The Australian Wine Research Institute

Sensory descriptive analysis on commercial wines of varied styles

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October 2013

The report has been modified from its original version to remove wine brand names due to confidentiality

Introduction

The aim of this study was to quantitatively describe the sensory attributes of Australian red, white, sparkling, sweet white and fortified wines as part of a project that aims to assess the response of Chinese consumer to different styles of Australian wines and the way they describe them.

Methodology

Five small descriptive studies were conducted, one for each style of wine in August-September 2013.

For the red and white wine studies, a panel of ten assessors (four male) was convened. A panel of eight assessors (three male) was used for the sparkling study, while nine assessors (three male) evaluated the sweet white and fortified wines. All the panellists are part of the AWRI trained descriptive analysis panel. Eight assessors attended all five studies.

For each study, the panel attended three to four training session to determine the most appropriate attributes to describe each sample set plus their definitions and reference standards. The panel then assessed the wines in a practice booth session before the formal sessions. Standards for aroma attributes were presented through all the studies. Details of the attributes used in the five studies and their definitions plus aroma reference standards are listed in Appendix 1 to 5.

Three replicates of each sample were presented to panellists in 3-digit-coded, covered, ISO standard wine glasses at 22 – 24°C, in isolated booths under daylight lighting, with randomised presentation order within each tray of samples across judges. Assessors were presented with 30 mL of each wine with the six wines assessed in two trays of three wines per tray and were forced to have a 45 second rest between samples plus a 15 minute rest between trays. During the 15 minute break assessors were requested to leave the booths and were directed to a different booth for each tray.

The intensity of each attribute was rated using an unstructured 15 cm line scale from 0 to 10, with indented anchor points of ‘low’ and ‘high’ placed at 10% and 90% respectively. Data was acquired using Fizz sensory software (version 2.47, Biosystemes, Couternon, France).

Panel performance was assessed using Fizz, Senstools (OP&P, The Netherlands) and PanelCheck (Matforsk) software, and included analysis of variance for the effect of sample, judge and presentation replicate and their interactions, degree of agreement with the panel mean and degree of discrimination across samples.

Analysis of variance (ANOVA) was carried out using JMP 7.0 (SAS Institute, Cary, NC). The effects of judge, wine, presentation replicate and their interactions were calculated. For the studies where there was a high number of significant product-by-judge interactions, judge was treated as a random effect with product by judge used as the error term. Otherwise, judges were treated as fixed effects. Following ANOVA, Fisher's least significant difference (LSD) value was calculated (P = 0.05). When there were enough samples in the study, principal component analysis was conducted on the mean values of significant attributes averaged over panellists and replicates, using the correlation matrix. Otherwise, a spider/radar plot of the most important attributes was created.

Table 1. List of the wines used in the consumer test in China profiled by AWRI descriptive panel

White	***Vintage***	***Region***	***Code***
Chardonnay	2011	Margaret River	291
Riesling	2012	Clare Valley	919
Sauvignon Blanc Semillon	2011	Margaret River	448
Viognier	2012	South Australia	390
Sparkling			
Moscato	nv	Australia	937
Chardonnay Pinot Noir	2005	Yarra Valley	405
Zibibbo Rose	nv	North East Victoria	756
Sweet			
Tawny	nv	South Australia	946
Moscato	2012	King Valley	713
Red			
Pinot Noir	2011	Mornington Peninsula	283
Cabernet Merlot	2011	Margaret River	509
Shiraz	2010	Adelaide Hills	170
Shiraz	2010	Barossa Valley	912
Grenache	2011	McLaren Vale	396

Results

Table 2A. Mean ratings for appearance and aroma attributes and significant effects for RED wines

