

The power of calibrated descriptive sensory panels

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Overview

- Descriptive Analysis as an Analytical Tool
- The Sensory Order of Operations
- Understanding Attributes
- Research into Immediate Feedback
- Using Calibrated Panels



Descriptive Analysis as an Analytical Tool

- Descriptive Analysis is an **analytical** method
- The quality of the results of DA depends on **accuracy & precision**.
 - Are the results correct and repeatable?
- Results depend on training assessors
 - “Experts” still require panel screening and training

Two basic questions about DA

- Can we get the panel right from the start?
 - The PanelCheck Lesson
- What is the best possible panel?



The Sensory Order of Operations

- What is an “order of operations”?
 - In mathematics an equation is calculated using...
 - BEDMAS (Brackets, Exponents, Divide, Multiply, Add & Subtract)
- The Sensory Order
 1. Identify the attribute (attribute standard)
 2. Rank its intensity
 3. Scale the intensity (calibration standard)

Attribute Classification System

Attribute Identity

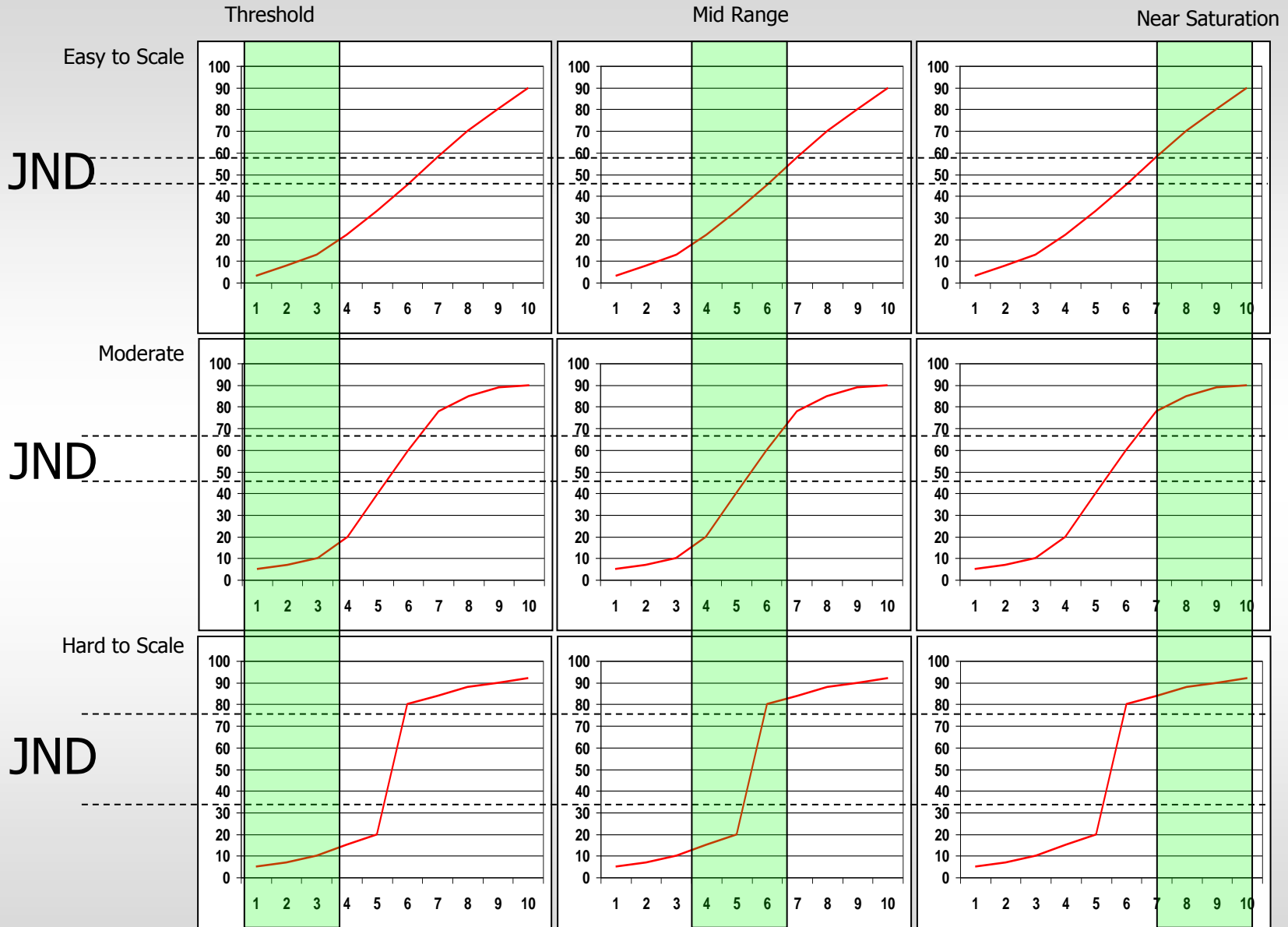
Specific Standard	Group of Attributes	Verbal or Evocative
A primary reference exists that defines the attribute completely.	A few good examples provide the definition for several related attributes	No specific reference can be used, but the concept can be communicated
Sugar or Salt	Fruit or floral	Barnyard or Diesel

Scaling Difficulty

Full Scaling	Rankable	Off/On
The attribute can be measured across the full range with precision of <10% of the scale range.	Across the range for the product, may be detected at 2,3 or 4 levels.	At the level in the product it is either absent or present, but does not lend itself to scaling.
Sucrose in juices	Bitterness in black coffee	Metallic in beverages



