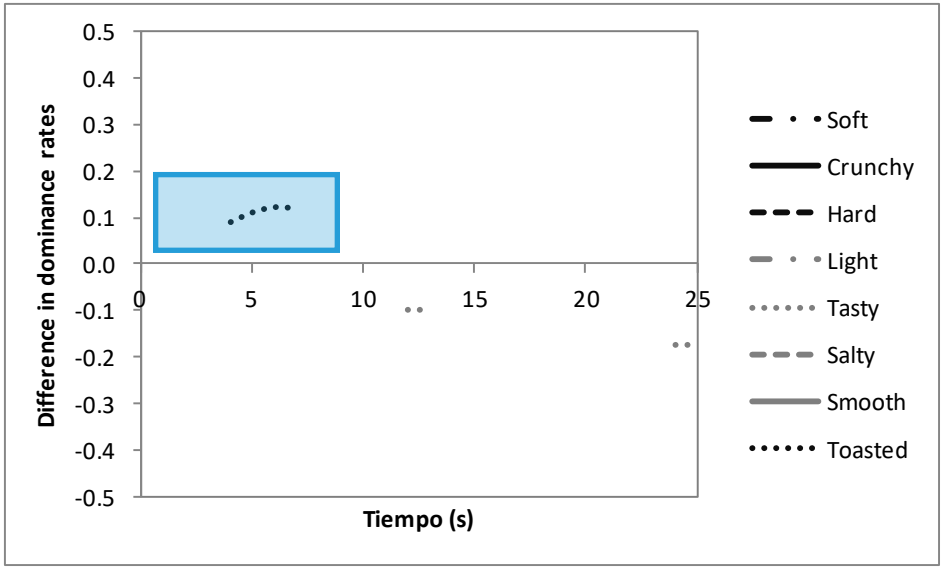


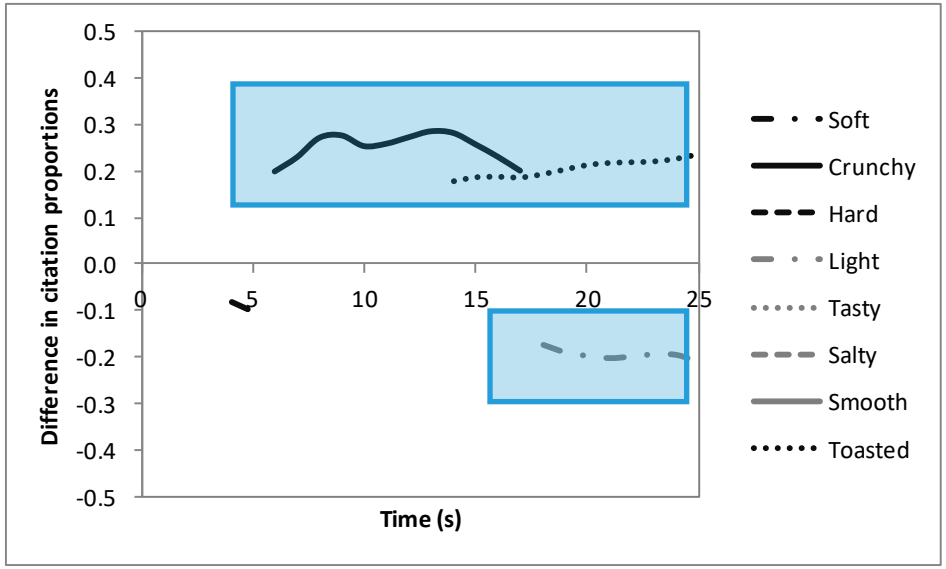
TCATA identificó atributos que fueron percibidos simultáneamente, incluyendo sabor extraño.

Evaluación de pan francés



TCATA permitió obtener información más detallada que TDS





La discriminación entre muestras fue mayor para TCATA que para TDS

Table 3
Summary of results for the three studies comparing TCATA and TDS with trained assessors.

Methodology	Parameters	Study 1 (strawberry yogurt)	Study 2 (salami)	Study 3 (Pategras cheese)
TCATA	(i) Average citation proportion across samples	0.26	0.27	0.22
	(ii) Maximum citation proportion for individual samples	0.60–0.78	0.70–0.86	0.66–0.77
	(iii) Percentage of all possible comparisons between pairs of samples that were significant throughout the evaluation	23%	19%	17%
TDS	(iv) Average dominance rate across samples	0.11	0.07	0.07
	(v) Maximum dominance rate for individual samples	0.33–0.50	0.30–0.40	0.39–0.43
	(vi) Number of significantly dominant attributes for individual samples	3–5	2–4	3–5
	(vii) Percentage of the evaluation time during which at least one attribute was significantly dominant	76%	69%	79%
	(viii) Maximum number of attributes simultaneously dominant for individual samples	2–3	2	2–3
	(ix) Time (s) with simultaneous dominant attributes for individual samples	2–13	6–21	1–12
	(x) Non-significantly dominant attributes across samples	–	*Soft, fibrous, gummy, greasy, brittle*	*Sour, sticky, gummy, off-flavour*
	(xi) Percentage of all possible comparisons between pairs of samples that were significant throughout the evaluation	14%	8%	9%

Table 4
Summary of results for the three studies comparing TCATA and TDS with consumers.

