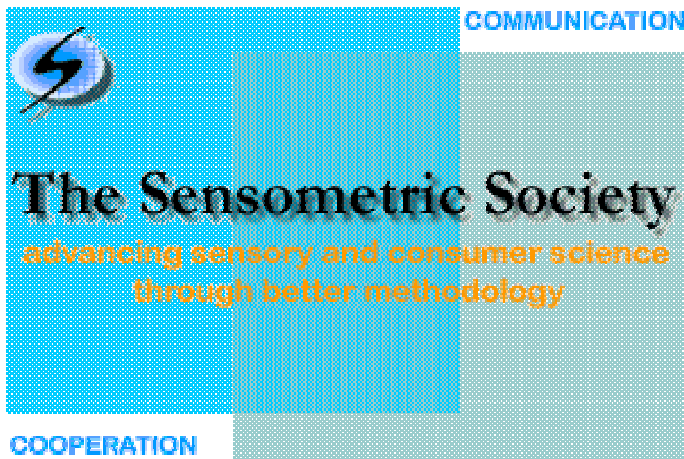


# Optimizing the proficiency of wine panels trained using feedback calibration.



Chris Findlay  
John Castura  
Pascal Schlich  
Isabelle Lesschaeve


# Optimizing Descriptive Analysis

- The Sensory Order of Operations
- Feedback Calibration
- Best practices in Descriptive Analysis
- Statistical measures to validate the panel's proficiency


# Descriptive Analysis

- Analytical measures depend on accuracy & precision
- Statistical treatments are post-hoc evaluations
  - Panel & panellist performance
  - Replication of panel results
- Improving the metrics
- Can we get it right from the beginning?
- What is the best possible panel?

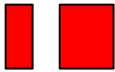

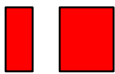

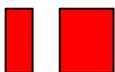

# DESCRIPTIVE ANALYSIS PROCEDURE

1. Identify of the key sensory attributes.
  2. Develop the trained panel.
  3. Develop the ballot.
  4. Measure the attributes.
  5. Analyze and interpret results.
- 
- A decorative graphic in the bottom right corner of the slide, featuring a large, light pink spiral and several curved, brushstroke-like lines extending towards the top right.

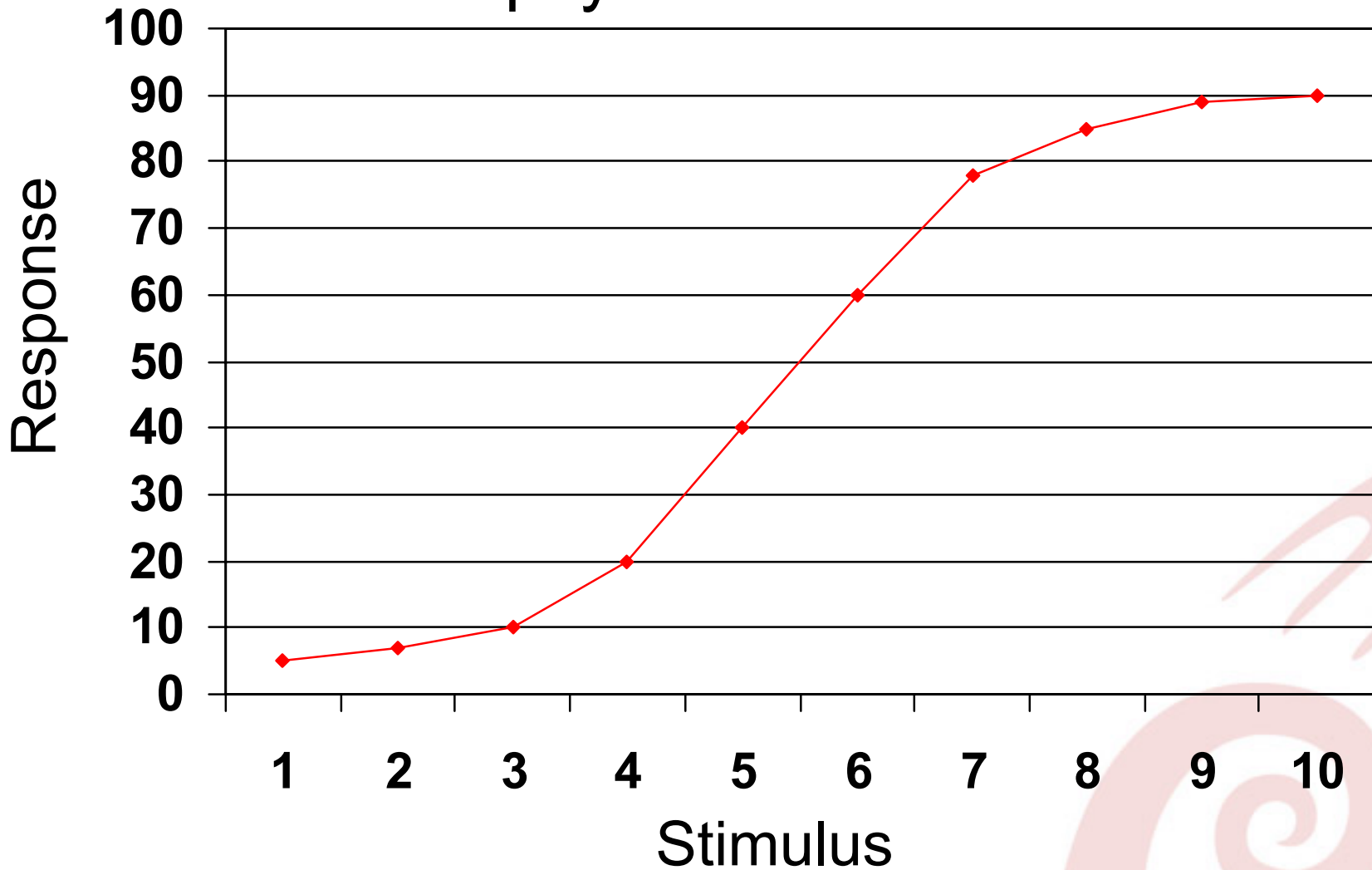
# A Sensory Order of Operations

1. Identify the attribute
  2. Rank its intensity
  3. Scale the intensity
- 

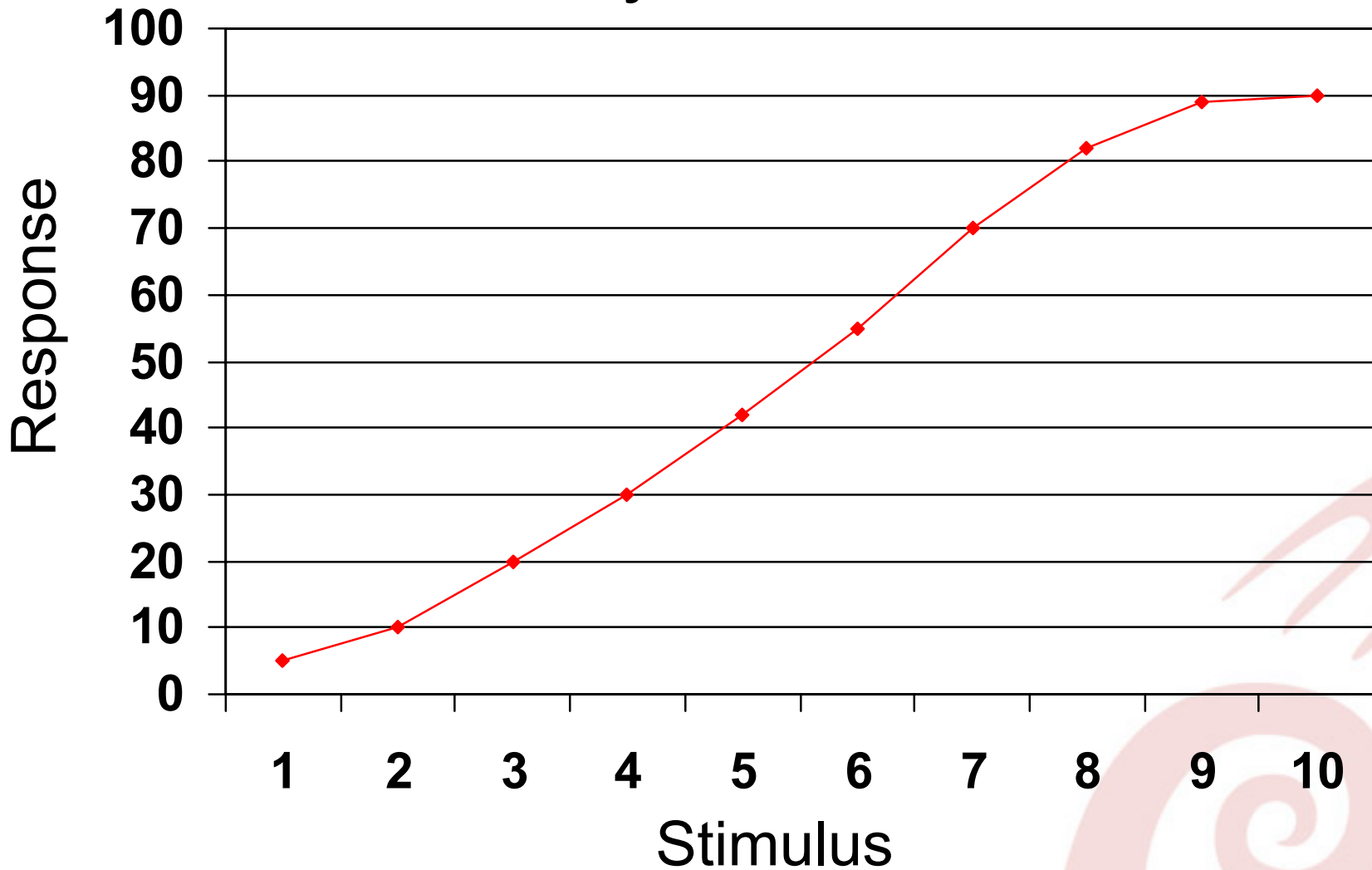
# Attribute Difficulty

<b>ATTRIBUTE</b>	<b>Scaling</b>		
<b>Identity</b>	Full	Rankable	Off/On
Specific Standard			
Group of Attributes			
Verbal or Evocative			

