Understanding consumer preferences for Australian Shiraz wines with informed tasting

UniSA | Ehrenberg-Bass Institute for Marketing Science

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Executive Summary

1) **Choice experiments can simulate real purchase behaviour:**

   We simulated consumers' wine choices from a shelf in an online experiment. The relative choices of the 21 real wines in the experiment strongly relate to real market sales as indicated by AC Nielsen data (correlation of 0.75).

2) **Price and sensory characteristics influence consumers' informed wine liking:**

   If consumers taste wines informed about its price and brand, price has a strong positive influence on consumers' liking, with higher priced wines being more liked. A number of sensory characteristics, such as medicinal, oxidised, band-aid and sulfide aromas have a negative impact on liking. Fresh fruit and sweetness are positive drivers of informed liking.

3) **Previous choice and sensory characteristics influence consumers' informed purchase intent:**

   When a wine is chosen often in the online shelf simulation, it is a strong predictor of (re)-purchase intent in the informed tasting. A number of sensory characteristics also significantly influence (re)-purchase intent. Fresh fruit aromas and fruit aftertaste have a positive influence on purchase intent while medicinal aromas reduce the likelihood of purchase.

4) **Further research:**

   The prediction of online experiments can be improved by including sensory and chemical data into the model. Further research with a larger data set is necessary to disentangle which of several strongly correlated sensory components have the strongest influence.

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About the Project

Title: Determining the relative importance to wine consumers of sensory and non-sensory attributes on liking and choice: a cross-cultural study

Funded by: Grape and Wine Research and Development Corporation (GWRDC)

Project Team: University of South Australia (Prof Larry Lockshin, Dr Simone Mueller)

The Australian Wine Research Institute (Dr Leigh Francis, Patricia Osidacz)

Centre for the Study of Choice (Prof Jordan Louviere)

The aim of the project is to develop and test a new method to predict consumer response to a wide range of packaging, label information, pricing, communication devices and Shiraz wine styles. The methods applied in this project are science based and market validated for modelling and predicting consumer wine choice.

We developed and tested the method in 2007/08 in one Australian market (Sydney) for Shiraz wines and validated the outcomes against actual AC Nielsen scanner data. The project integrates theory and methods from economics and psychology (choice modelling), statistics and marketing (optimal design for choice experiments), and sensory science (wine chemistry, sensory judgements by trained tasters and consumer tastings).

More detailed information can be found:

1) The record of the presentation to GWRDC on 19 September (DVD enclosed)
2) At the project's webpage www.winepreferences.com.

Combined Sensory and Non-Sensory Experiment

This report presents findings for the wines you provided us for a large study combining online wine choices, trained panel ratings of sensory attributes, wine chemistry and large scale consumer preference testing. Thank you again for providing us with the wine samples.

The combined experiment consisted of two stages, which were completed by the same consumers:

1) **Wine choice simulation without tasting:**

   420 consumers, representative of Sydney wine consumers, participated from their homes in an online choice experiment. Respondents chose a bottle of wine to have for dinner with friends from several shelves of five wines, each with real bottle photographs (see Figure 1).

2) **Subsequent tasting and rating of wine in informed condition**

   After the online experiment the same 420 consumers participated in an informed wine tasting in a Sydney consumer testing lab (SensoMetrics, see Figure 2). Each consumer tasted five of the 21 wines previously displayed in the online experiment. As in a real life situation, consumers were informed about the brand and price of the wine they rated for liking and their purchase intent (Figure 3).

Aims of the combined experiment

The combined experiment aimed to answer the following questions:

1) Do consumer's online choices predict their real purchase behaviour and strongly relate to sales (measured by AC Nielsen market data)?

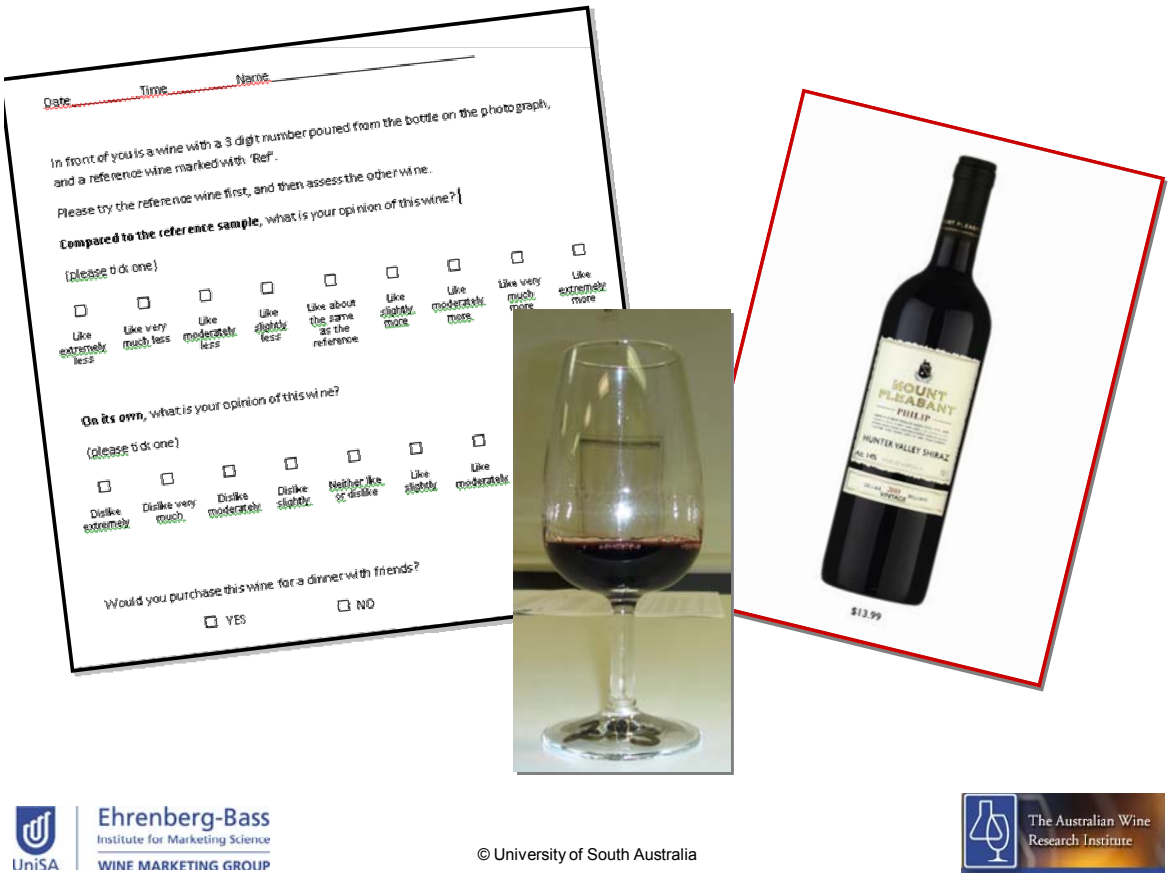
2) How important is price and previous shelf choice for wine liking and purchase intent responses when tasting the wines?