Methodology	Parameter	Study 4 (orange juice)	Study 5 (French bread)	Study 6 (mussels)
TCATA	(i) Average citation proportion across samples	0.22	0.23	0.24
	(ii) Maximum citation proportion for individual samples	0.45–0.78	0.60–0.72	0.88–0.90
	(iii) Percentage of all possible comparisons between pairs of samples that were significant throughout the evaluation	28%	16%	18%
TDS	(iv) Average dominance rate across samples	0.10	0.08	0.06
	(v) Maximum dominance rate for individual samples	0.26–0.41	0.30–0.32	0.41–0.43
	(vi) Number of significantly dominant attributes for individual samples	1–2	1–3	2–3
	(vii) Percentage of the evaluation time during which at least one attribute was significantly dominant	59%	54%	57%
	(viii) Maximum number of attributes simultaneously dominant for individual samples	1–2	1–2	2
	(ix) Time (s) with simultaneous dominant attributes for individual samples	2	2	26–27
	(x) Non-significantly dominant attributes across samples	*Acid, astringent*	*Hard, toasted, salty*	*Firm, garlic, moist, savoury, soft*
	(xi) Percentage of all possible comparisons between pairs of samples that were significant throughout the evaluation	14%	9%	14%

Table 5
Summary of results for the comparison of task perceptions for TCATA and TDS with consumers in Studies 4–6. Values shown are means with standard deviations between brackets. Rating scale anchored at 1 = "disagree extremely" and 7 = "agree extremely".

Statement about task perception		Study 4 (orange juice)	Study 5 (French bread)	Study 6 (mussels)
It was easy to answer the questions	TCATA	5.3 (1.4)	5.9 (1.6)	5.9 (1.1)
	TDS	5.3 (1.6)	5.6 (1.9)	5.9 (0.9)
	p-Value	0.84	0.06	0.96
It was tedious to answer the questions	TCATA	2.1 (1.5)	1.4 (1.0)	2.4 (1.1)
	TDS	2.3 (1.8)	1.6 (1.0)	2.9 (1.2)
	p-Value	0.63	0.04	0.02

En resumen

- TDS y TCATA permiten obtener información sobre la percepción del consumidor de los aspectos temporales de la percepción de los productos.

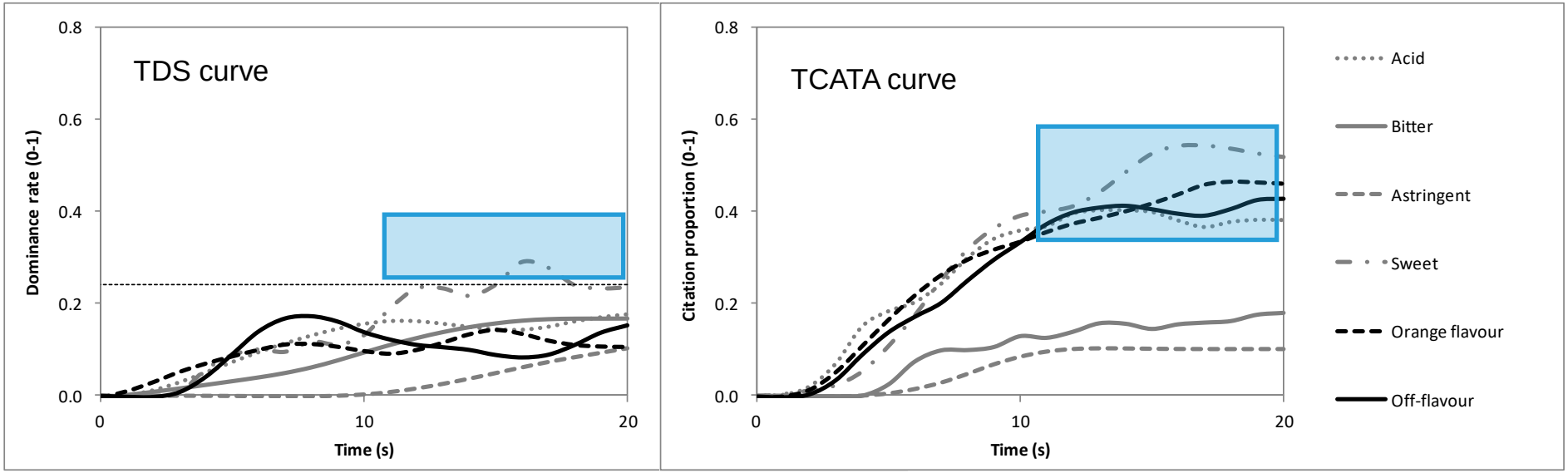
- Las dos metodologías generan información diferente sobre la percepción:
  - Atención vs. descripción
  - ¿Cuál es más relevante para determinar la percepción hedónica?