Cases that describe attribute scaling properties



JND – Just Noticeable Difference

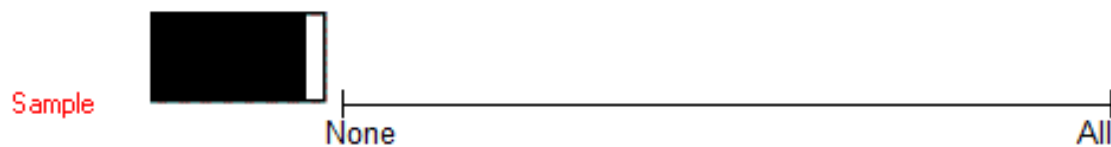
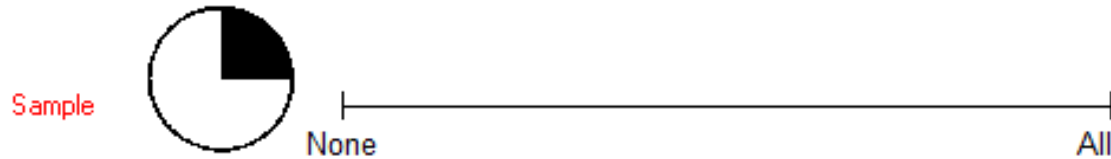
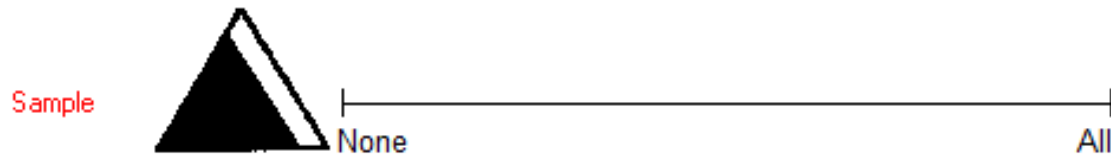
An example of white wine attribute classification

Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor	Typical Target Scale 0-100	Plus or Minus Range
Apple	0.0128	0.0036	0.0000	19	5
Peach	0.0293	0.4323	-	17	6
Melon	0.0764	0.2743	0.0000	16	6
Pear	0.0210	0.0585	-	20	7
Grapefruit	0.0506	0.0052	0.0098	32	5
Pineapple	0.6900	0.1904	0.0000	25	10
Rose	0.0165	0.0413	0.1706	18	7
Green Bean	0.0733	0.5398	-	10	5
Grape	-	-	0.0000	20	9
Asparagus	0.6106	0.1990	0.0211	9	5
Cloves	-	-	0.0000	14	7
Cut Grass	0.1448	0.7807	-		
Mushroom	0.3281	0.3056	0.0076	4	3
Earthy	0.0417	0.3941	0.0000	10	5
Alcohol	0.4657	0.4144	0.0000	27	6
Pungent	0.0418	0.1966	0.0000	26	7
Nutty	0.2322	0.1428	0.0004	14	5
Honey	0.1169	0.0022		32	9
Caramel	0.0044	0.0721	0.0000	17	6
Raisin	-	-	0.0000	15	6
Smoky	-	-	0.0000	22	6
Vanilla	0.8331	0.4013	-	17	7
Resinous	0.0574	0.0583	-		
Oak	0.1650	0.1567	0.0000	21	6
Cedar	0.0027	0.0001	-		
Medicinal	0.2422	0.5369	0.0000	8	4
Black Pepper	0.8079	0.1214	0.0000	18	6
Vinegar	-	-	0.0000	20	10
Attribute	-	-	Taste/ Mouthfeel		
Sweet	-	-	0.0000	20	5
Sour	-	-	0.0000	30	6
Bitter	-	-	0.0000	24	7
Astringent	-	-	0.0000	20	5
Burn/Hot	-	-	0.0000	24	6
Cooling	-	-	0.0000		
Smooth	-	-	0.0000		
Attribute Classification	Specific		Scaling Difficulty	Scalable	
	Group			Rankable	
	Evocative			On/Off	

Providing Immediate Feedback

The Ballot

Mark on the line to indicate the proportion of the area of the shape that is shaded.



Question 1 of 2



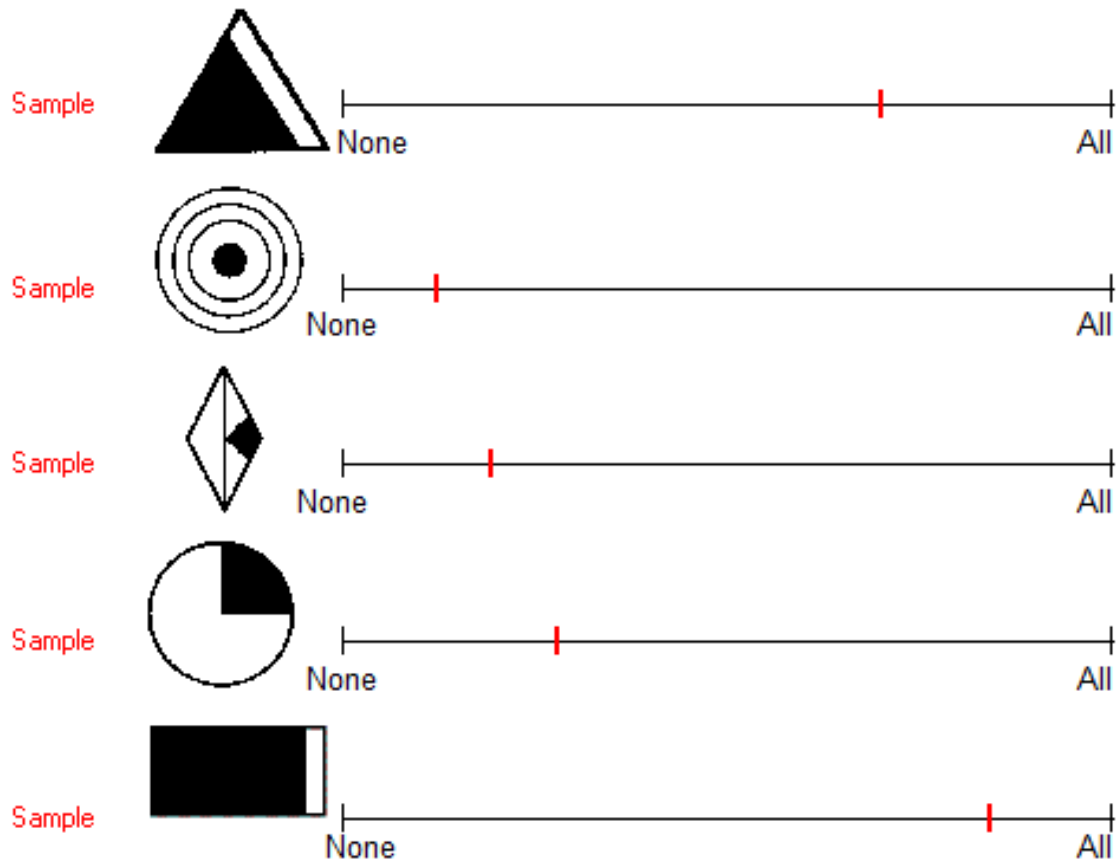
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The Response