Wine	*Opacity*	*Purple*	*Brown*	*Overall fruit*	*Red fruits*	*Dark fruits*	Dried Fruit	*Oak*	*Vanilla*	*Sweet Spice*	*Grassy*	*Green Capsicum*	*Cooked Vegetabl*	*Mint*	*Earthy*	Dusty	Smokey	Pungent
396	3.44	1.25	1.28	3.88	2.93	2.37	1.51	2.02	2.53	1.61	0.89	0.37	1.39	0.71	1.21	0.98	0.82	2.77
170	4.77	1.41	1.66	4.29	1.96	3.90	2.51	2.96	2.73	2.47	0.80	0.21	1.28	0.83	1.67	1.27	1.27	2.85
283	1.65	0.05	3.28	3.35	2.68	1.21	1.41	1.24	1.15	1.29	0.87	0.46	3.00	0.56	1.95	1.58	1.23	2.38
509	3.72	1.18	1.77	3.74	2.82	2.43	1.43	2.46	1.50	1.55	1.80	1.80	1.38	1.67	1.25	1.13	1.38	3.29
912	6.64	4.65	0.06	4.30	1.25	4.15	2.29	3.42	2.58	2.10	0.80	0.41	0.74	1.50	1.07	1.09	0.84	2.84
P value	<.0001	<.0001	<.0001	.0003	<.0001	<.0001	.1101	<.0001	<.0001	<.0001	.0079	.0007	<.0001	<.0001	.0352	.4984	.8744	.0717

Table 2B. Mean ratings for palate attributes and significant effects for RED wines

Wine	*Overall fruit fl*	*Red fruits fl*	*Dark Fruits fl*	*Oak fl*	*Green*	Sweet	Viscosity	Acid	Astringency	Bitter	Hotness	Fruit AT
396	3.88	3.02	2.65	2.09	1.71	1.89	3.26	4.36	4.74	2.05	3.84	3.16
170	4.02	1.86	3.88	3.12	1.45	1.50	3.66	4.07	5.16	2.39	3.57	3.50
283	3.48	3.09	1.10	1.31	2.20	1.21	2.71	4.22	4.23	2.11	2.84	2.88
509	3.69	2.72	2.79	2.60	2.76	1.07	3.25	4.76	5.74	2.69	3.76	3.15
912	4.24	1.42	4.33	3.46	1.88	1.71	3.83	4.29	5.90	2.53	3.95	3.77
P value	0.005	<0.0001	<0.0001	<0.0001	0.0061	0.0858	<0.0001	0.0556	<0.0001	0.2634	<0.0001	<0.0001

fl= flavour
significant attributes at P<0.05 in *italics*

Table 3A. Mean ratings for appearance and aroma attributes and significant effects for WHITE wines

Wine	*Colour Intensity*	*Green*	*Copper*	*Overall fruit*	*Overall aroma*	*Lemon /Lime*	*Pineapple*	*Passion fruit*	*Stone fruit*	*Floral*	*Grassy*	*Capsicum*
919	3.40	0.99	0.41	3.22	4.33	2.52	1.41	0.79	1.82	1.37	0.75	0.04
291	3.82	1.24	0.11	2.87	5.07	1.38	1.09	0.53	2.65	0.14	0.35	0.13

448	2.40	0.95	0.15	3.33	4.42	2.55	1.96	1.94	0.77	0.64	3.00	3.08
390	3.70	1.50	0.15	3.73	4.32	1.99	1.79	1.00	2.39	1.95	1.11	0.20
P value	<.0001	<.0001	<.0001	0.0006	<.0001	0.0011	0.0413	0.0004	0.0001	<.0001	<.0001	<.0001

Wine	***Kerosene***	***Smokey***	***Oak***	***Toast***	***Honey***	**Cheesy/ Sweaty**	**Pungent**
919	2.26	0.62	0.94	0.89	1.09	1.25	3.13
291	0.82	1.78	3.36	3.68	2.11	1.34	2.65
448	0.38	0.38	0.43	0.31	0.59	1.36	2.83
390	0.59	1.24	0.97	1.38	1.48	0.80	3.26
P value	<.0001	0.0146	<.0001	<.0001	0.0066	0.2405	0.3211

Table 3B. Mean ratings for palate attributes and significant effects for WHITE wines

Wine	***Sweet***	**Acid**	***Astringency***	***Viscosity***	***Bitter***	***Hotness***	***Fruit AT***
919	1.48	4.85	4.19	3.49	2.67	3.26	2.44
291	0.88	4.91	3.98	3.74	2.82	2.94	2.39
448	1.28	4.78	4.17	3.32	2.34	2.98	2.88
390	1.95	4.63	4.11	3.85	2.86	4.23	2.76
P value	0.003	0.1424	0.0008	0.0101	0.0025	<.0001	<.0001

fl= flavour
significant attributes at P<0.05 in *italics*

Table 4A. Mean ratings for appearance and aroma attributes and significant effects for SPARKLING wines