- TCATA parece más adecuada para describir de forma completa los cambios temporales de las características de los productos.

Relación entre los perfiles sensoriales dinámicos y aceptabilidad: Dominancia vs. descripción

Estudio	Categoría	Muestras	Consumidores	Duración	Términos	Diseño
1	Jugo de naranja	5	200	25	11	Diseño entre sujetos: TDS (50), TCATA (50) o aceptabilidad (100)
2	Pan francés	5	100	25	8	Diseño entre sujetos: TDS (50) or TCATA (50) Todos los consumidores indicaron su aceptabilidad luego de la descrpción
3	Chocolate	5	100	60	10	

- En algunos casos los atributos significativamente dominantes no explican los puntajes de aceptabilidad de los consumidores.



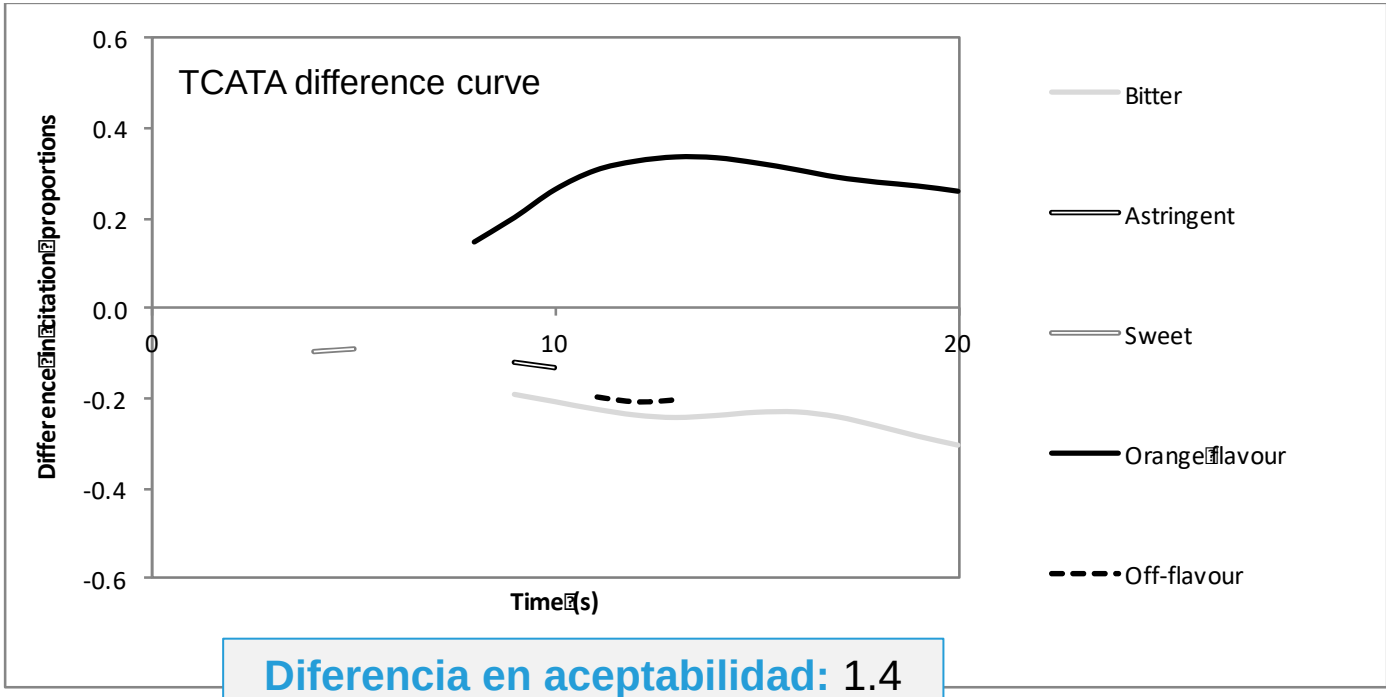
Aceptabilidad: 4.7

Curvas de diferencias

- En dos de los estudios la información de TDS y TCATA sobre diferencias significativas entre muestras en general fue similar.