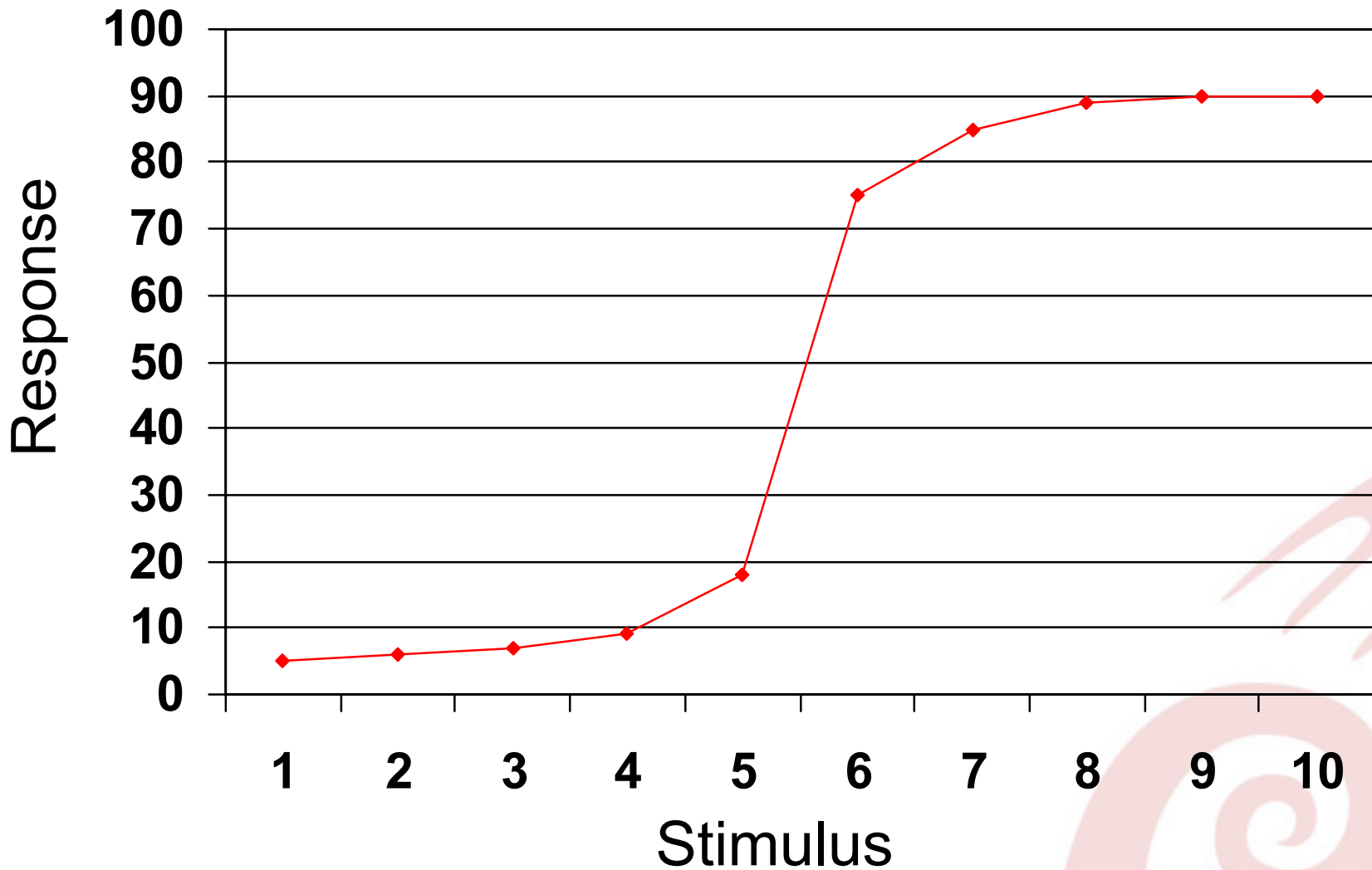
## The psychometric function



# Easy to Scale



## Difficult to scale



# The Red Wine Study

Using the Feedback Calibration Method



# Objective

- To investigate the use of immediate feedback with calibration standards as a method to improve the training process and to provide anchors which permit comparison between panels.

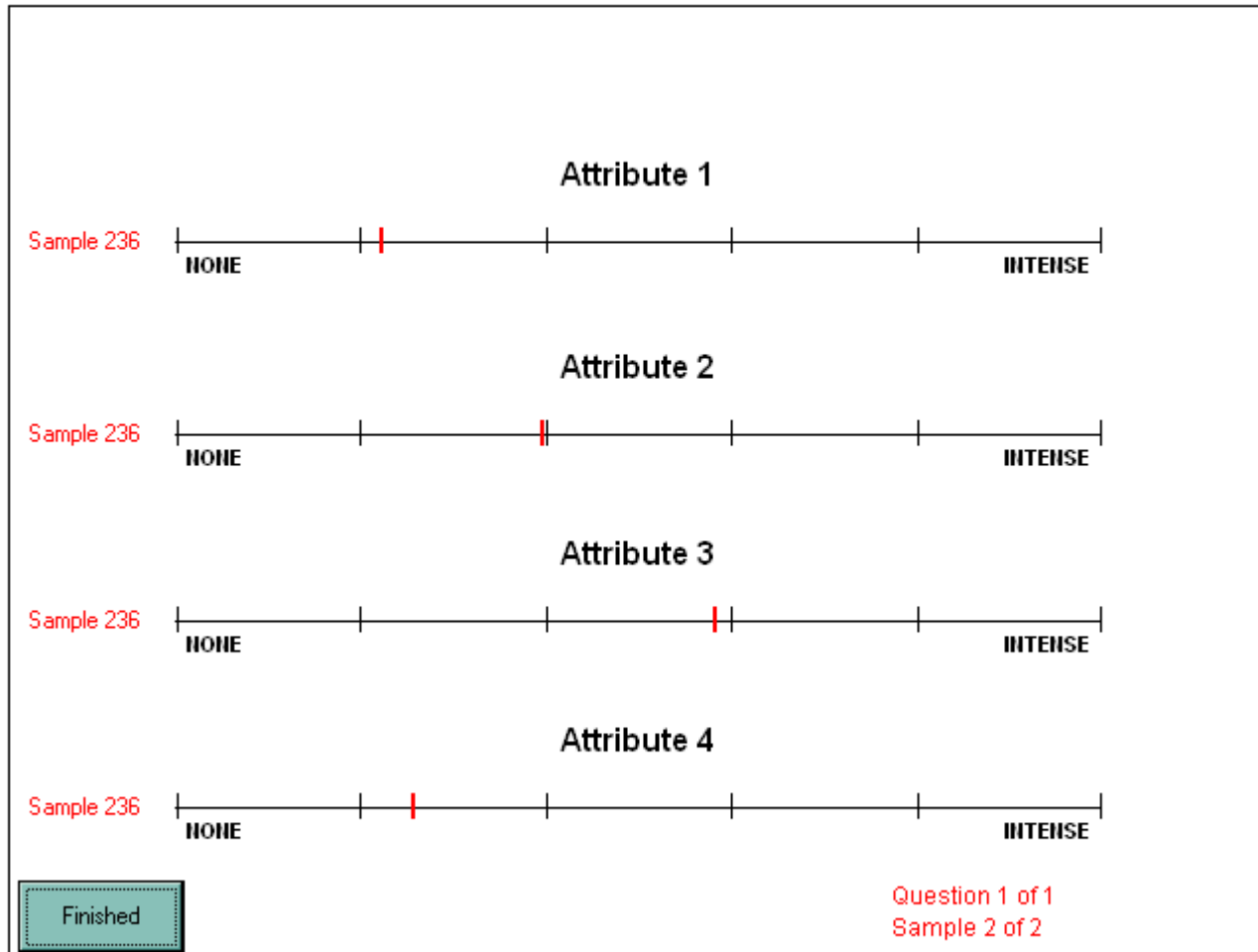
# Determination Panel

- An experienced determination panel performed descriptive profiling of 20 red wines. Their results were used to establish the attributes and targets for the second phase of the research.