Mark on the line to indicate the proportion of the area of the shape that is shaded.


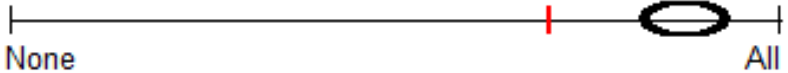


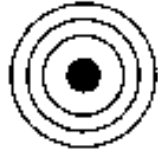
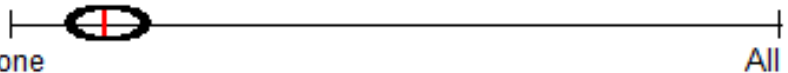
Next Question


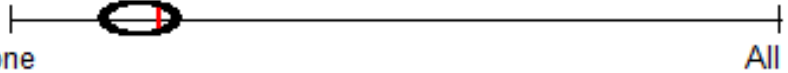
Question 1 of 2



Immediate Feedback



Mark on the line to indicate the proportion of the area of the shape that is shaded.

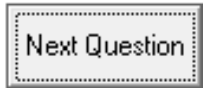
Sample  None  All

Sample  None  All

Sample  None  All

Sample  None  All

Sample  None  All

 **Feedback**



Setting meaningful attribute targets

The Feedback Calibration Method (FCM[®]) is based upon providing panelists with “true” information at the time they evaluate the attribute.

If feedback is either untrue or trivial, the panelist will become confused and the desired learning will not take place.

Meaningful targets for feedback depend upon;

- an understanding of the role of the psychometric function of any attribute
- the effect of context and
- the area of the intensity curve that describes the attribute for the product category.