3) Which sensory properties influence consumer liking and purchase intent under informed conditions?

Figure 1 Screenshot of the online experiment

Figure 2 Central Location Test in Sydney

Figure 3 Consumers evaluate liking and purchase intent with information of wine



Selection of wines

Based on AC Nielsen data for New South Wales in 2007, we selected more than 80 Shiraz wines in the price range of $8-$26. The wines represented current vintages (2001-2006) available in the market at the time of the selection in November 2007. The basic chemical composition of these wines was measured by AWRI and their sensory characteristics were evaluated in a bench tasting by AWRI experts.

From these 80 wines 21 wines were selected for the experiment (Table 1). Wines were selected to cover a wide range of sensory properties (fruit intensity, oak, astringency, sweetness, etc.) and a wide range of extrinsic (non-sensory) characteristics, such as price points, label type, high and low sales, well known and not so well known brands and regions.

Table 1: List of the 21 Shiraz wines selected for the study.
Note that the order of the wines is not identical to the order in Tables A-C of the appendix.

Wine	Region
McGuigan Black Label	blend
Yellow Tail	blend
Jamiesons Run	Coonawarra
Rosemount	blend
Hardys Oomoo	McLaren Vale
Jacob's Creek Reserve	Barossa
Wolf Blass Yellow Label	blend
Mount Pleasant Phillip	Hunter Valley
Wynns	Coonawarra
Gramps	Barossa
Plantagenet Omrah	WA
Brookland Valley Verse 1	WA
Taylors	Clare
Redman Shiraz	Coonawarra
McWilliam's Barwang	Hilltops NSW
Mt Langi Ghiran Cliff Edge	Victoria
Serafino	Mclaren Vale
Penfolds Bin 28	Barossa
Saltram Mamre Brook	Barossa
Tyrells Rufus Stone	Heathcote Vic
Penfolds Bin 128	Coonawarra

Sensory descriptive analysis

The AWRI trained sensory panel, consisting of 13 assessors recruited from the local community, evaluated the sensory characteristics of all 21 wines in triplicate using a consumer-based non-technical set of descriptors.

The sensory descriptive analysis resulted in a solution with four dimensions (principal components), see Figures A to C in the appendix:

- Principal Component 1: fruity/vanilla aromas versus brown colour and medicinal/aged aromas
- Principal Component 2: sweet/red berry versus astringent, warmth, oak, darker colour
- Principal Component 3: sulfide (only one wine had a high loading on this axis)
- Principal Component 4: black pepper (only a few wines showed this characteristic)

The arrows in the charts show the direction of sensory descriptors (e.g. vanilla, fresh fruit or sour). A wine's location in the coordinate system indicates its sensory characteristic as measured by the trained panel. The arrows that lie closest to a wine's position most strongly represent its sensory spectrum.

Chemical analysis

A detailed chemical analysis of the wines is given in Tables B and C of the appendix.