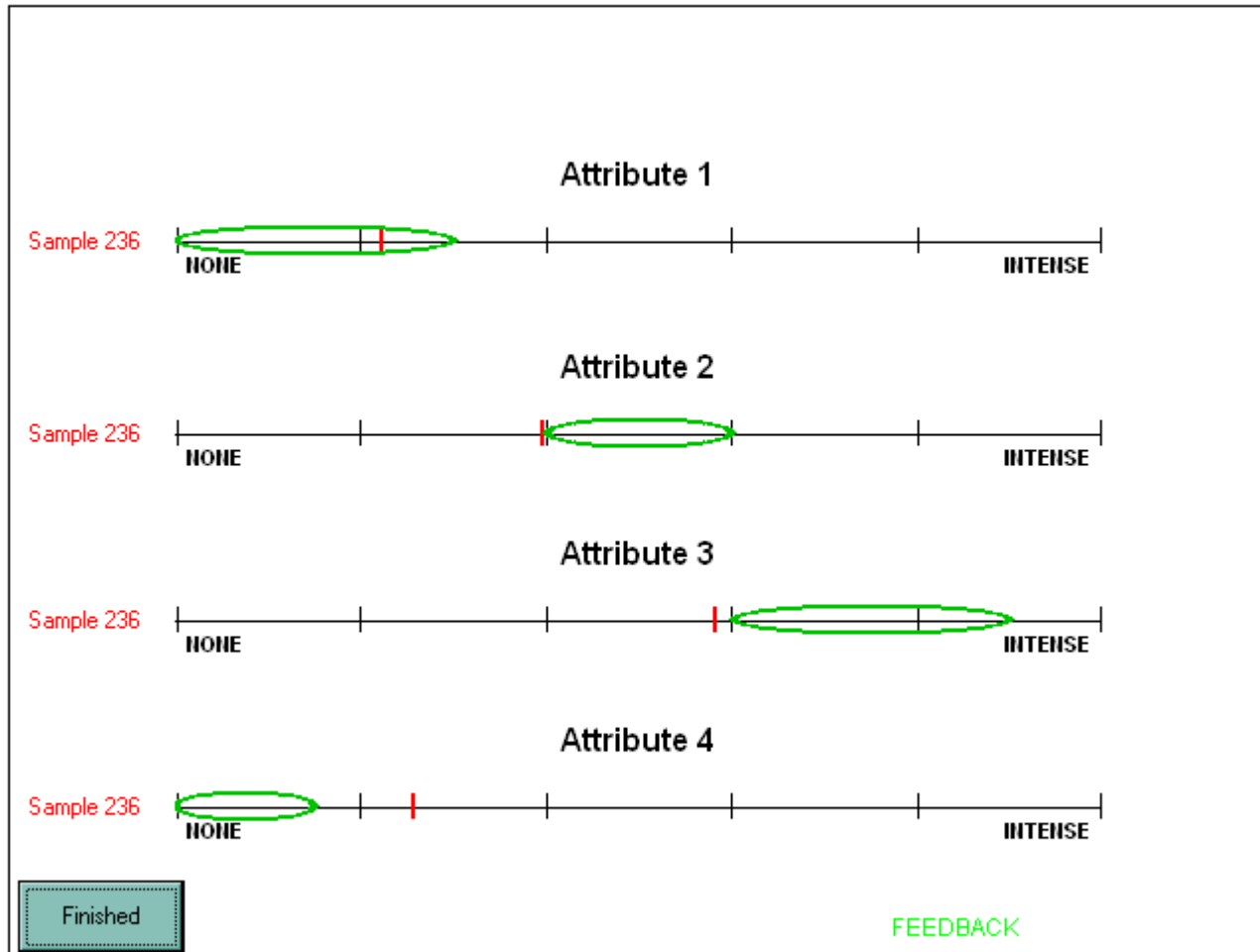




# Panelist Screen



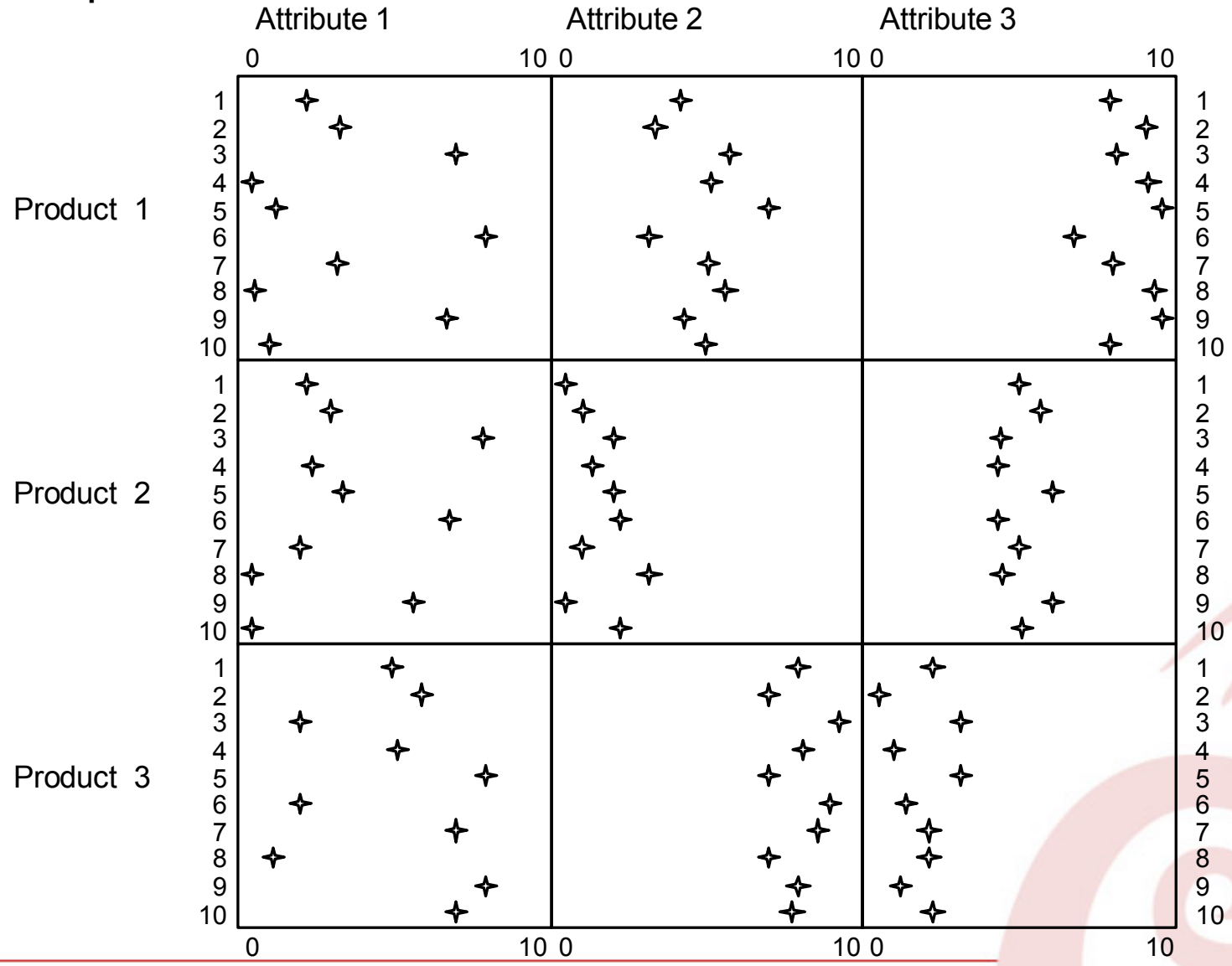
# Immediate Feedback

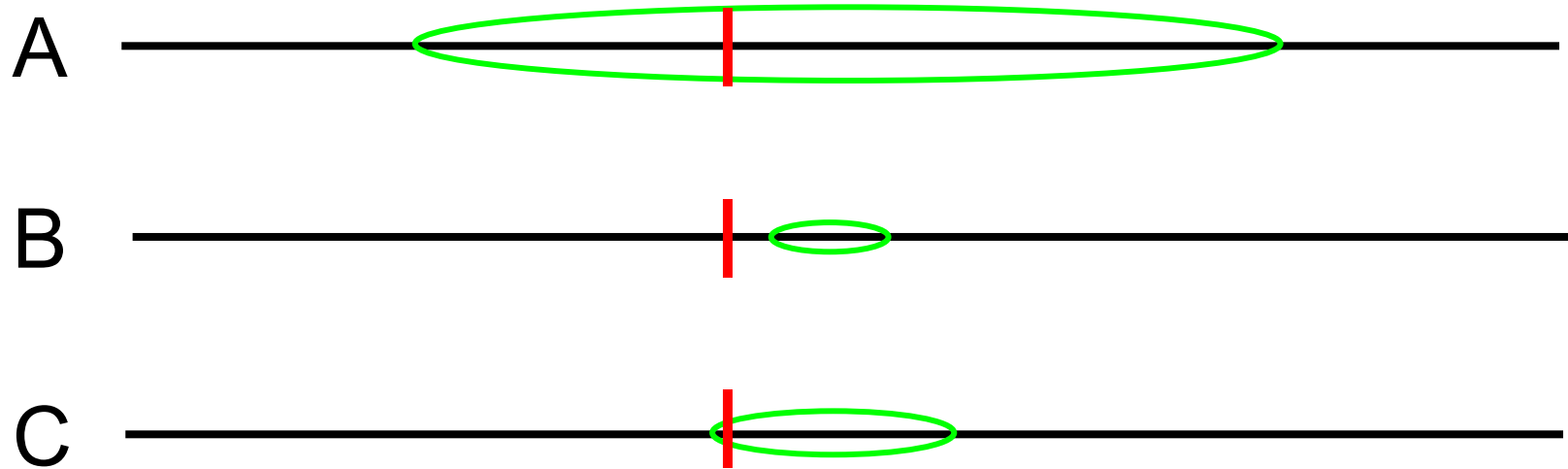


# Response Distribution

Samples