Wine	***Green***	***Gold***	***Rose Gold***	***Overall fruit***	**Tropical Fruit**	**Stone fruit**	***Green Apple***	***Bruised Apple***	***Floral***	***Rose Water***	**Dry Grass**	**Honey**	***Biscuit***	***Yeast***	**Pungent**
937	0.06	0.74	3.03	3.67	2.49	2.29	0.72	0.67	2.22	2.98	0.78	1.47	1.04	0.60	1.84
405	1.94	2.96	0.08	3.34	1.99	1.87	1.31	2.51	0.35	0.08	1.46	2.31	2.43	2.28	2.05
756	0.07	0.34	5.22	3.89	2.29	2.11	0.37	0.77	2.23	3.96	0.96	2.17	1.21	0.65	1.46
P value	<.0001	<.0001	<.0001	0.0207	0.2853	0.7948	0.0155	<.0001	<.0001	<.0001	0.0989	0.0571	0.0198	<.0001	0.3471

Table 4B. Mean ratings for palate attributes and significant effects for SPARKLING wines

Wine	*Overall fruit fl*	*Citrus*	*Sweet*	*Foam/Froth*	*Viscosity*	*Acidity*	*Astringency*	*Bitter*	*Hotness*
937	4.27	2.60	4.14	4.03	3.38	3.27	3.16	1.47	2.32
405	3.60	3.54	0.41	3.49	2.97	5.07	4.05	3.40	2.86
756	4.33	2.33	4.40	4.69	3.39	3.12	2.95	0.53	2.15
P value	0.0005	0.0003	<.0001	<.0001	0.0121	<.0001	<.0001	<.0001	0.0023

fl= flavour
significant attributes at P<0.05 in *italics*

Table 5A. Mean ratings for aroma and palate attributes for the SWEET WHITE wine

Wine	Overall fruit	Citrus fruit	*Tropical Fruit*	Apple	*Confect -ion*	*Floral*	*Box Hedge*	*Dusty*	Pungent	*Overall fruit fl*	Stone fruit fl	*Sweet*	Viscosity	*Acidity*	*Astringency*	Fruit AT
713	4.40	2.51	2.61	1.71	0.50	1.57	2.12	1.33	2.67	4.59	2.87	5.40	3.51	3.40	3.01	3.75

Table 5B. Mean ratings for appearance, aroma and palate attributes for the FORTIFIED wine

Wine	*Orange*	*Yellow*	Overall Aroma	Dried fruit	Bruised Apple	Honey	Treacle	*Wood*	Overall flavour	Dark Fruit	Nutty	Sweet
946	1.57	3.22	5.05	3.52	3.96	2.39	3.16	2.26	5.29	3.59	2.59	4.61

fl= flavour
significant attributes at P<0.05 in *italics*

Appendix 1. Attribute names and definitions for all terms used in formal sensory descriptive analysis of eight Australian red wines

APPEARANCE	
Attribute	**Definition**
Opacity	The degree to which light is not allowed to pass through a sample
Purple	Intensity of the colour purple in the sample
Brown	Intensity of the colour brown in the sample
AROMA	
Attribute	**Definition**
Overall fruit intensity	Intensity of the fruit aromas in the sample
Red fruits	Intensity of the aroma of red fruits and berries: raspberries, strawberries, cherries, cranberries
Dark fruits	Intensity of the aroma of dark fruits and berries: blackberries, plums, black currants
Dried Fruit	Intensity of the aroma of dried fruits: raisins, prunes, figs
Oak	Intensity of the aroma of wood, oak, sawdust, wood shavings
Vanilla	Intensity of the aroma of vanilla
Sweet Spice	Intensity of the aroma of various sweet spices: cinnamon, nutmeg, cloves, aniseed
Grassy	Intensity of the aroma of fresh cut grass, leaves, stalks
Mint	Intensity of the aroma of mint, menthol, eucalyptus
Green Capsicum	Intensity of the aroma of fresh green capsicum
Cooked Vegetables	Intensity of the aroma of various cooked vegetables, water vegetables have been cooked in
Earthy	Intensity of the aromas of wet earth, organic matter
Dusty	Intensity of the aroma of dust
Smokey	Intensity of the aroma of smoke, burnt or charred wood
Pungent	Intensity of the aroma and effect of alcohol
PALATE	
Attribute	**Definition**
Overall fruit flavour	Intensity of fruit flavours in the sample
Red fruits	Intensity of the flavour of red fruits and berries: raspberries, strawberries, cherries, cranberries
Dark Fruits	Intensity of the flavour of various dark fruits: blackberries, currants, plums
Oak	Intensity of the flavour of oak, wood, sawdust
Green	Intensity of the flavour of green stalks
Sweet	Intensity of sweet taste; sucrose
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low=watery, thin mouth feel. High=oily, thick mouth feel.
Acid	Intensity of acid taste in the mouth including aftertaste
Astringency	The drying and mouth-puckering sensation in the mouth, including the textural, mouth-coating aftertaste that lingers after expectorating.
Bitter	The intensity of bitter taste perceived in the mouth, or after expectoration.
Hotness	The intensity of alcohol hotness perceived in the mouth, after expectoration. Low = warm; High = hot.
Fruit AT	The lingering fruit flavour perceived in the mouth after expectorating.