Response Distribution

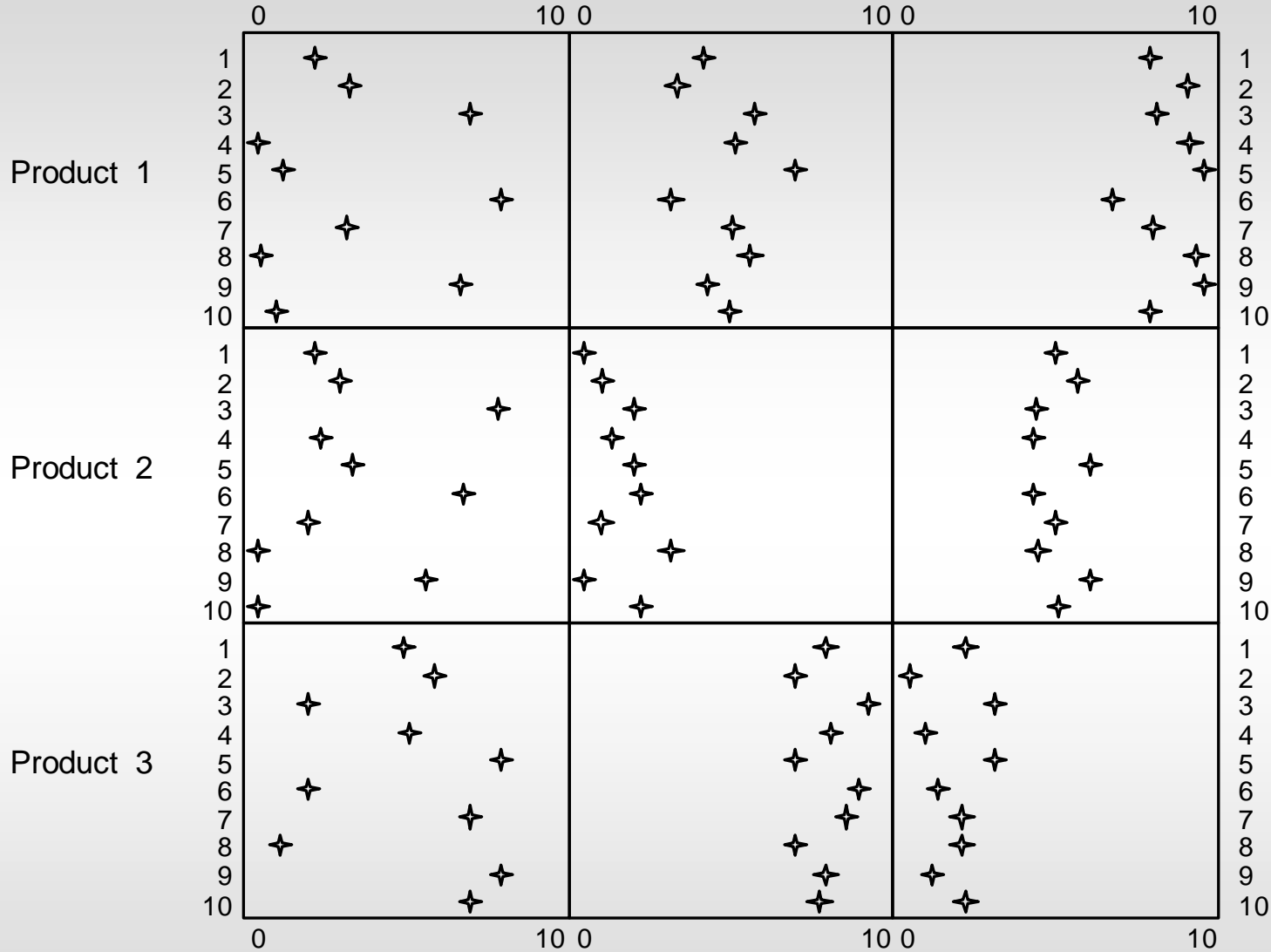
Samples

Attributes

Attribute 1

Attribute 2

Attribute 3

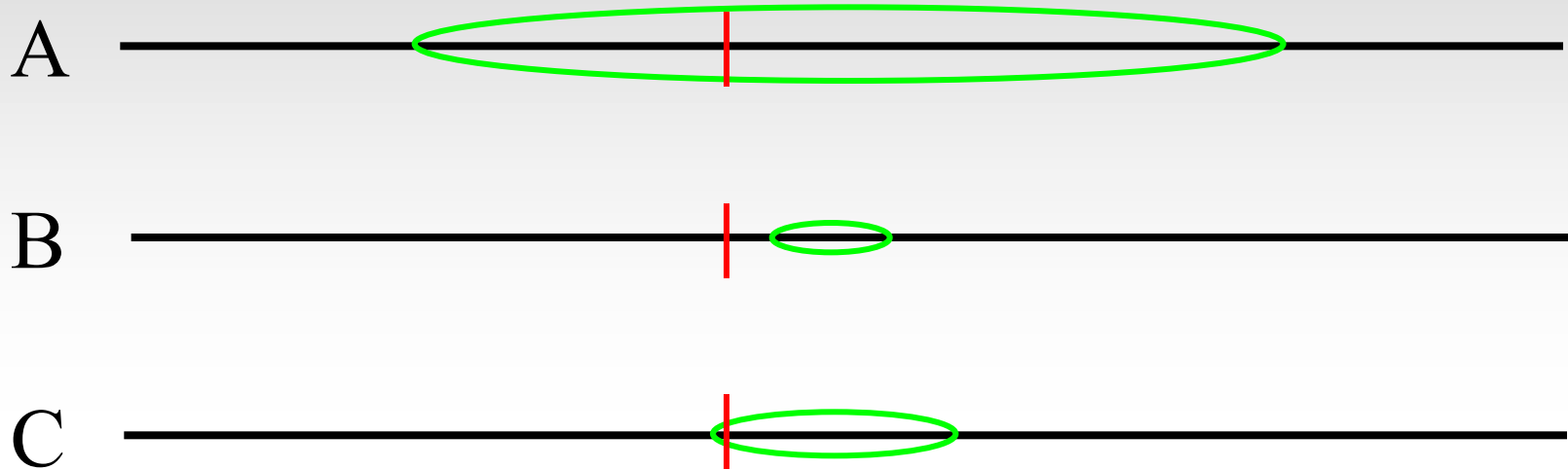


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Targets and Truth



- The truth is not a single fixed point, it is an interval.
- The size of the interval depends on the attribute
- The significance of any attribute will depend on the range of samples used in the study



Immediate Feedback Research

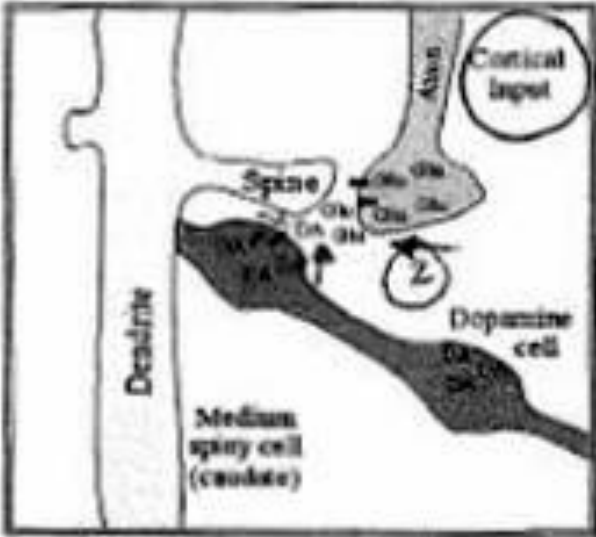
- In Theory
- In Practice – White Wine

Strengthening the Synapse

Implicit System
Learns Information-Integration Categories

Neurobiological evidence demonstrates response strengthening occurs up to 2-3 seconds following feedback reward, but no later

Feedback timing should be critical for implicit category learning but not for explicit category learning.



The diagram illustrates the neural circuitry involved in implicit learning. It shows a 'Cortical input' (1) entering the 'Striatum' (2). The striatum is divided into 'D1' and 'D2' receptor-expressing regions. A 'Dopamine cell' is shown providing input to the striatum. The striatum is connected to the 'Medium spiny cell (caudate)'. A 'Dendrite' is also shown. The diagram is labeled with '1' and '2' in circles, corresponding to the text on the left.