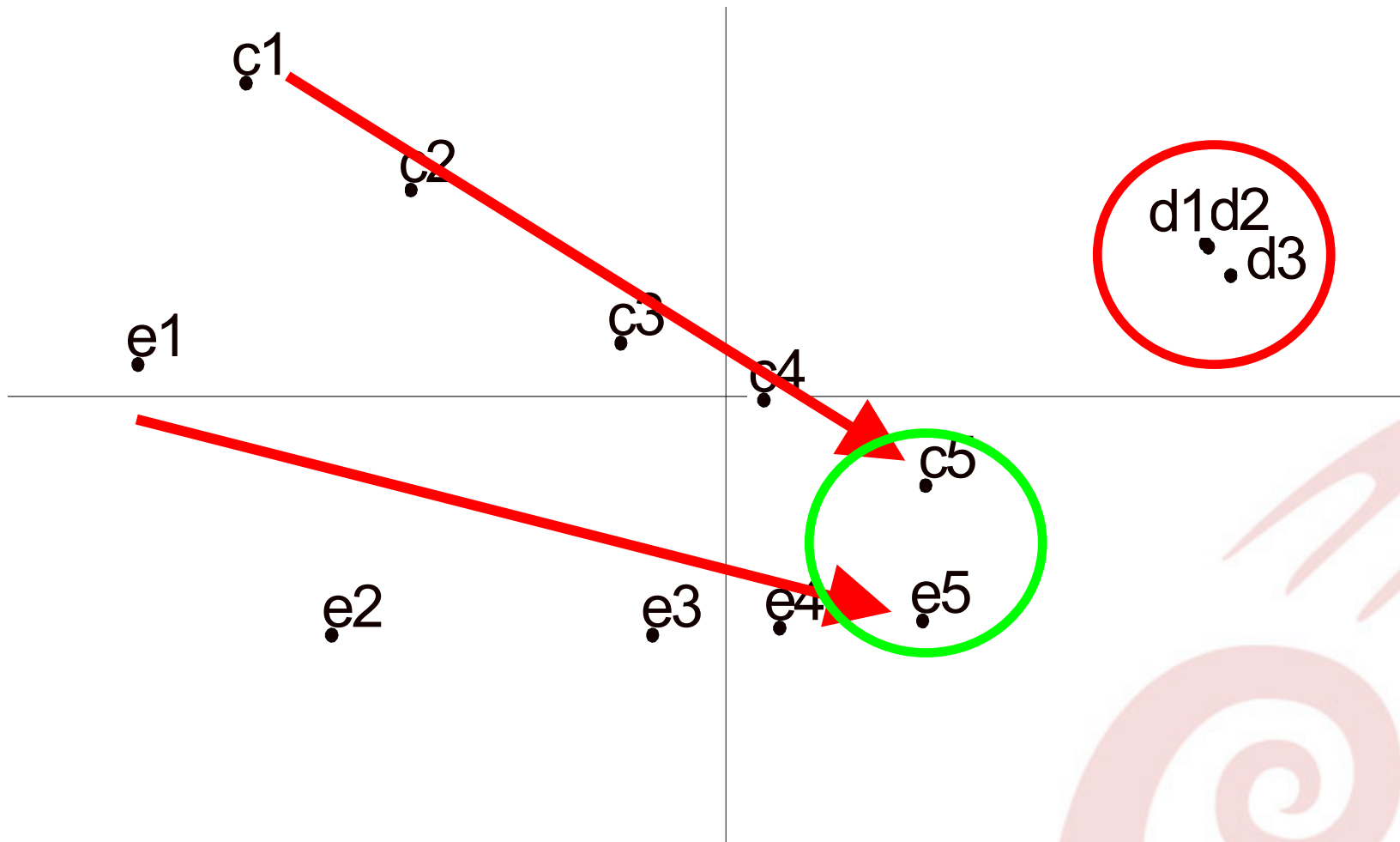
Attributes



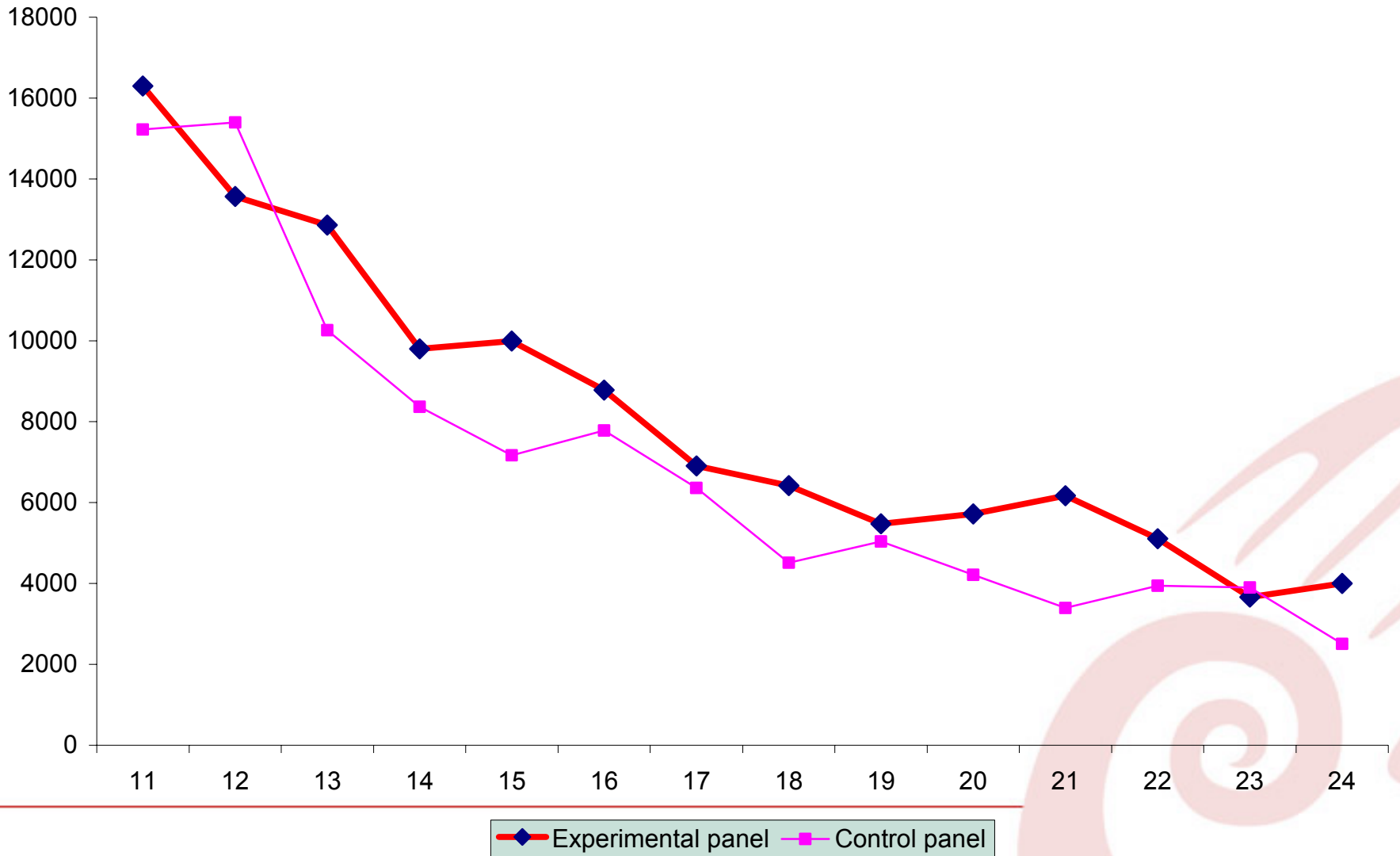


- The truth is not a fixed point
- The distribution depends on the attribute
- Attribute significance depends on the sample set used in the study