Appendix 2. Attribute names and definitions for all terms used in formal sensory descriptive analysis of seven Australian white wines

APPEARANCE	
Attribute	**Definition**
Colour Intensity	Intensity of the colour of the sample
Green	Intensity of the colour green in the sample
Copper	Intensity of the colour copper in the sample
AROMA	
Attribute	**Definition**
Overall **fruit** intensity	Intensity of the fruit aromas in the sample
Overall **aroma** intensity	Intensity of the aromas in the sample
Lemon/Lime	Intensity of the aroma of lemons, lemon peel, limes
Pineapple	Intensity of the aroma of pineapple
Passionfruit	Intensity of the aroma of Passionfruit
Stone fruit	Intensity of the aroma of peaches, apricots, including apricot nectar
Floral	Intensity of the aromas of flowers, including orange blossoms, rose and rose water, lavender
Grassy	Intensity of the aroma of cut grass, fresh grass, leaves
Capsicum	Intensity of the aroma of green capsicum
Kerosene	Intensity of the aroma of kerosene, including petroleum, machine oil
Smokey	Intensity of the aroma of smoke, burnt toast, smoked nuts
Oak	Intensity of the aroma of oak, wood
Toast	Intensity of the aroma of toast, buttered toast
Honey	Intensity of the aroma of honey
Cheesy/Sweaty	Intensity of the aroma of cheese and/or sweat
Pungent	Intensity of the aroma and effect of alcohol
PALATE	
Attribute	**Definition**
Citrus	Intensity of the flavours of lemon, lime, orange, grapefruit
Sweet	Intensity of the taste of sucrose.
Acid	The intensity of acid taste perceived in the mouth, including after expectorating.
Astringency	The drying and mouth-puckering sensation in the mouth. Low=coating teeth; Medium=mouth coating & drying; High=puckering, lasting astringency.
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low=watery, thin mouth feel. High=oily, thick mouth feel.
Bitter	The intensity of bitter taste perceived in the mouth, including after expectorating.
Hotness	The intensity of alcohol hotness perceived in the mouth, including after expectorating. Low = warm; High = hot. Includes burning sensations in the mouth.
Fruit AT	Intensity of the lingering fruit flavour perceived in the mouth after expectorating.

Appendix 3. Attribute names and definitions for all terms used in formal sensory descriptive analysis of four Australian sparkling wines