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Summary and Conclusions on Implicit I-I Category Learning

- Feedback administration significantly influences category learning
- For Information-Integration Category learning:
 - Observational feedback severely impairs learning vs. feedback learning
 - Giving selectively positive or negative feedback will impair learning vs. “full” feedback.
 - Delaying feedback more than a few seconds severely impairs learning

The White Wine Study

- Two panels were recruited and trained to evaluate white wine; one panel was composed of experienced red wine panellists (Panel T), the other of panellists with no experience in sensory analysis (Panel U).
- Each panel used the Wine Aroma Wheel to develop their own white wine lexicon over 5 days of training sessions of 2.5h each. Panels T and U used 110 and 76 line scale attributes, respectively.
- Four additional training sessions were used to apply best practices from conventional training and computerized feedback.
- At the conclusion of training, each panel evaluated the same 20 white wines in triplicate.



The Wine Aroma Wheel



Developed by Professor Ann Noble at UC Davis in 1990

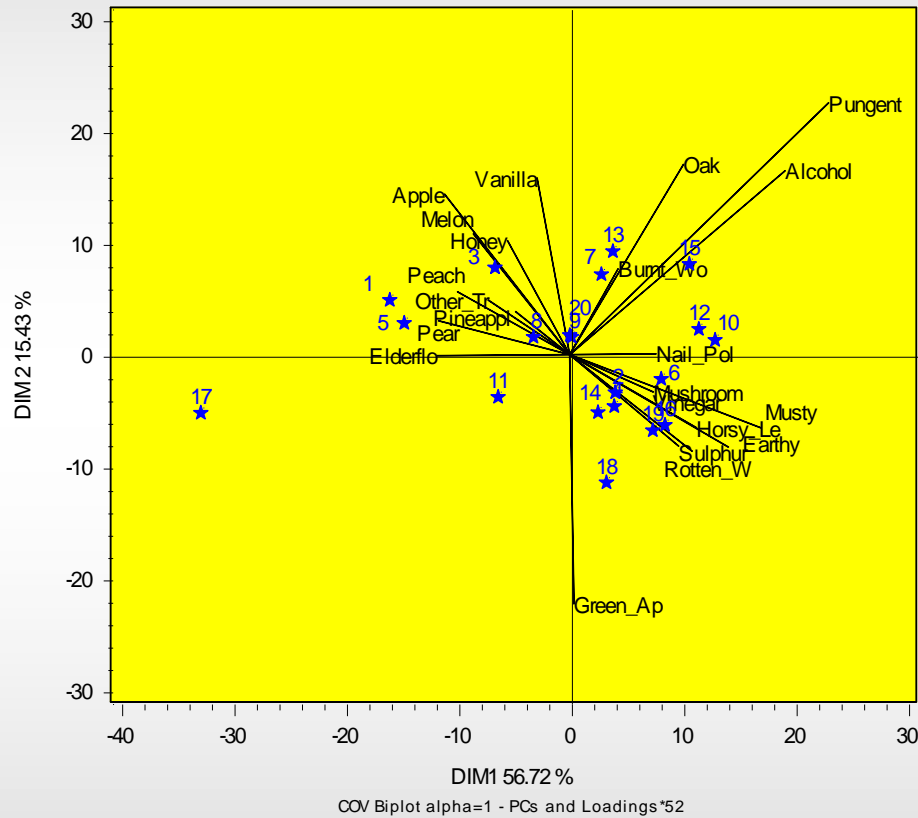
Practical considerations

- How many attributes are enough?
 - Panel D 131 attributes
 - Panel T 110 attributes
 - Panel U 76 attributes
- How do you handle additional attributes?
 - Especially attributes near threshold
 - Pick them from a list. (Check All That Apply)
- How frequently should feedback be given?
- How wide should the target range be?