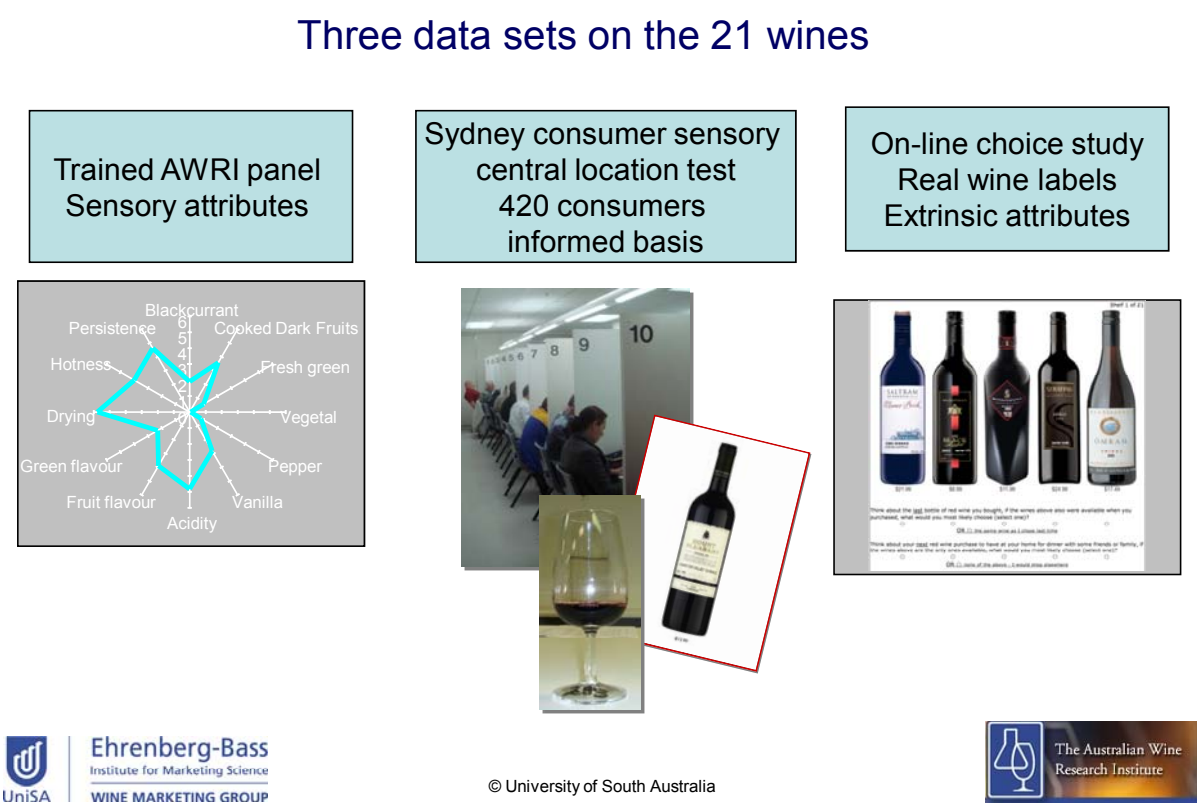
Table 2: Chemical components measured

Chemical component	Indicator for
Alc in % vol	Indicates alcohol content
pH	pH-value (acidity)
Titratable Acidity in g/L	As Tartaric Acid (acidity)
RS in g/L	residual sugar: glucose + fructose: indicates sweetness
Acetic Acid in g/L	VA, volatile acidity
Tannin in mg/L	Indicates astringency
4-Ethyl-guaiacol in µg/L	Indicator of Brettanomyces aroma
4-Ethyl-phenol in µg/L	Indicator of Brettanomyces aroma
4-Methyl-guaiacol in µg/L	Indicator of oak aroma: smoky
5-Methyl-furfural in µg/L	Indicator of oak aroma: caramel
Cis-Oak Lactone in µg/L	Indicator of oak aroma: coconut
Trans-Oak Lactone in µg/L	Indicator of oak aroma: woody
Eugenol in µg/L	Indicator of oak aroma: spicy
Furfural in µg/L	Indicator of oak aroma: caramel
Guaiacol in µg/L	Indicator of oak aroma: smoky
Vanillin ug/L	Indicator of oak aroma: vanilla

Results

The three different data sets from the combined experiment were used for the analysis singularly or in combination (see Figure 4).

Figure 4 Overview of combined experiment data obtained



1) Do consumer's online choices predict their real purchase behaviour and relate to sales (measured by AC Nielsen market data)?

Table A in the appendix contains AC Nielsen sales data for 2007 (volume in '000 Litre and value in $ 000) and the results of the online choice experiment. The choice indicator was calculated from the aggregated choices over all 420 consumers. If a wine was chosen as best out of the five options on the shelf, it increased the choice indicator. If it was chosen as worst, then it decreased the choice indicator. Thus, the larger the choice indicator, the more often the wine has been chosen as best. The rank data reflects this: for example the wine with a choice indicator of 2.03 was ranked first.

There is a quadratic relationship between choice indicator and price, indicating that mid-priced wines are more often chosen than low or high priced wines. The correlation between sales volume and the choice indicator is high and significant (0.75). Accordingly, a wine is more likely to be chosen on the shelf if it already had high sales. Several factors are responsible for this high positive relationship:

a) Consumer habits:

   Because wine is an 'experience good' (can only be evaluated after it is purchased) consumers tend to choose and repurchase wines from the same repertoire for which they previously had positive experiences.

b) Availability determines mind share:

   Consumers can only choose a wine that is available on the shelf. Wines that are more often available, and thus generally more known to the consumer, have a larger share in a consumer's consideration set and are more likely to be chosen and remembered.

The relationship between wine sales and choice in the online experiments improves if chemical characteristics are included in the model. Because of the limited data set size of only 21 wines and the large number of chemical and sensory characteristics (Tables B, C and Figures A-C in the appendix) a unique selection is not possible (there are too many independent variables). As a preliminary finding the sugar content (RS) had a positive influence on sales, that is, the sweeter a wine, the greater the sales figures for this sample set. Note that of the 21 wines studied, only three had RS greater than 4 g/L, all lower priced/high volume/well known large company wines

Our findings confirm that it is not easy for a new wine or winery to enter the market and to gain substantial share. Previous sales have a high predictive power for future sales. Sensory characteristics appear to have some influence on online choice, but further research with a larger data set than only 21 wines is needed to identify the most important chemical and sensory cues.