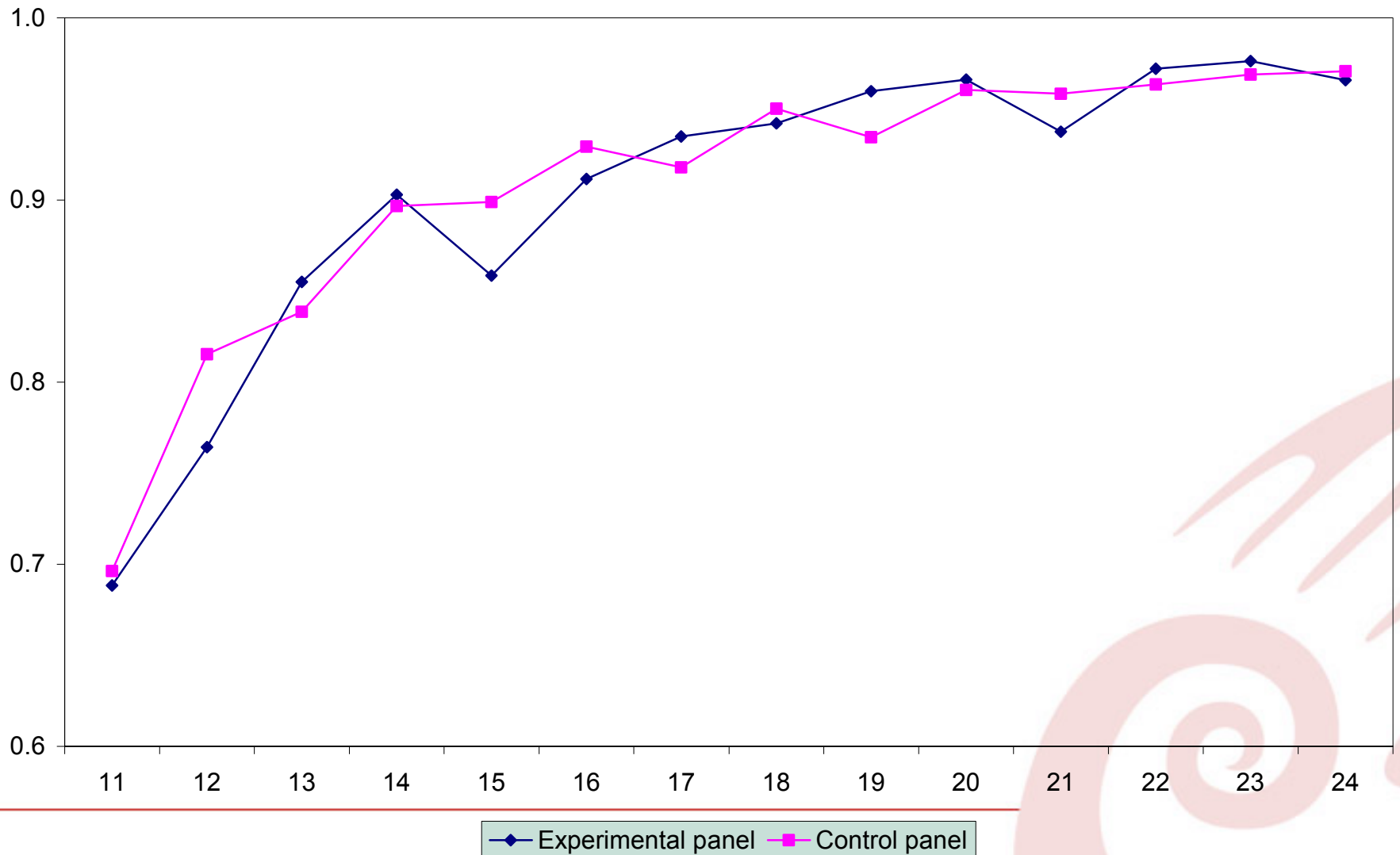
## GPA of Panel replicates



Aggregate distance from range



Pearson's r



## Conclusions from the Red Wine Study

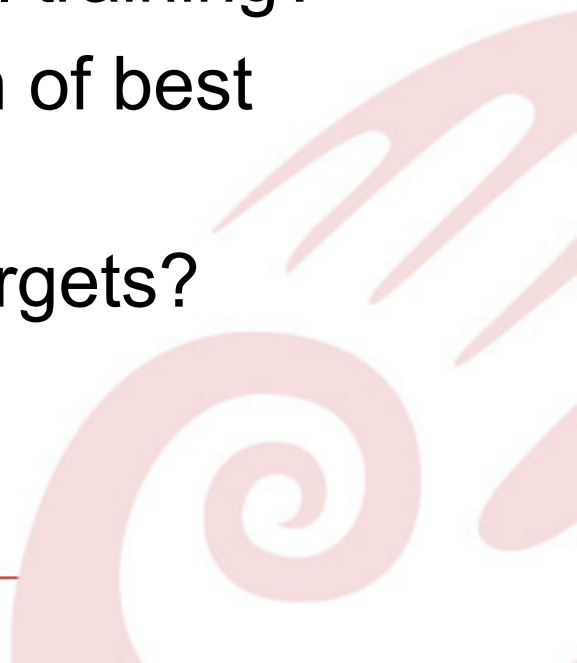
1. Feedback Calibration provides an effective and unbiased training for descriptive panelists, regardless of the style, skill or experience level of the trainer.
2. Training times can be cut significantly.

# The White Wine Study

Using Optimized Descriptive Analysis



# Optimizing DA

- Does the combination of both conventional and FCM techniques results in faster or more accurate descriptive panel training?
  - What constitutes the application of best practices?
  - Can a panel create their own targets?
- 
- A decorative graphic in the bottom right corner of the slide, featuring a large, light red spiral and several curved, brushstroke-like lines in the same color.

# The 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).

# The Study

- 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.

# The Study

- 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.

# How many attributes are enough?

- Panel D            130 attributes
- Panel T            110 attributes
- Panel U            76 attributes
  
- Additional attributes chosen from a list.

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	

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 Strirring	
		X	X	5	Flavor	
6					Feedback on 12 wines	2.5
		X	X	6	Aroma Before Stirring/ Aroma After Strirring	
		X	X	6	Flavor	
7					Feedback on 7 wines	2.5
		X	X	7	Aroma Before Stirring/ Aroma After Strirring	
		X	X	7	Flavor	
8					Feedback on 6 wines	2.5
		X	X	6	Aroma Before Stirring/ Aroma After Strirring	
		X	X	6	Flavor	
9					Feedback on 7 wines	2.5
		X	X	7	Aroma Before Stirring/ Aroma After Strirring	
		X	X	7	Flavor	
					TOTAL	22.5

# Feedback Frequency

## Panel T

	Attributes	Feedback	Events	% Possible
Session 6	150	21	42	14%
Session 7	92	59	129	73%
Session 8	152	120	316	69%
Session 9	133	101	184	55%

## Panel U

Session 6	76	33	99	43%
Session 7	76	41	114	55%
Session 8	76	48	116	56%
Session 9	76	47	100	44%

	Panel T		Panel U	
	Average Range (0 – 100)	% Correct	Average Range (0 – 100)	% Correct
<b>Session 6</b>	<b>33</b>	<b>64</b>	<b>20</b>	<b>64</b>
<b>Session 7</b>	<b>70</b>	<b>71</b>	<b>18</b>	<b>70</b>
<b>Session 8</b>	<b>66</b>	<b>49</b>	<b>14</b>	<b>66</b>
<b>Session 9</b>	<b>15</b>	<b>64</b>	<b>13</b>	<b>72</b>