Panel Results

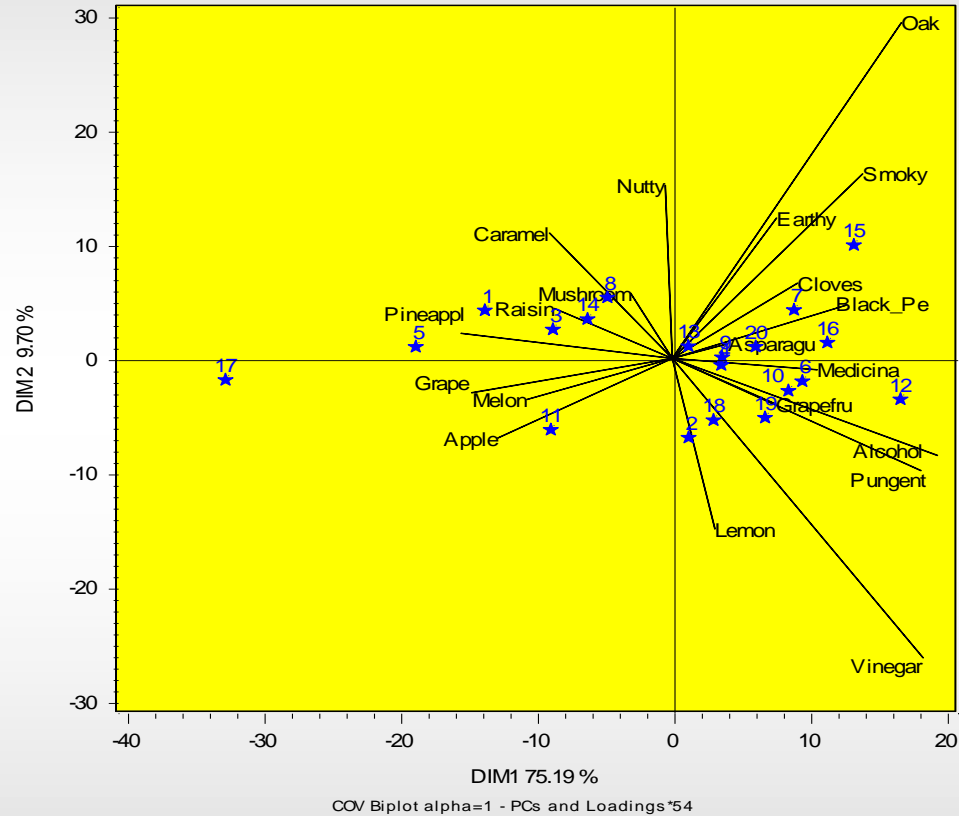
Panel T 22 Flavor Attributes

Panel T - 22 FLA attributes



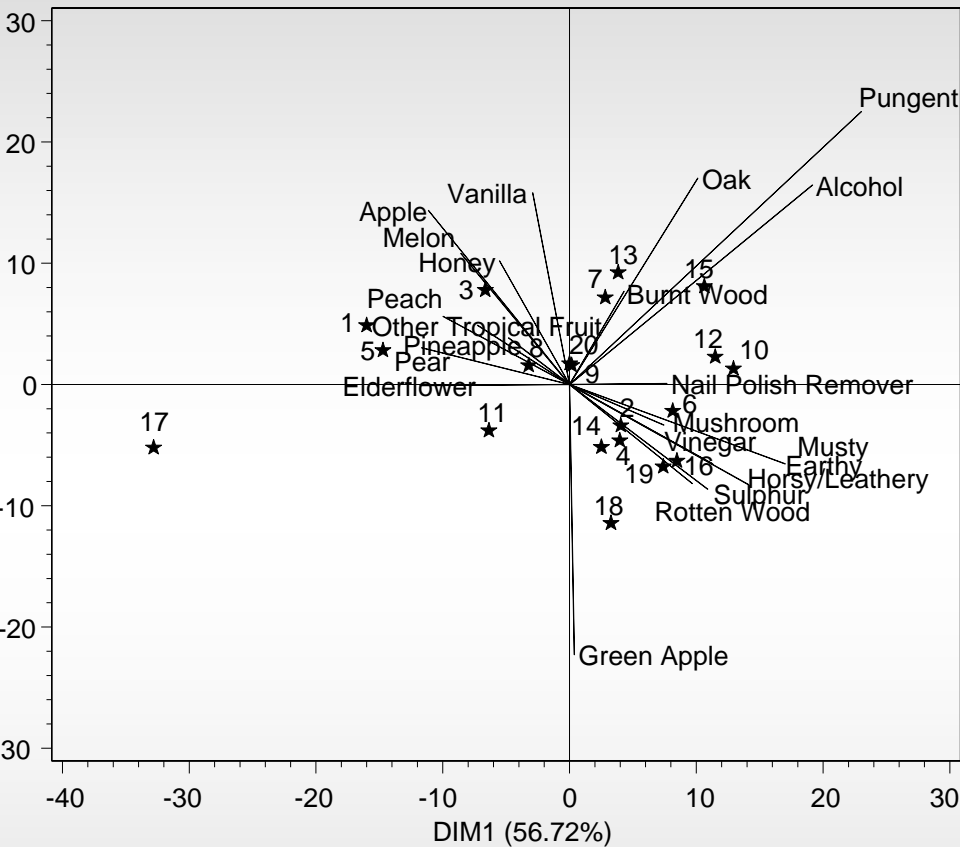
Panel U 20 Flavor Attributes

Panel U - 20 FLA attributes

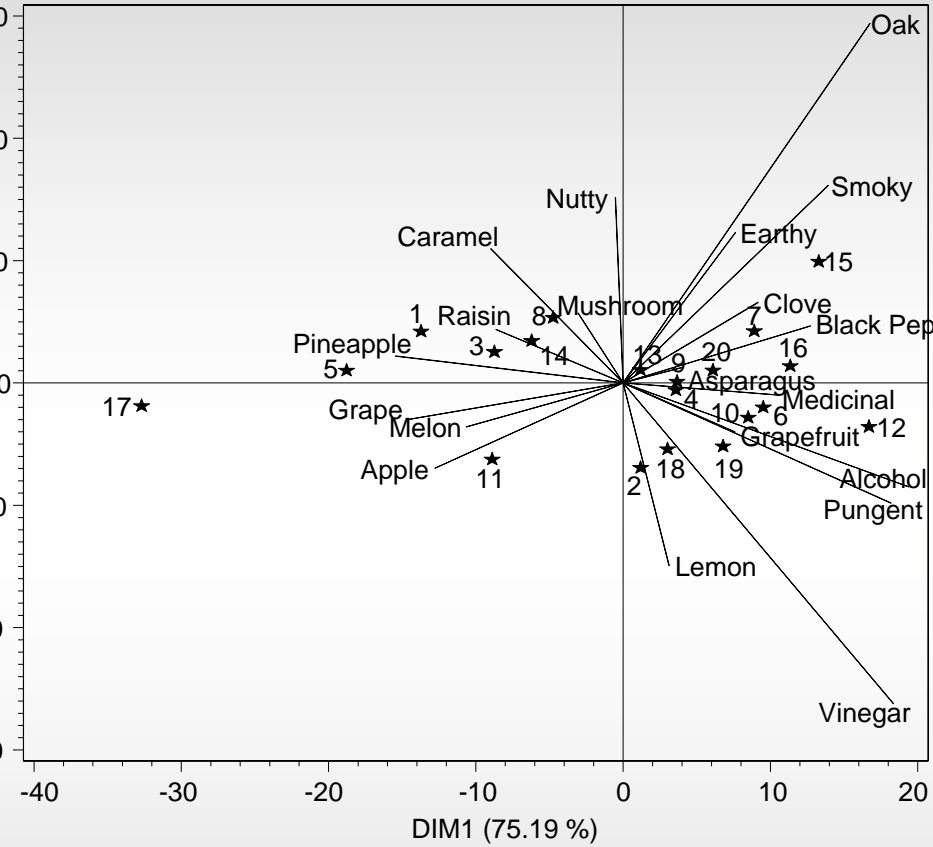


NRV Comparisons for Flavour

NRV 11.4

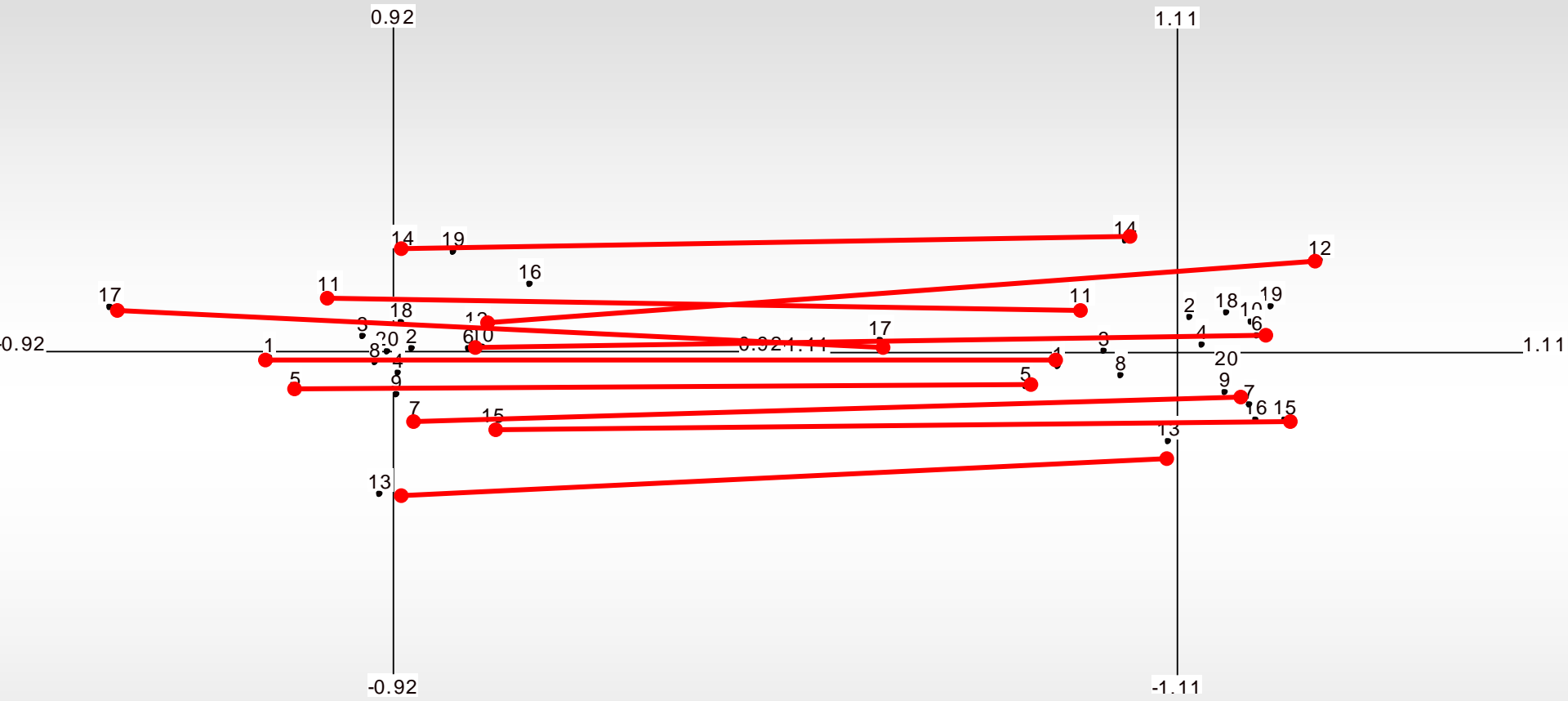


Panel T



Panel U

GPA of 20 wines for all attributes



Panel T

Panel U

FCM DESCRIPTIVE ANALYSIS PROCEDURE

1. Recruit and screen panelists
2. Identify the key sensory attributes of the product range
3. Apply a sensory order of operations approach to attribute development and classification
4. Develop meaningful feedback targets for individualized training
5. Use Feedback Calibration sessions to train the panel
6. Set proficiency targets for panelists
7. Assess the proficiency of the panelists and panel
8. Finalize the ballot
9. Measure the attribute responses for the products
10. Analyze and interpret product results

Training



Training Panel U part 1

Session	Group	Booth	Debrief	Wines	Activity	Time (h)
1	X				Project overview and introduction to sensory	2.5
	X				Aroma and taste descriptive exercise	
	X					
	X			3	Develop descriptors using the Wine Aroma Wheel	
	X			3	Aroma Before Stirring / Oak and Fruit focus	
	X			3	Aroma After Stirring	
	X			3	Flavor	
2	X				Astringency and bitterness	2.5
	X			4	Develop 15 descriptors using the Wine Aroma Wheel	
	X			4	Aroma Before Stirring/ Aroma After Stirring	
	X			4	Flavor	
3	X				Review descriptors from Sessions 1 & 2	2.5
	X				Rating attributes 0, 25, 50, 75, 100 on paper line scale for 5 attributes	
		X	X	3	Aroma Before Stirring/ Aroma After Stirring	
		X	X	3	Flavor	
4	X				Taste Recognition in Water/ Wine on Paper	2.5
		X	X	4	Aroma Before Stirring/ Aroma After Stirring	
		X	X	4	Flavor	