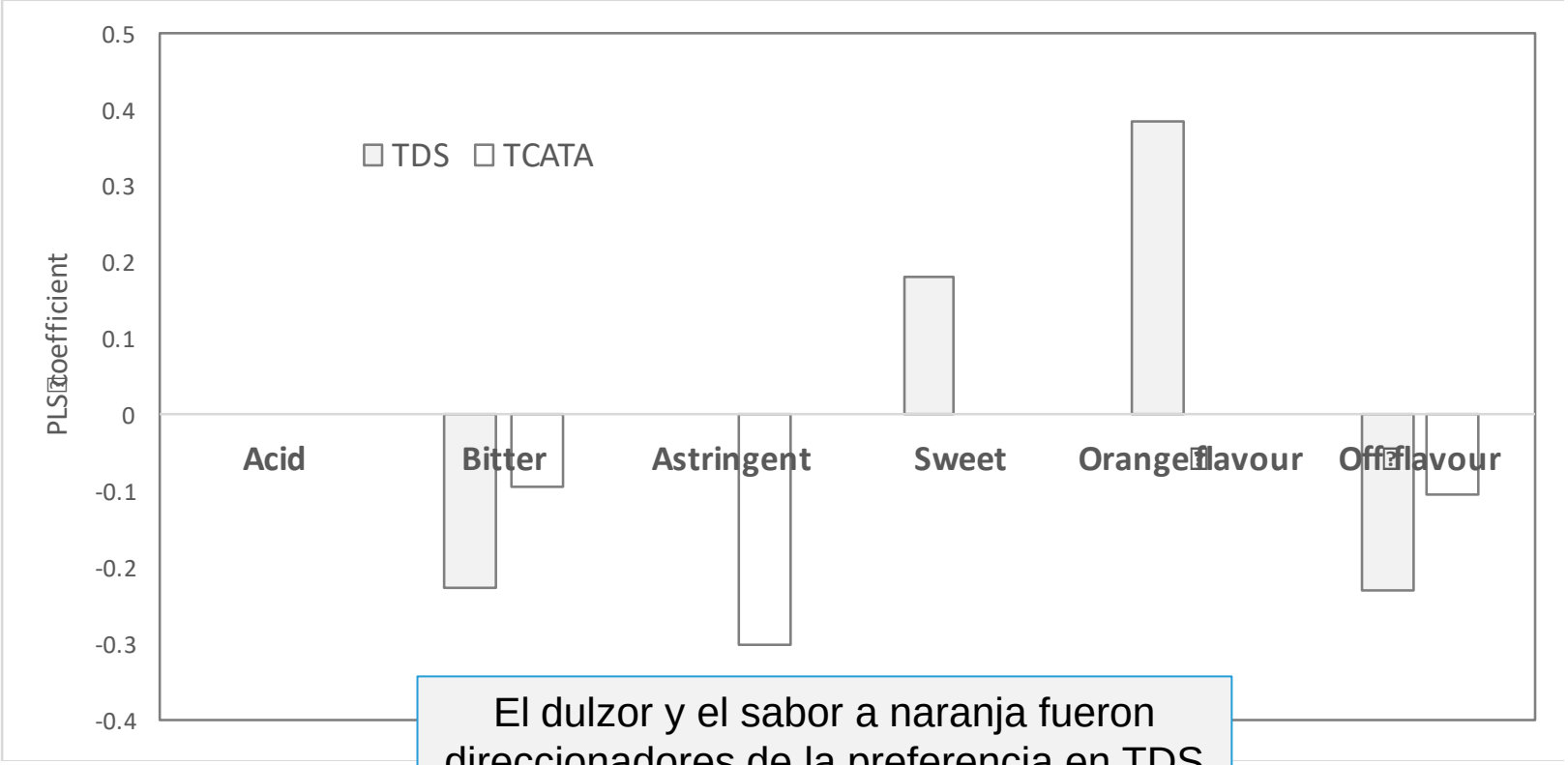
Estudio	Pares de muestras	Diferencia en aceptabilidad	Atributos significativos en TDS	Atributos significativos en TCATA
2 – Pan francés	S1-S2	-0.7	+soft (4), -crunchy (8), **-tasty (5)**	+soft (19), -crunchy (8), **+smooth (1)**
	S1-S3	-0.6	+soft (19), - crunchy (21), +light (5s), **-tasty (2), +salty (1)**, -toasted (2)	+soft (22), -crunchy (23), +light (16), **+smooth (2),** -toasted (1)
	S1-S4	-0.9	+soft (21), -crunchy (14)	+soft(14), -crunchy (23), **+tasty (1), +smooth (1)**

- En el caso del jugo de naranja, TDS no encontró diferencias significativas entre muestras con distinto puntaje de aceptabilidad.