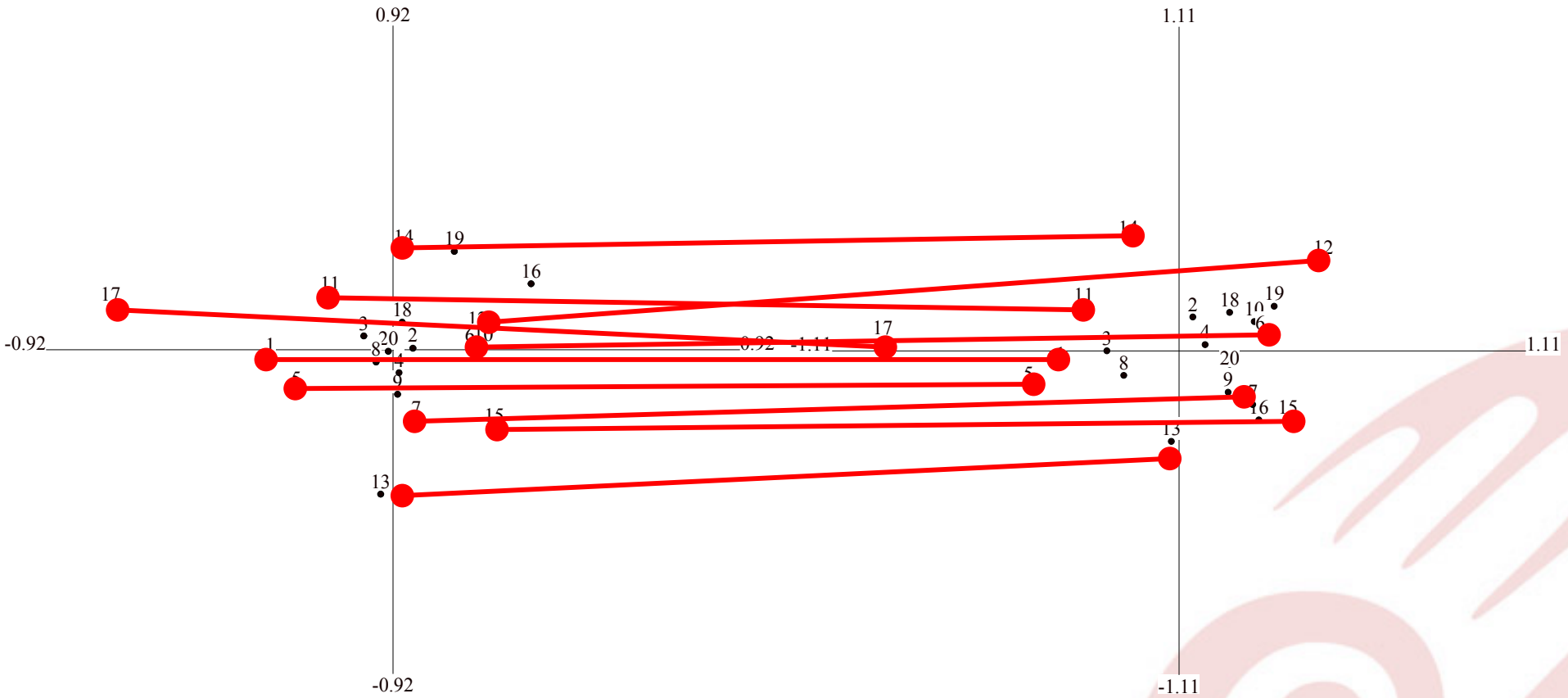
Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor	Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor
Apple	0.2900	0.1268	0.0023	Honey	0.0691	0.0165	0.0015
Green Apple	0.0356	0.2734	0.0060	Butterscotch	0.6294	-	-
Banana	0.0932	0.0172	0.1660	Brown Sugar	0.0592	0.0668	-
Grape	0.3061	0.3535	0.0668	Vanilla	0.0018	0.0004	0.0016
Peach	0.1005	0.0066	0.0004	Alcohol	0.0320	0.0325	0.0000
Pineapple	0.0006	0.0276	0.0016	Pungent (alcohol irritation)	0.0042	0.0061	0.0000
Other Tropical Fruit	0.0001	0.0200	0.0049	Nail Polish Remover	0.4528	0.3172	0.0044
Melon	0.2085	0.1932	0.0011	Solvent	-	0.0139	-
Pear	0.0541	0.0276	0.0000	Asparagus	0.0003	0.0036	-
Lemon Zest	-	0.2509	0.1657	Black Pepper	0.0779	0.0353	-
Rose	0.0805	0.7085	0.7632	Cinnamon	0.0504	0.0016	-
Elderflower	0.0001	0.0007	0.0000	Clove	0.7267	0.1846	-

Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor	Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor
Butter	0.1739	0.3329	0.1685	Rotten Wood	-	0.0028	0.0032
Earthy	0.2578	0.0288	0.0000	Yeast (Bread)	0.0887	0.2089	0.4351
Horsy/Leather	0.0107	0.1867	0.0000	Vinegar	-	-	0.0001
Sulphur (burnt matches)	-	0.0001	-				<b>Taste Mouthfeel</b>
Sulphur (cooked vegetables)	0.0000	0.0035	0.0000	Bitter	-	-	0.0000
Turpentine/Terpenes	0.0613	0.1918	0.2405	Sour/Acid	-	-	0.0000
Mushroom	0.1062	0.2263	0.0151	Sweet	-	-	0.0000
Musty	0.0030	0.0003	0.0000	Astringent	-	-	0.0000
Oak	0.0592	0.1629	0.0004	Mouth Burn (localized)	-	-	0.0000
Wet Wood/Wet Sawdust	0.3874	0.4571	0.1598	Warm (global)	-	-	0.0740
Fresh Cut Wood	0.4286	0.2739	0.4403	Prickling	-	-	0.0001
Burnt Wood	0.0957	0.0043	0.0410	Smooth	-	-	0.0000

Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor	Attribute	Aroma Before Stirring	Aroma After Stirring	Flavor
Apple	0.0128	0.0036	0.0000	Cut Grass	0.1448	0.7807	-
Peach	0.0293	0.4323	-	Mushroom	0.3281	0.3056	0.0076
Melon	0.0764	0.2743	0.0000	Earthy	0.0417	0.3941	0.0000
Pear	0.0210	0.0585	-	Alcohol	0.4657	0.4144	0.0000
Lemon	0.5981	0.3363	0.0127	Pungent (alcohol irritation)	0.0418	0.1966	0.0000
Grapefruit	0.0506	0.0052	0.0098	Nutty	0.2322	0.1428	0.0004
Pineapple	0.6900	0.1904	0.0000	Honey	0.1169	0.0022	
Rose	0.0165	0.0413	0.1706	Caramel	0.0044	0.0721	0.0000
Green Bean	0.0733	0.5398	-	Raisin	-	-	0.0000
Grape	-	-	0.0000	Smoky	-	-	0.0000
Asparagus	0.6106	0.1990	0.0211	Vanilla	0.8331	0.4013	-
Cloves	-	-	0.0000	Resinous/ Terpenes	0.0574	0.0583	-

<b>Attribute</b>	<b>Aroma Before Stirring</b>	<b>Aroma After Stirring</b>	<b>Flavor</b>	<b>Taste/ Mouthfeel</b>
<b>Oak</b>	0.1650	0.1567	0.0000	-
<b>Cedar</b>	0.0027	0.0001	-	-
<b>Medicinal</b>	0.2422	0.5369	0.0000	-
<b>Black Pepper</b>	0.8079	0.1214	0.0000	-
<b>Vinegar</b>	-	-	0.0000	-
<b>Sweet</b>	-	-	-	0.0000
<b>Sour/ Acid/ Tart</b>	-	-	-	0.0000
<b>Bitter</b>	-	-	-	0.0000
<b>Astringent</b>	-	-	-	0.0000
<b>Burn/Hot</b>	-	-	-	0.0000
<b>Cooling</b>	-	-	-	0.0000
<b>Smooth</b>	-	-	-	0.0000