Because we used real bottle photographs and the packaging of the 21 wines was not varied in a systematic way we cannot conclude which effect label style or colour have from the real bottle online experiment. These insights can only be provided from an experiment where packaging characteristics are independently varied as we did in the graphical discrete choice experiment, which run independently of the real bottle experiment we report here. Further details on this graphical wine bottle experiment varying four different label styles and four label colours can be found in the presentation on the DVD. We will also present these findings in an article in the Australian and New Zealand Wine Industry Journal in early 2009 which you will also find on our webpage www.winepreferences.com after it was published.

Overall our results give evidence that online choice experiments are a valid research instrument to predict consumers' real purchase behaviour. This is an important insight as the history of marketing research using instruments of attitude measurement and stated purchase intent have not provided satisfactory predictions for what consumers really do in the market place. Online choice experiments can be carried out fast and cost-effective and provide an efficient and valid alternative to other wine marketing research methods.

2) What explains consumers' wine liking in an informed tasting?

In the informed tasting consumers rated how well they liked a wine with a structured 9-point scale (dislike extremely to like extremely). The right side of Table A gives the average liking and standard deviation for each wine including its rank.

The indicated liking did not relate to the sales volume of a wine, nor the previous choice in the online experiment. That is, wines that were most liked when tasted were not necessarily chosen often in the online study and were not necessarily high in actual sales. By combining the consumer liking data with the sensory descriptions from the trained sensory panel, the price of the wine, and the online choice values, we were able to find drivers that influence consumer liking. The relationship between liking and key wine attributes is depicted in Figure D in the appendix.

- Price was the strongest positive driver of liking (red arrow): the higher the price of the wine, the higher consumer rated his or her liking (price is located closest to the blue liking arrow in Figure D).
- The sensory characteristics fresh fruit, dark fruit, oak and purple/darker colour in the upper right quadrant were re positively associated with liking.
- Wines of older vintages were less liked. These were characterised by medicinal, band-aid, sherry-like aromas and had a browner colour (left upper quadrant).
- Reductive sulfidic wine characteristics are disliked by consumers. Wines characterised by the trained consumer panel with earthy-vegetal and cooked egg aromas were a negative driver of consumers' liking (lower left quadrant).

Our findings indicate that consumers use extrinsic attributes like price as a proxy to help them to evaluate the sensory quality of a wine: they are likely to have an expectation before tasting regarding how pleasant a wine might be based on how expensive it is. Not surprisingly, if consumers are informed about the price of a wine it has a strong influence on their liking evaluation. Nevertheless we also found sensory attributes to be important for consumers' liking. Negative drivers such as aromas of older wines, sulfider characteristics and earthy-vegetal aromas negatively influence consumers' evaluations. This is of great interest as all the wines studied were current vintages, and it provides strong guidance to wine companies to guard against having wines on the market with even low levels of reductive or oxidative flavours. For example, the wine with the highest cooked egg/sulfide flavour was one of the least liked wines, but was produced by one of the largest wine companies in Australia, and had received a gold medal at the Adelaide wine show a few months prior to the test, presumably when the reductive character was not so evident. Based on these first findings this negative influence is stronger than the positive influence of characteristics such as fruitiness and oak.

Note that one wine was excluded when investigating this data set because unfortunately different batches were delivered to the consumer tasting and to the trained consumer panel, which did not allow connecting both data sets. Thus only 20 wines were investigated

3) Which sensory and non-sensory properties influence purchase intent under informed conditions?

After the rating of a wine's liking consumers, indicated if they would purchase the wine they had just tasted for the given price (0: no, would not purchase and 1: yes, would purchase). Again we combined all three data sets to determine the positive and negative drivers of purchase intent in an informed condition. The results are summarised in Figure E in the appendix.

While the subject's choice in the online experiment had no influence on his or her liking of a wine, it was the most important driver of purchase intent. That is, a wine previously chosen in the shelf simulation was a strong predictor for re-purchase after the wine was actually tasted.

Several sensory characteristics had a positive or negative influence on purchase intent after taking into consideration the choice. Characteristics described by the trained consumer panel as 'fresh fruit' and 'fruit aftertaste' were two strongest positive drivers of purchase intent while wines with medicinal aromas were less likely to be purchased (see Figure E).

Price had no direct influence on purchase intent. Because price was known to the consumers in the online experiment, it is also captured by the variable 'online choice' which strongly influences purchase intent.

If consumers are informed about the wine when tasting it, their choice without tasting (online choice) has a strong influence on purchase intent. Thus, the biggest predictor of (re-) purchase intent after tasting the wine while viewing its label and price is whether the person had chosen the wine previously in the online experiment. Sensory characteristics influence this re-purchase to a smaller extent. Further research with a larger data set is required to refine the results and to disentangle the relative influence of sensory and other characteristics which are often highly correlated and therefore cannot be fully separated.