Diferencia en aceptabilidad: 1.4

Regresión PLS sobre las áreas debajo de las curvas de TDS o TCATA



El dulzor y el sabor a naranja fueron direccionadores de la preferencia en TDS pero no en TCATA (dulzor equivalente)

Anáilsis de TDS y TCATA como CATA (Meyners, 2016)

- Las respuestas de cada consumidor se dividen en cuatro cuartos (Q1 to Q4) y se analizan como CATA.

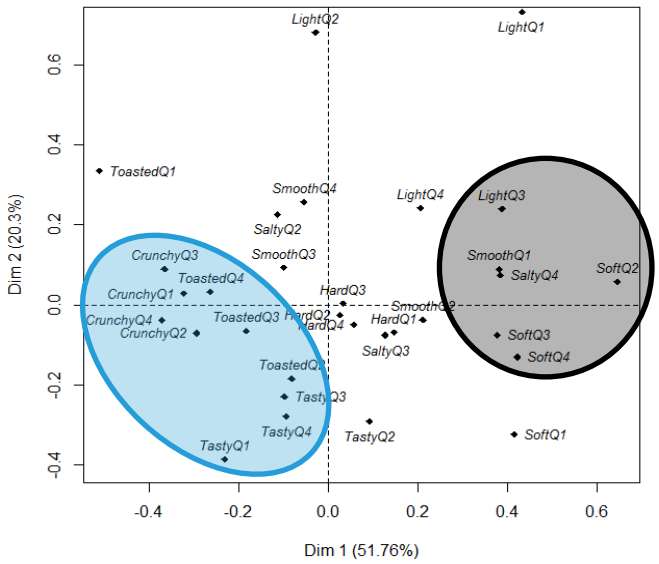
Cons	Sample	Attribute	0	1	2	…	30	31	32	…	45	46	47	…	59	60	Q1	Q2	Q3	Q4
1	1	Hard	0	1	1	…	0	0	0	…	0	0	0	…	0	0	1	0	0	0
1	1	Chocolate	0	0	0		0	0	1		1	1	1		1	0	0	0	1	1
…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…

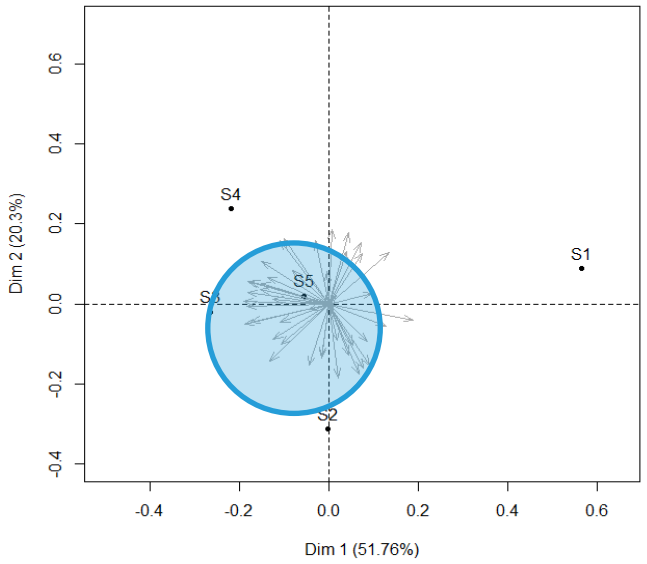
- Se puede aplicar análisis de correspondencia sobre la tabla de frecuencias y se proyecta la aceptabilidad.

Sample	Hard Q1	Hard Q2	HardQ3	...	Chocolate Q1	ChocolateQ2	…	Cons1	…
1	43	38	…	…	15	43	…	5	
2	35	21	…	…	13	26	..	6	
…	…	…	…	…	…	…	…	…	