## GPA of 20 wines for all attributes



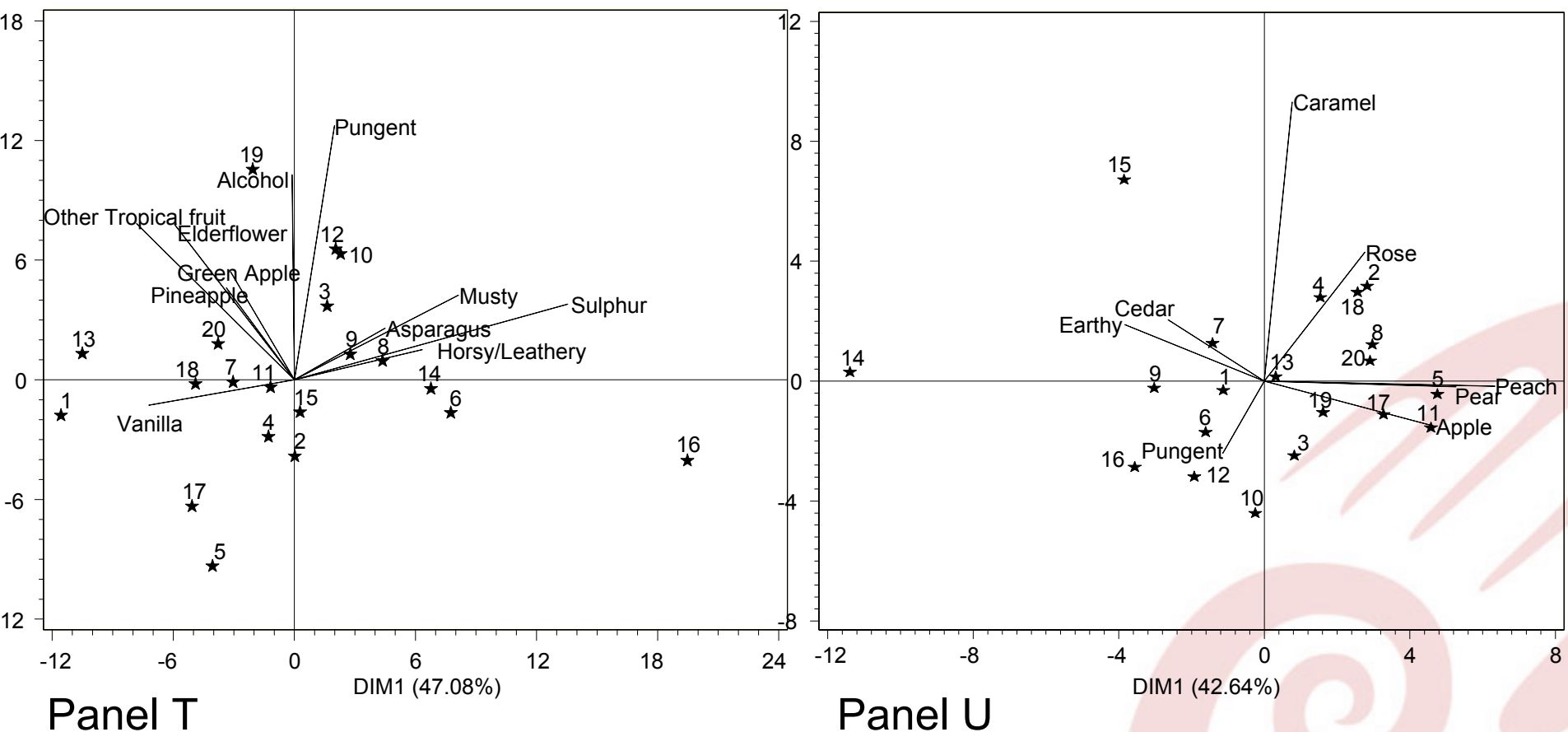
Panel T

Panel U

# Statistical Treatment

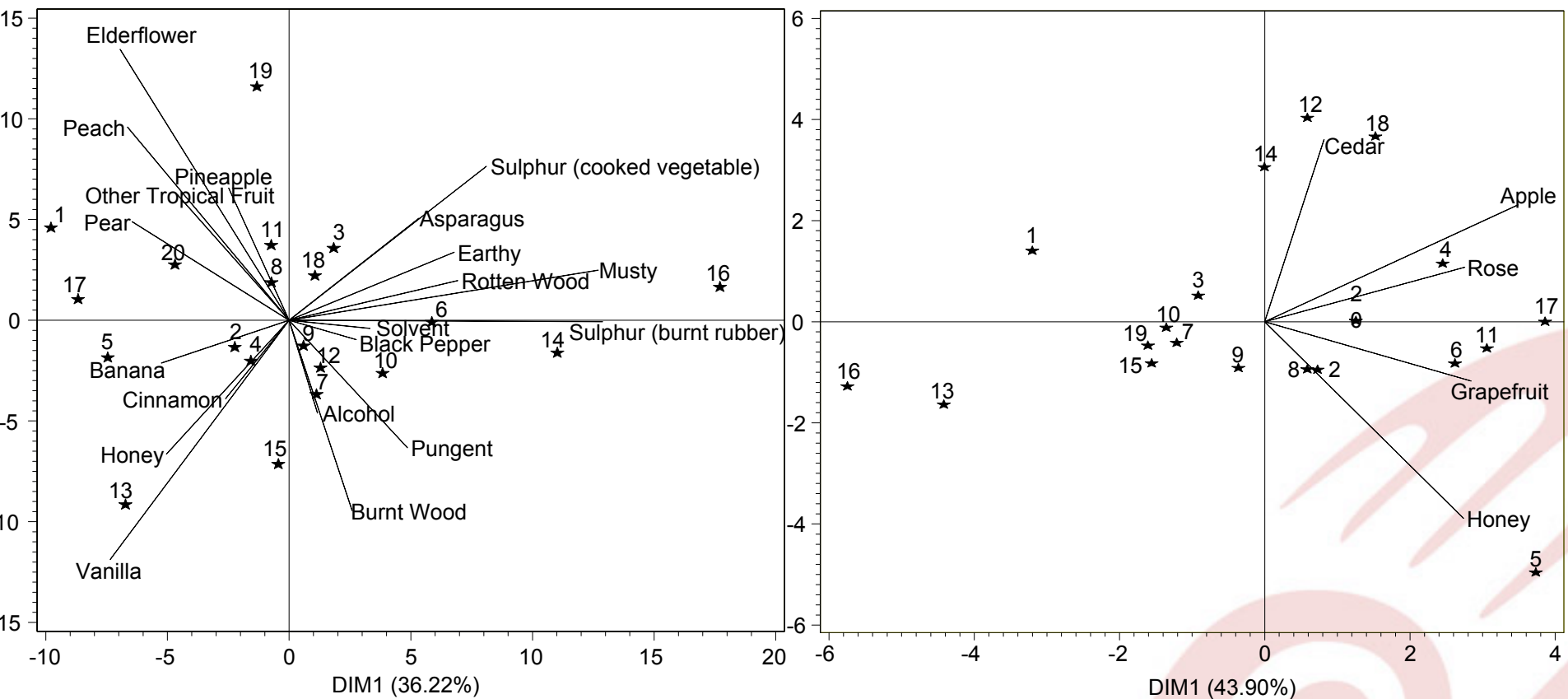
- RV was calculated to correlate the matrixes
- a normalized RV (NRV) based on permutation tests was calculated to determine whether the RV calculated was different than an RV generated by chance (Schlich, 1996).
- An NRV larger than 2 indicates that two configurations are significantly ( $p=0.05$ ) more similar than when product labels are permuted within one configuration.
- An NRV between 1.5 and 2 indicates that two configurations are slightly similar, and
- An NRV between 1 and 1.5 indicates almost no similarity. cov-PCA and the biplot projections, and RV and NRV calculations were conducted in SAS (Release V8.2, 2001, SAS Institute, Inc., Cary, NC, USA).