Table A: Results of online choice and subsequent informed sensory consumer test

Wine	ACN sales vol	ACN sales value	Online choice experiment			Sensory consumer test				
	in Litre 000s	$ ('000)	Experiment retail price	Choice indicator	Rank choice experiment	liking mean 9 point scale	liking stdev	liking rank	purchase intent mean 0 or 1	purchase intent rank
1	26.3	556.5	$16.99	1.10	9	5.31	2.02	21	0.45	21
2	0.6	16.3	$15.99	0.89	14	6.09	1.94	9	0.61	5
3	50.8	987.1	$14.99	0.83	16	5.57	1.98	17	0.48	18
4	85.0	1,537.9	$14.49	1.71	2	6.02	1.79	10	0.62	4
5	28.0	501.3	$12.99	1.34	6	5.93	1.74	12	0.63	3
6	378.2	4,566.6	$8.99	0.64	18	5.89	2.10	13	0.59	9
7	26.0	698.5	$16.99	1.58	4	5.84	1.86	16	0.52	17
8	74.9	1,400.6	$13.99	1.23	7	5.49	2.01	20	0.47	19
9	0.5	15.9	$24.49	0.56	21	6.55	1.60	1	0.55	15
10	49.3	1,608.9	$25.99	0.94	13	6.38	1.84	3	0.61	6
11	35.3	1,181.5	$25.99	1.09	11	6.44	1.92	2	0.63	1
12	3.8	74.8	$17.49	0.87	15	6.17	1.67	6	0.56	14
13	26.9	617.4	$16.99	1.22	8	5.50	2.00	19	0.46	20
14	142.3	2,308.0	$11.99	1.09	10	5.99	1.95	11	0.57	12
15	12.6	263.7	$21.99	1.00	12	6.18	1.87	5	0.56	13
16	1.3	38.3	$24.99	0.59	19	6.16	1.83	7	0.57	11
17	108.9	2,251.4	$15.99	1.56	5	5.85	1.90	15	0.61	7
18	8.6	217.4	$17.99	0.75	17	6.18	1.79	4	0.60	8
19	64.2	1,180.8	$14.49	1.69	3	6.11	1.81	8	0.63	2
20	163.6	3,230.1	$14.99	2.03	1	5.87	1.92	14	0.59	10
21	122.1	1,594.2	$9.99	0.56	20	5.53	1.87	18	0.53	16

ACN data refer to: January - December 2007

Table B: Chemical analysis results – part I

Wine	Vintage	Alc	Ph	Tart Acid	RS	Acetic Acid	Tannins	4-Ethyl-guaiacol	4-Ethyl-phenol	4-Methyl-guaiacol	5-Methyl-furfural
		%		g/L	g/L	(mg/L)	µg/L	µg/L	µg/L	µg/L	µg/L
1	2006	14.1	3.6	6.3	1.7	0.43	1,807	nd	nd	8	47
2	2005	14.7	3.5	6.5	0.9	0.68	2,139	nd	nd	9	96
3	2006	14.3	3.5	6.4	0.9	0.58	2,237	nd	nd	4	58
4	2004	14.4	3.5	6.3	0.9	0.60	2,116	nd	nd	9	61
5	2005	14.7	3.5	6.3	0.7	0.46	1,312	nd	24	3	46
6	2006	13.4	3.5	6.4	16.0	0.44	1,102	nd	nd	4	14
7	2001	14.0	3.3	6.8	0.8	0.43	1,629	39	390	6	15
8	2003	14.3	3.4	6.8	0.9	0.77	2,319	47	454	10	12
9	2004	14.7	3.5	6.8	0.5	0.66	2,012	nd	12	5	36
10	2004	14.6	3.6	6.5	0.7	0.54	2,121	nd	58	7	20
11	2006	14.9	3.5	6.6	0.8	0.62	2,278	nd	58	7	54
12	2005	14.7	3.6	6.6	0.7	0.90	1,927	nd	97	4	34
13	2004	12.9	3.4	6.6	0.2	0.41	2,360	16	155	5	27
14	2006	13.6	3.6	5.7	4.7	0.56	1,288	nd	nd	2	20
15	2005	15.2	3.5	6.9	0.7	0.68	2,373	nd	17	7	96
16	2006	15.0	3.4	7.0	1.0	0.55	1,585	nd	16	7	197
17	2006	14.6	3.4	6.8	1.2	0.64	1,876	nd	48	7	35
18	2005	15.7	3.4	7.0	0.9	0.63	1,591	nd	45	6	84
19	2006	13.8	3.6	6.2	0.8	0.51	1,450	nd	40	5	71
20	2006	14.2	3.6	6.1	1.0	0.59	1,960	nd	18	7	147
21	2007	13.7	3.51	6.7	7.4	0.36	1,878	nd	42	30	88

nd = Not Detected

Table C: Chemical analysis results – part II

Wine	Vintage	Cis-Oak Lactone	Eugenol	Furfural	Guaiacol	Trans-Oak Lactone	Vanillin
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1	2006	75	13	287	18	36	167
2	2005	689	47	45	28	86	352
3	2006	135	16	440	22	30	147
4	2004	297	28	217	26	62	180
5	2005	129	14	335	18	18	115
6	2006	48	nd	410	10	nd	55
7	2001	430	39	470	25	70	105
8	2003	517	50	347	34	73	153
9	2004	199	28	221	22	79	134
10	2004	252	21	378	26	33	231
11	2006	191	21	236	23	92	311
12	2005	150	20	233	22	66	198
13	2004	320	26	345	24	48	112
14	2006	34	nd	264	15	nd	75
15	2005	396	39	605	25	87	238
16	2006	361	33	751	24	74	384
17	2006	280	23	295	27	47	169
18	2005	234	30	315	21	74	238
19	2006	71	nd	353	19	18	136
20	2006	162	15	353	21	40	229
21	2007	35	nd	874	26	16	555

nd = Not Detected

Figure A: Descriptive sensory characterisation by sensory panel – Dimension I and II