APPEARANCE	
Attribute	**Definition**
Green	Intensity of the colour green
Gold	Intensity of the colour gold
Rose Gold	Intensity of the colour rose gold
AROMA	
Attribute	**Definition**
Overall fruit intensity	Intensity of the fruit aromas in the sample
Tropical Fruit	Intensity of the aroma of pineapple, melons, guava, watermelon
Stone fruit	Intensity of the aroma of apricots, peaches, nectarines
Green Apple	Intensity of the aroma of green apples, other green fruits
Bruised Apple	Intensity of the aroma of bruised apple, sherry
Floral	Intensity of the aromas of flower, perfume
Rose Water	Intensity of the aroma of rose water, turkish delight, confection, lychee
Dry Grass	Intensity of the aroma of dry grass, hay
Honey	Intensity of the aroma of honey, toffee, golden syrup
Biscuit	Intensity of the aroma of sweet biscuits, bread, toast, butter
Yeast	Intensity of the aroma of yeast
Pungent	Intensity of the aroma and effect of alcohol
PALATE	
Attribute	**Definition**
Overall fruit flavour	Intensity of fruit flavours in the sample, including after expectorating
Citrus	Intensity of the flavours of lemon, lime, orange, grapefruit
Sweet	Intensity of the taste of sucrose.
Foam/Froth	Intensity of the foam/froth in the mouth, expansion of the sample in the mouth
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low=watery, thin mouth feel. High=oily, thick mouth feel.
Acidity	The intensity of acid taste perceived in the mouth, including after expectorating.
Astringency	Intensity of the drying and mouth-puckering sensation in the mouth, including after expectorating. Low=coating teeth; Medium=mouth coating & drying; High=puckering, lasting astringency.
Bitter	The intensity of bitter taste perceived in the mouth, including after expectorating
Hotness	The intensity of warmth, heat perceived in the mouth, including after expectorating. Low = warm; High = hot. Also includes burning sensation during or after expectoration.

Appendix 4. Attribute names and definitions for all terms used in formal sensory descriptive analysis of three Australian sweet white wines

AROMA	
Attribute	**Definition**
Overall fruit intensity	Intensity of the fruit aromas in the sample
Citrus fruit	Intensity of the aroma of lemon, lime, orange
Tropical Fruit	Intensity of the aroma of pineapple, melons, banana,
Apple	Intensity of the aroma of red and green apples
Confection	Intensity of the aroma of musk lollies, red jelly lollies, boiled lollies
Floral	Intensity of the aromas of flower bouquets, roses, bath soaps
Box Hedge	Intensity of the aroma of Box Hedge
Dusty	Intensity of the aroma of dust
Pungent	Intensity of the aroma and effect of alcohol
PALATE	
Attribute	**Definition**
Overall fruit flavour	Intensity of fruit flavours in the sample
Stone fruit	Intensity of the flavours of peach, apricot,
Sweet	Intensity of the taste of sucrose.
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low=watery, thin mouth feel. High=oily, thick mouth feel.
Acidity	The intensity of acid taste perceived in the mouth, including after expectorating.
Astringency	Intensity of the drying and mouth-puckering sensation in the mouth, including after expectorating. Low=coating teeth; Medium=mouth coating & drying; High=puckering, lasting astringency.
Fruit AT	Intensity of the lingering fruit flavour perceived in the mouth after expectorating.

Appendix 5. Attribute names and definitions for all terms used in formal sensory descriptive analysis of three Australian fortified wines

APPEARANCE	
Attribute	**Definition**
Orange	Intensity of the colour orange in the sample
Yellow	Intensity of the colour yellow in the sample
AROMA	
Attribute	**Definition**
Overall Aroma intensity	Intensity of all the aromas in the sample
Dried fruit	Intensity of the aroma of dried raisins, muscatelles, figs, prunes, dates, apricots
Bruised Apple/Sherry	Intensity of the aroma of bruised apples, sherry
Honey	Intensity of the aroma of honey
Treacle	Intensity of the aroma of treacle, molasses, caramel, golden syrup, sweet soy
Wood	Intensity of the aroma of wood, oak
PALATE	
Attribute	**Definition**
Overall flavour intensity	Intensity of all of the flavours in the sample
Dark Fruit	Intensity of the flavours of dark fruits
Nutty	Intensity of the flavours of nuts
Sweet	Intensity of the taste of sucrose.
Viscosity	The perception of the body, weight or thickness of the wine in the mouth. Low=watery, thin mouth feel. High=oily, thick mouth feel.
Acidity	The intensity of acid taste perceived in the mouth, including after expectorating.
Astringency	Intensity of the drying and mouth-puckering sensation in the mouth, including after expectorating. Low=coating teeth; Medium=mouth coating & drying; High=puckering, lasting astringency.
Bitterness	Intensity of the bitter taste perceived in the mouth or after expectorating
Burning	Intensity of the burning sensation in the mouth and on the lips including after expectorating
Fruit AT	Intensity of the lingering fruit flavours after expectorating