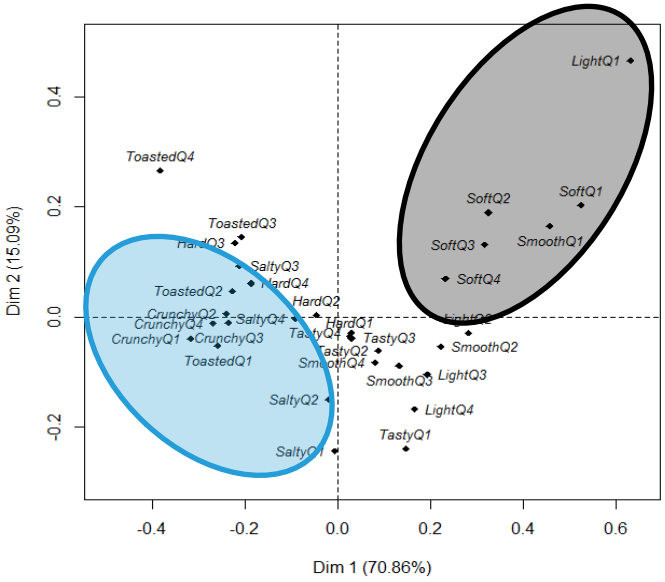
Pan francés

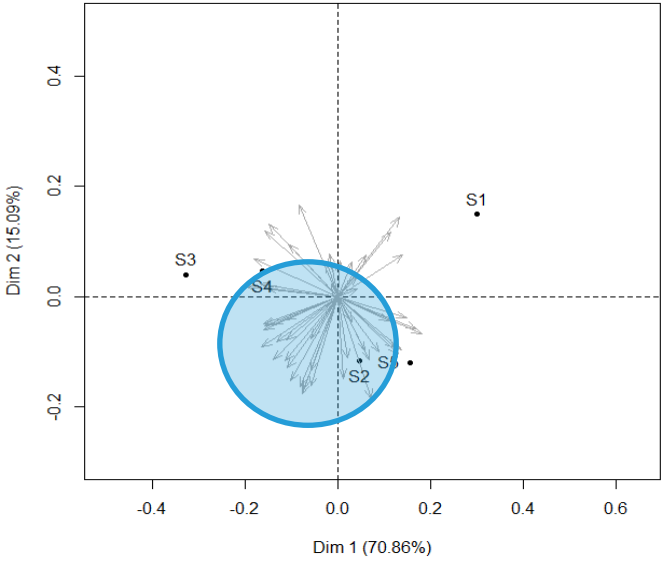
TDS





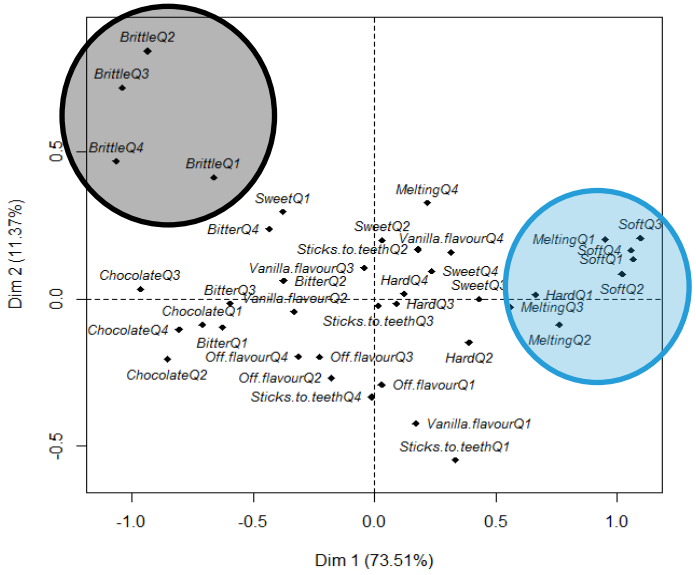
TCATA

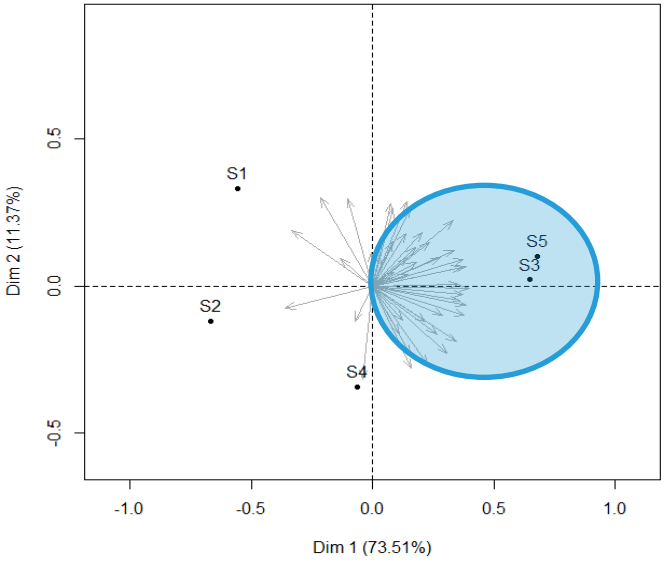