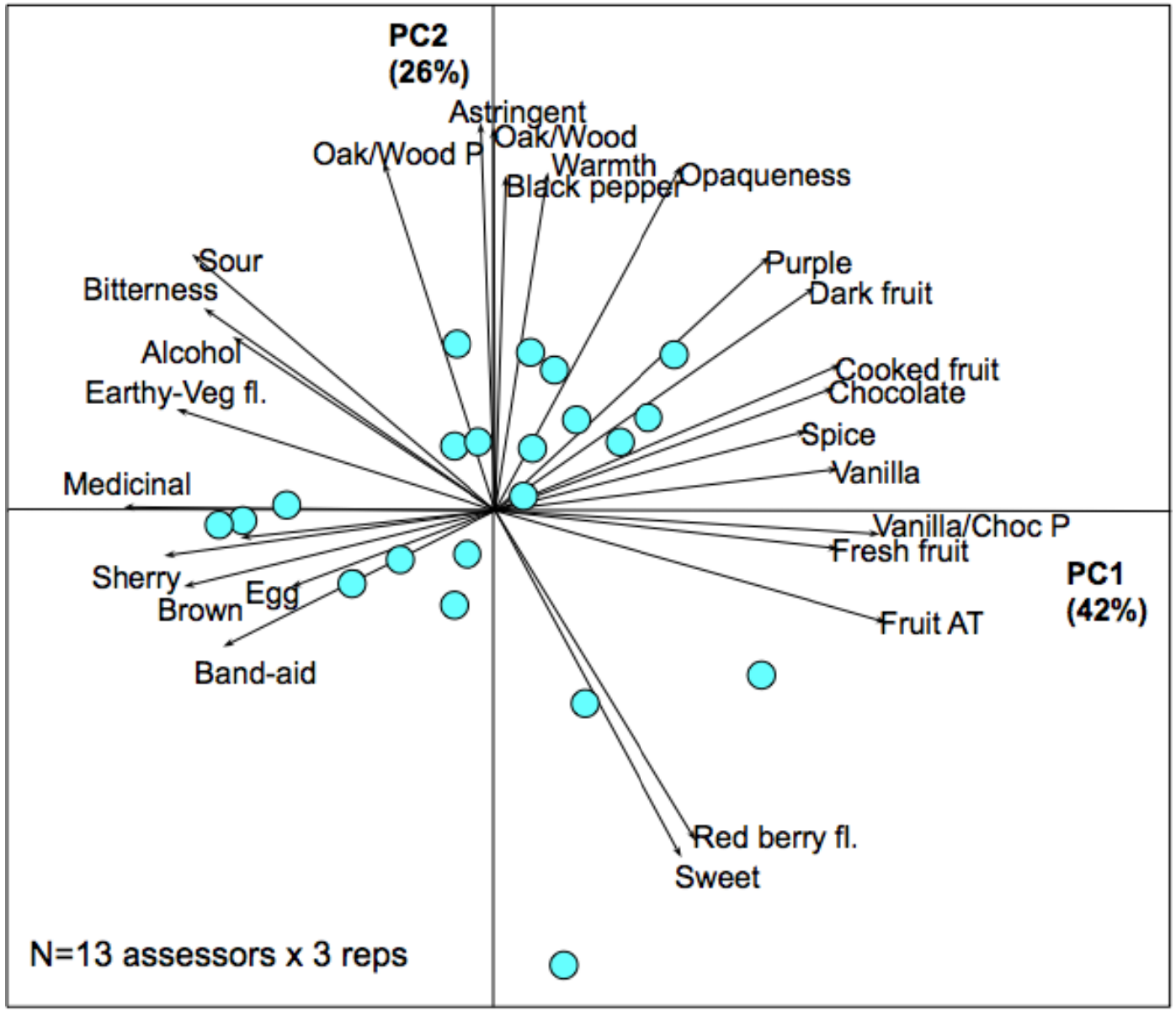


Figure B: Descriptive sensory characterisation by sensory panel – Dimension I and I