# ABS – Aroma Before Stirring NRV 1.8



# AAS – Aroma After Stirring

# NRV 1.3

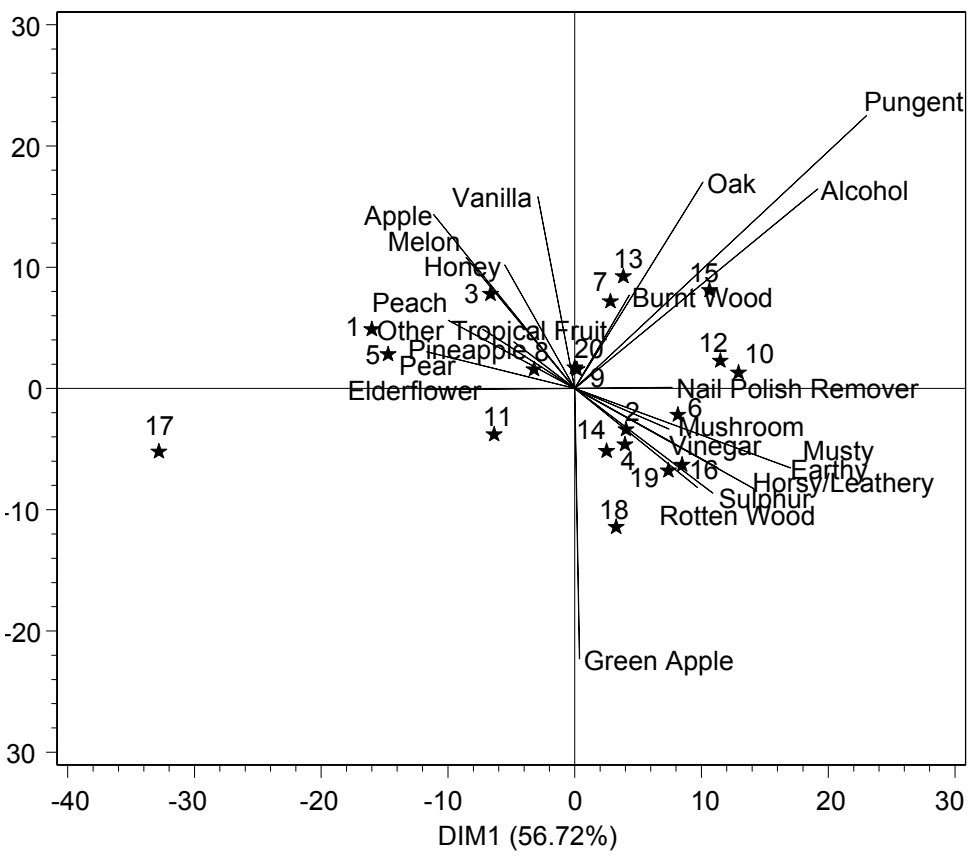


Panel T

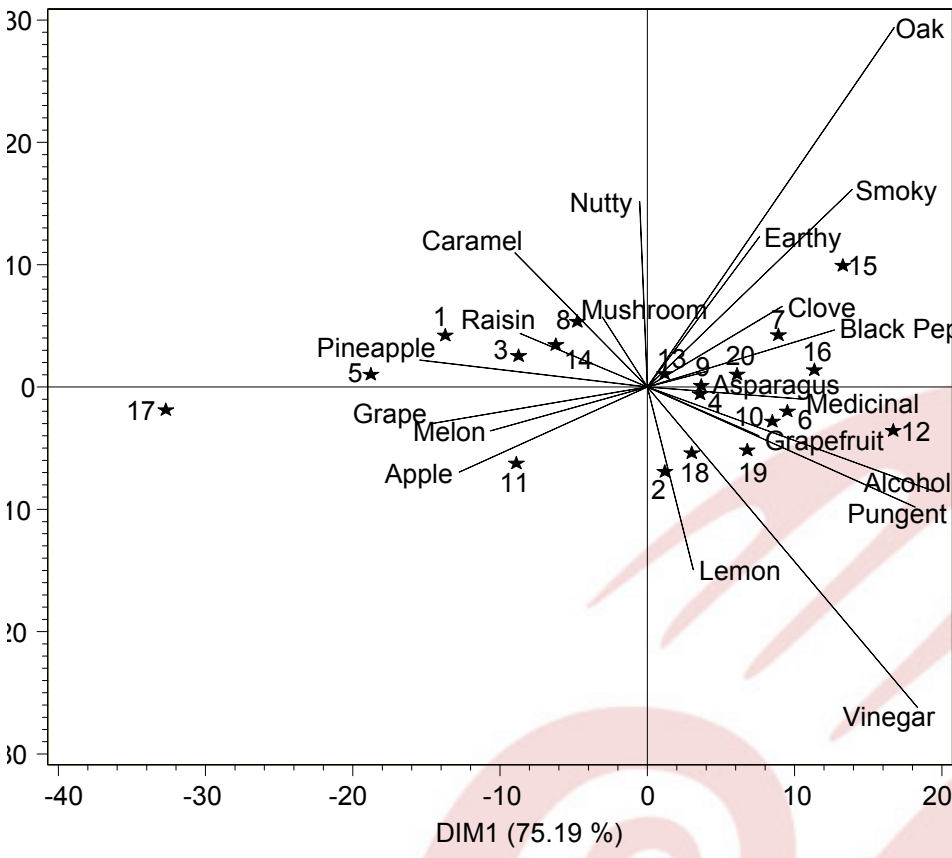
Panel U

# FLA – Flavor

# NRV 11.4

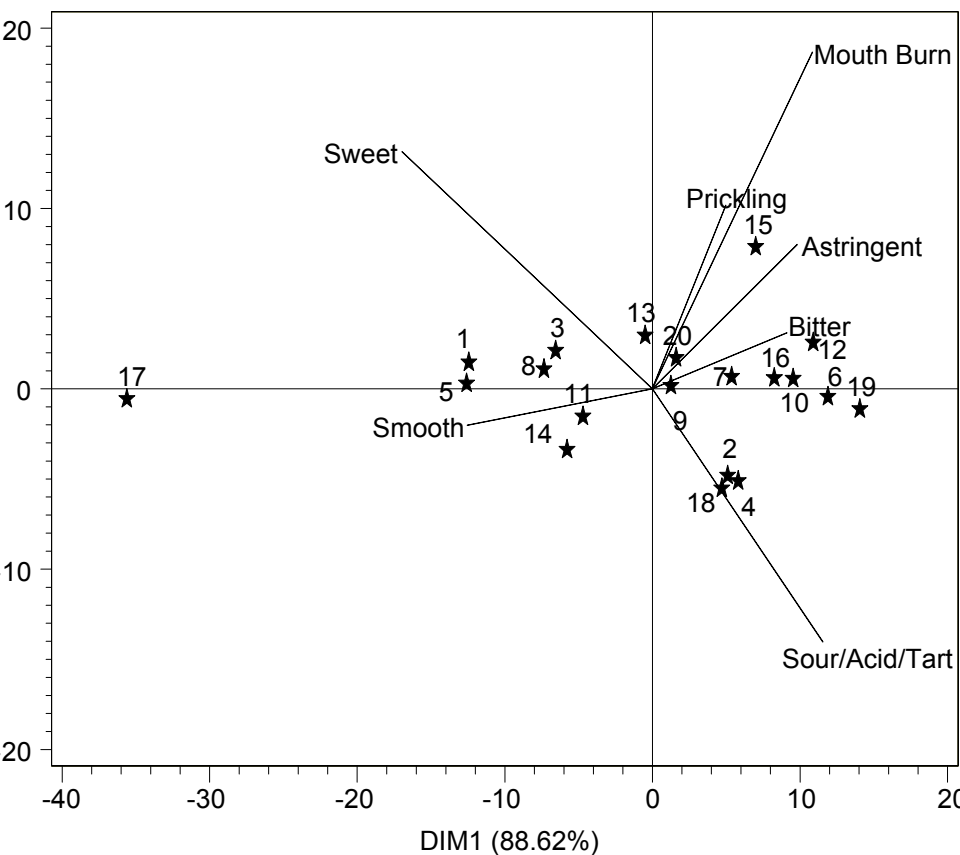
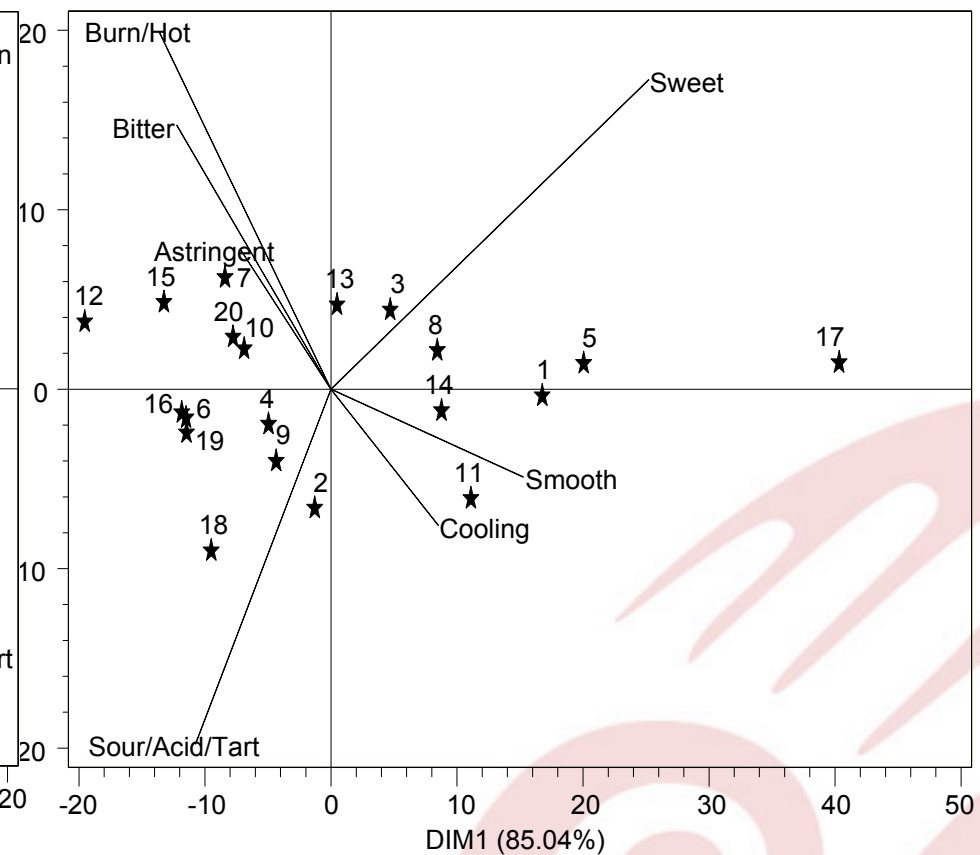


Panel T



Panel U

# TMF – Taste/Mouthfeel NRV 11.8


**Panel T**

**Panel U**

		Panel T				Panel U			
		ABS	AAS	FLA	TMF	ABS	AAS	FLA	TMF
Panel T	ABS	.							
	AAS		.						
	FLA		4.6						
	TMF	2.1		10.9	.				
Panel U	ABS	<b>1.8</b>	3.5	1.5	0.2				
	AAS	0.4	<b>1.3</b>	1.4	0.5				
	FLA	2.7	2.8	<b>11.4</b>	11.6				
	TMF	2.4	2.4	10.9	<b>11.8</b>			12.8	.

Normalized RV coefficients for Panel T and Panel U for aroma before stirring, aroma after stirring, flavor, and taste/mouthfeel

- Immediate feedback provides panelists with strong individualized method of learning attributes and scaling.
- 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 - 22.5 h versus 45 h Panel C

## Acknowledgements

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Compusense Panelists