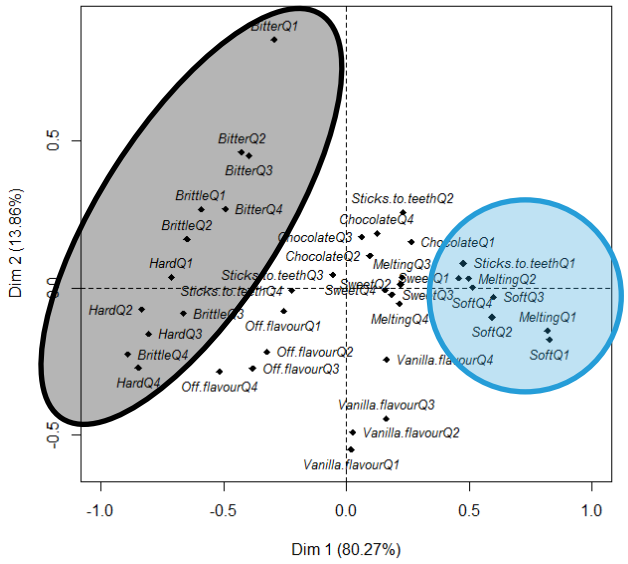
Chocolate

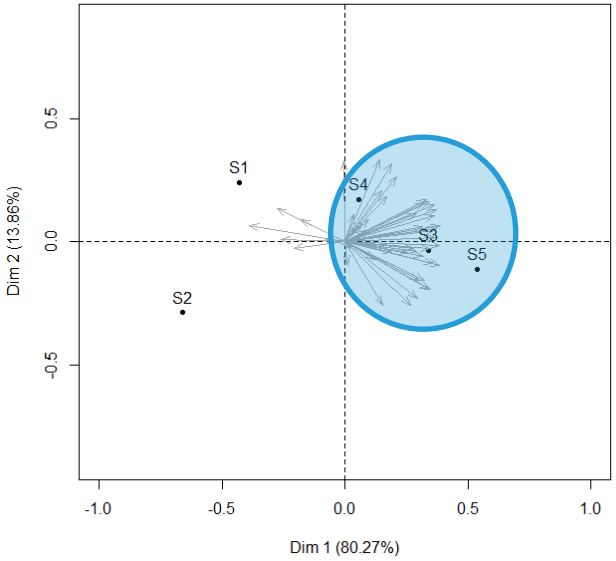
TDS





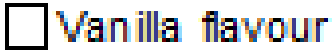
TCATA





Análisis de penalización (Meyners et al., 2013)