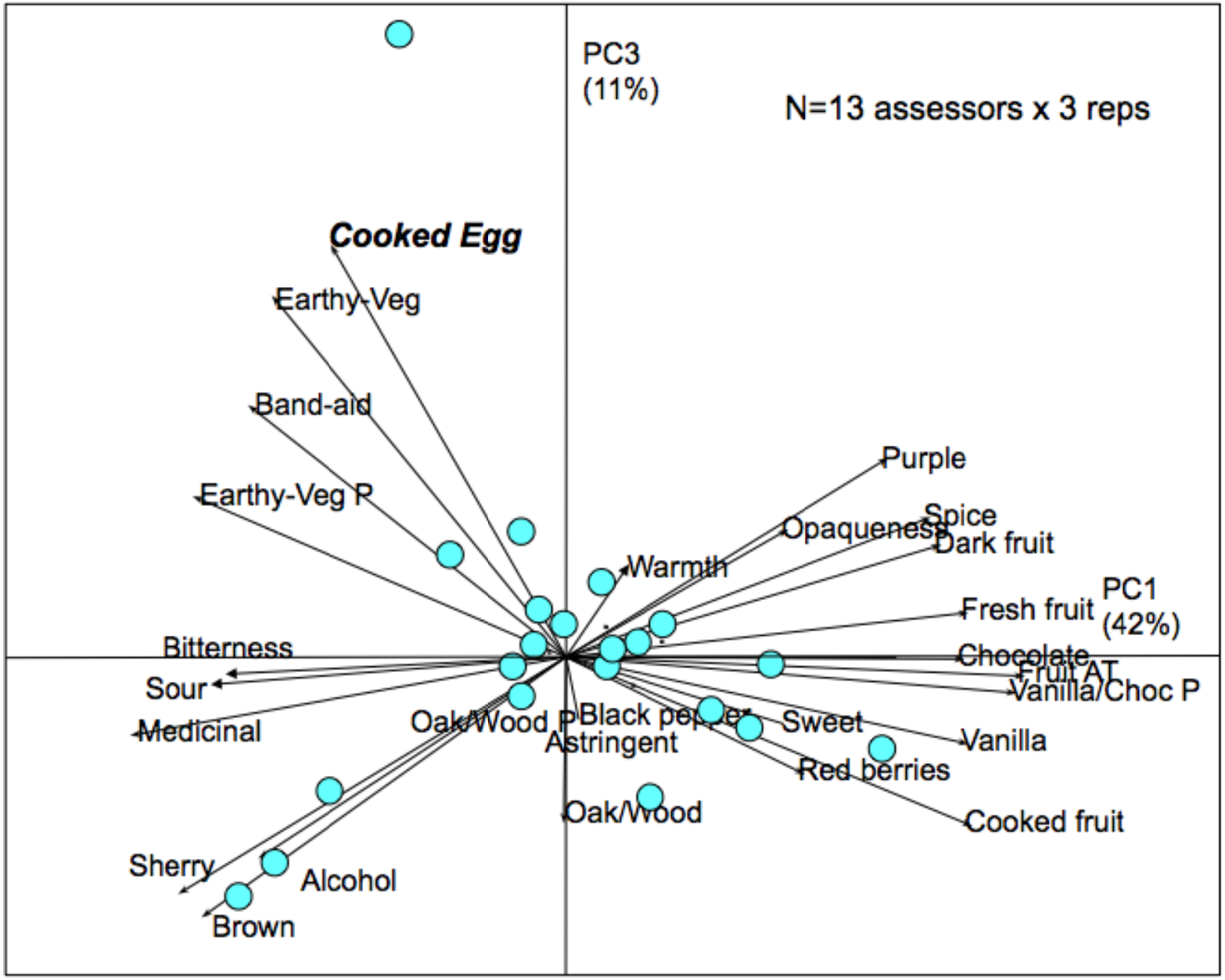


Figure C: Descriptive sensory characterisation by sensory panel – Dimension I and IV