Training Panel U part 2

5	X				Review of Session 4 with Spider plots and individual reports	2.5
					Balanced presentation of 10 wines	
		X	X	5	Aroma Before Stirring/ Aroma After Stirring	
		X	X	5	Flavor	
6					Feedback on 12 wines	2.5
		X	X	6	Aroma Before Stirring/ Aroma After Stirring	
		X	X	6	Flavor	
7					Feedback on 7 wines	2.5
		X	X	7	Aroma Before Stirring/ Aroma After Stirring	
		X	X	7	Flavor	
8					Feedback on 6 wines	2.5
		X	X	6	Aroma Before Stirring/ Aroma After Stirring	
		X	X	6	Flavor	
9					Feedback on 7 wines	2.5
		X	X	7	Aroma Before Stirring/ Aroma After Stirring	
		X	X	7	Flavor	
					TOTAL	22.5

Testing

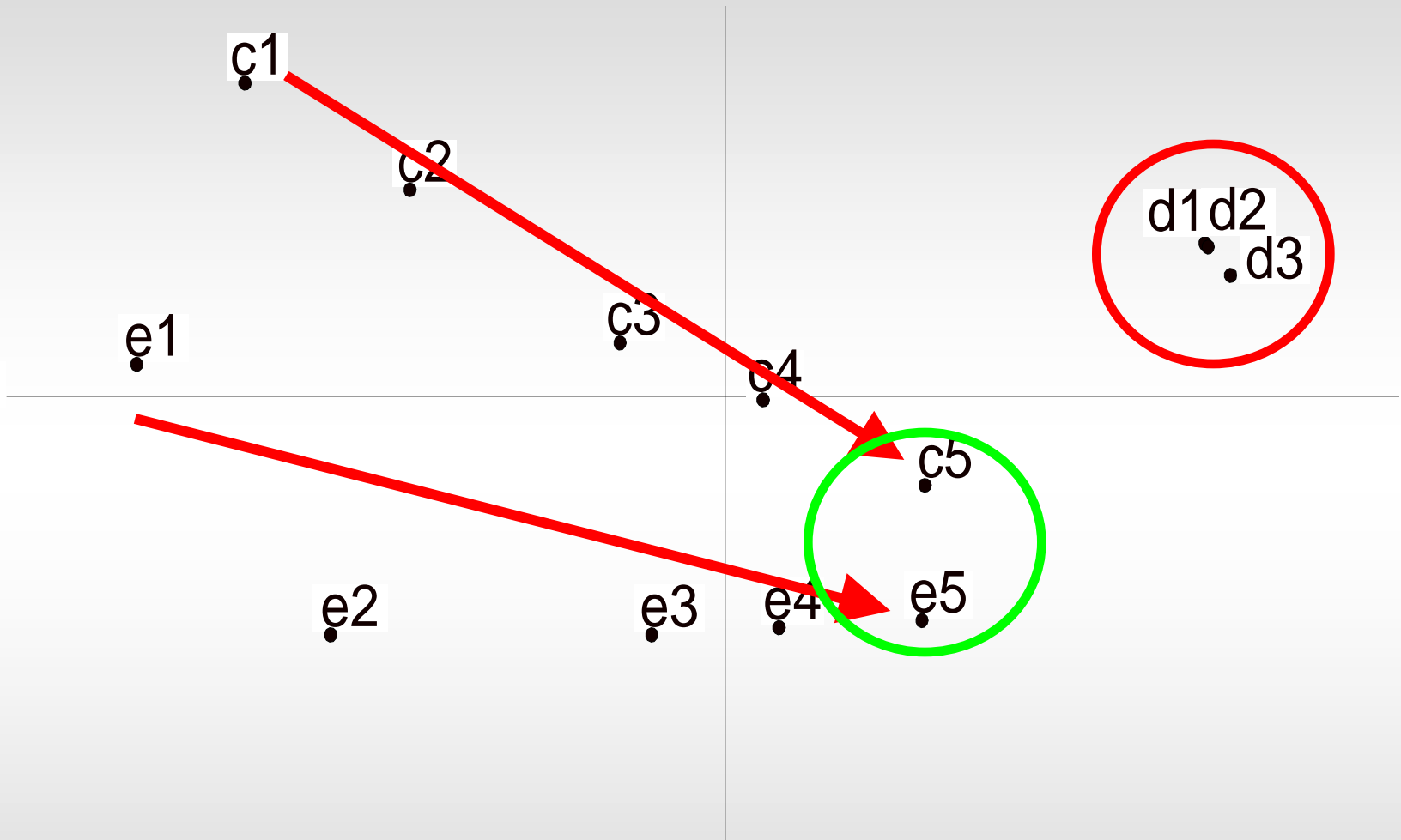


Conclusions on Feedback Calibration

- Immediate feedback provides panelists with strong individualized method of learning attributes and scaling. It also facilitates integration of new panelists.
- Panels can develop and refine their own targets.
- Calibration can be achieved through specific lexicons with reproducible attribute standards.
- Training times can be cut in half with no penalty in panel performance.
 - Panel U in 22.5 h versus 45 h for Panel C
 - Refreshing of a panel can be achieved in 2 to 4 h
- Calibration provides reliable and repeatable descriptive profiles which deliver;
 - Shelf-life studies that are meaningful.
 - Product maps that can be created from historical data.
 - Product development results which can be added to a library of sensory properties that save



GPA of Sequential Shelf Life



FCM Research Publications

Feedback Calibration: a training method for descriptive panels

- Findlay, C.J., Castura, J.C., Lesschaeve, I. Food Quality and Preference, 2007, 18(2), 321-328

Use of feedback calibration to reduce the training time for wine panels

- Findlay, C.J., Castura, J.C. Schlich, P., Lesschaeve, I. Food Quality and Preference, 2006, 17(3-4), 266-276.

Monitoring calibration of descriptive sensory panels using distance from target measurements

- Castura, J.C., Findlay, C.J., Lesschaeve, I. Food Quality and Preference, 2005, 16(8), 682-690.

<http://www.compusense.com/resources/research.php>

For more information, please contact

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