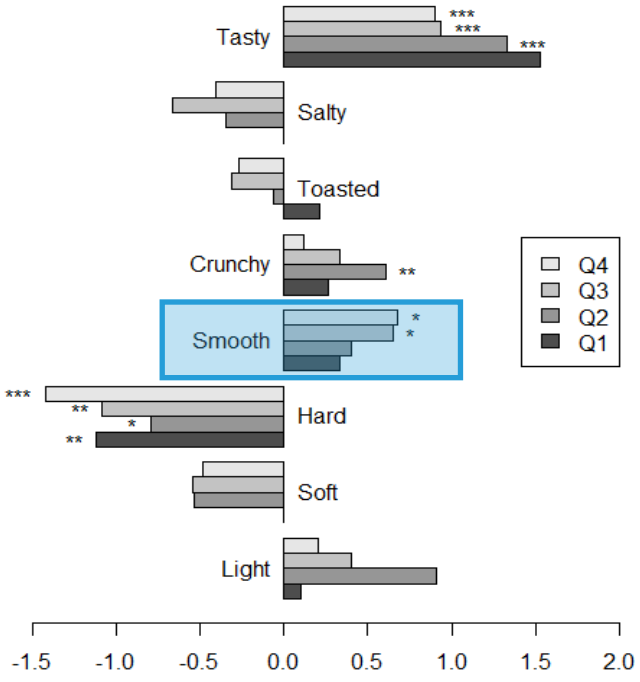
Average overall liking (X=1,Q1) = OV1

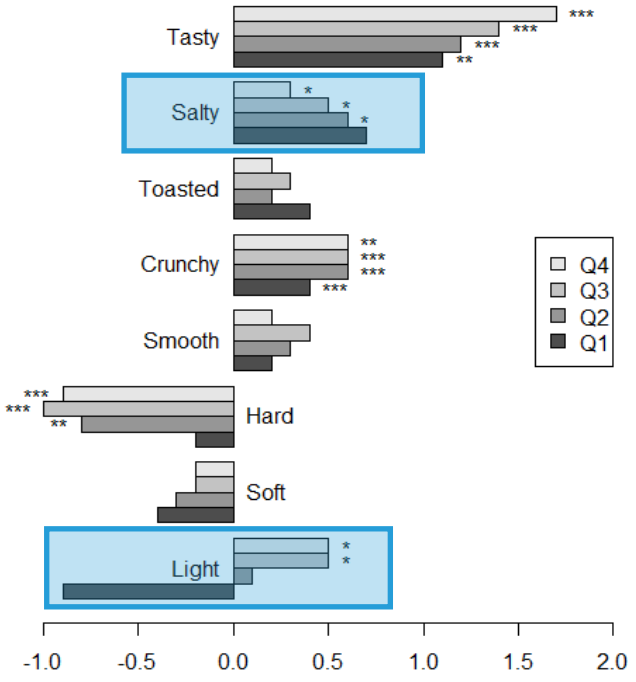


Average overall liking (X=0,Q1) = OV2

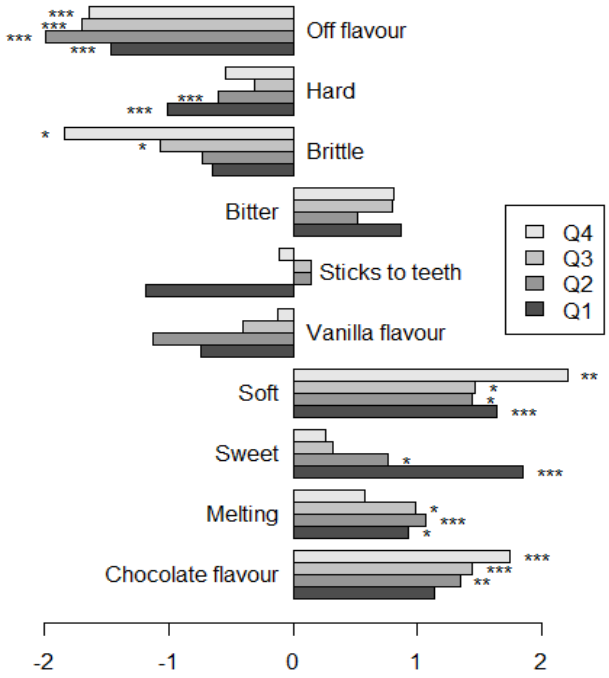
Penalty lift (X, Q1) = OV1-OV2

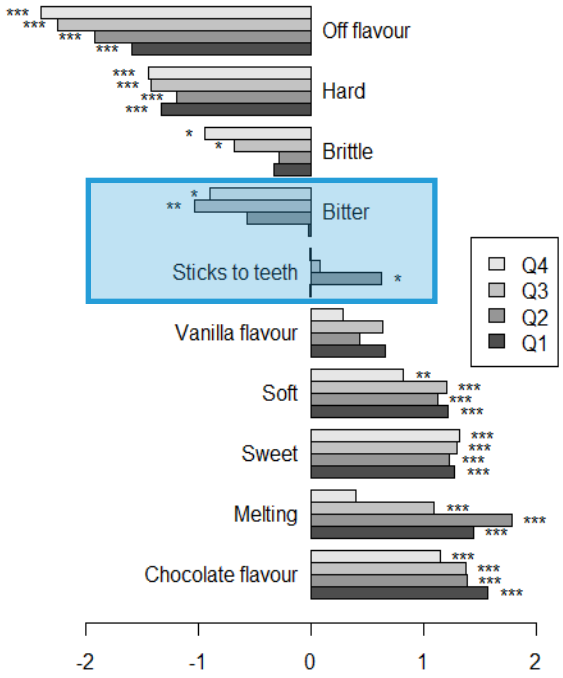
Pan francés


Tasty
Salty
Toasted
Crunchy
Smooth
Hard
Soft
Light
Q4
Q3
Q2
Q1
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0


Tasty
Salty
Toasted
Crunchy
Smooth
Hard
Soft
Light
Q4
Q3
Q2
Q1
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Chocolate


Off flavour
Hard
Brittle
Bitter
Sticks to teeth
Vanilla flavour
Soft
Sweet
Melting
Chocolate flavour
Q4
Q3
Q2
Q1
-2
-1
0
1
2


Off flavour
Hard
Brittle
Bitter
Sticks to teeth
Vanilla flavour
Soft
Sweet
Melting
Chocolate flavour
Q4
Q3
Q2
Q1
-2
-1
0
1
2

Conclusiones

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Conclusiones

- TDS y TCATA permiten obtener información sobre la percepción del consumidor de los aspectos temporales de la percepción de los productos.

- Las dos metodologías generan información diferente sobre la percepción:
  - Atención vs. descripción
  - ¿Cuál es más relevante para determinar la percepción hedónica?

- TCATA parece más adecuada para describir de forma completa los cambios temporales de las características de los productos.

UNIVERSIDAD DE LA REPUBLICA URUGUAY

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SC Sensometría & Ciencia del Consumidor

Preguntas?

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