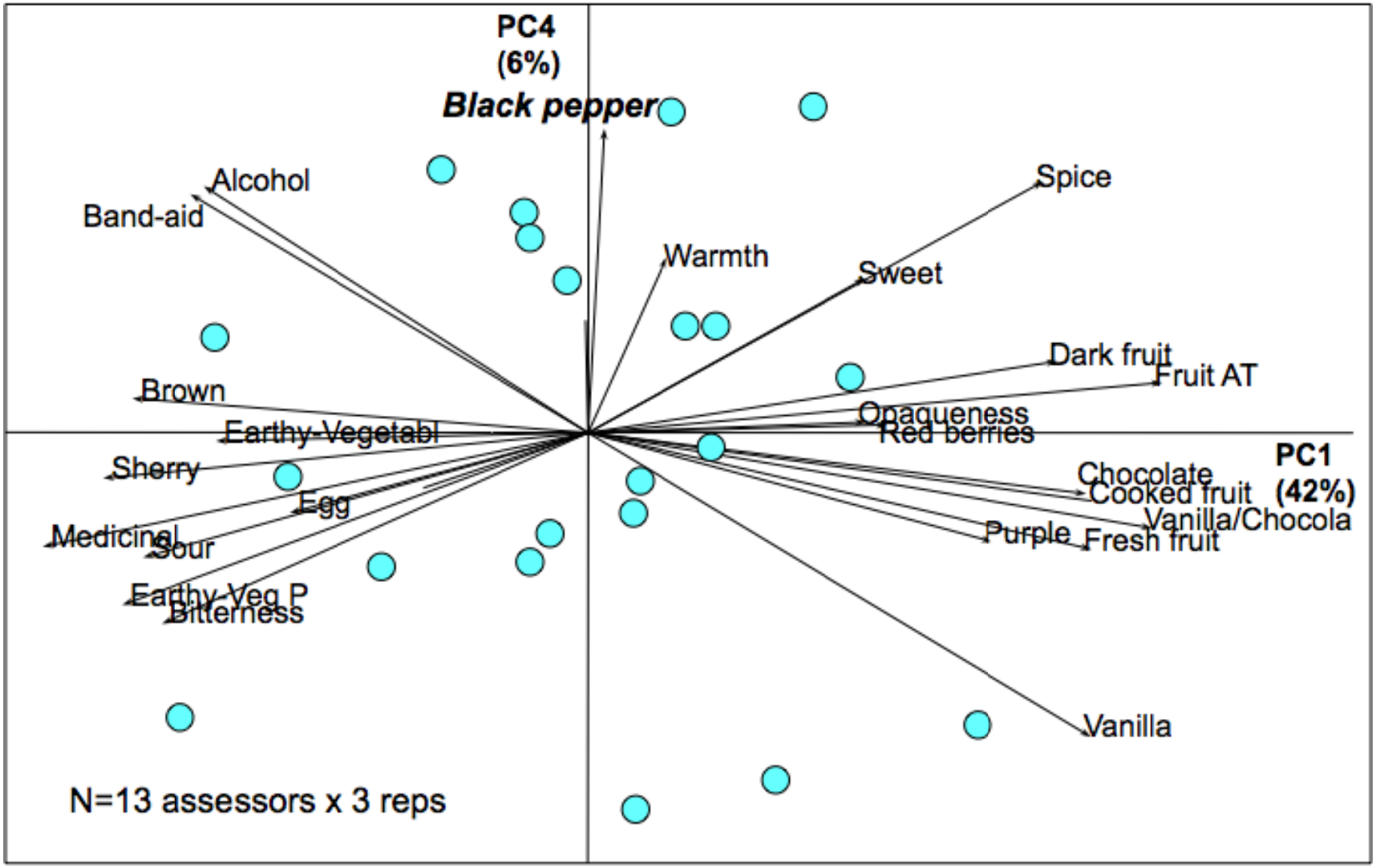


Figure D: Model of consumer liking (informed sensory tasting)

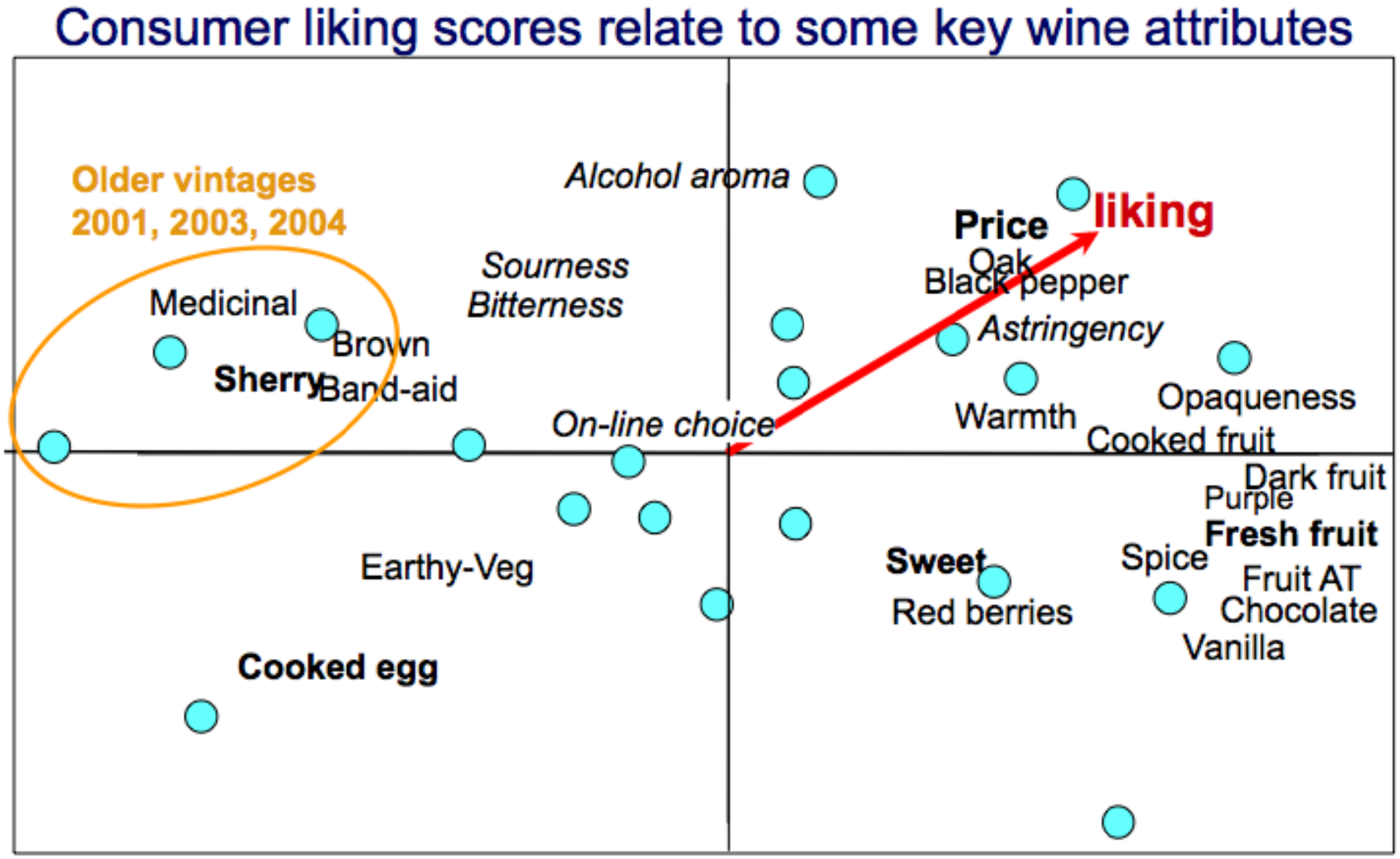


Figure E: Model of purchase intent (informed sensory tasting)