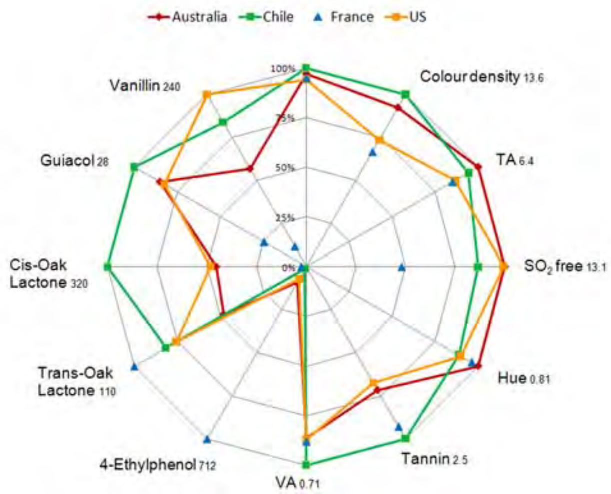
Determining the relative importance to wine consumers of sensory and non-sensory attributes on liking and choice: A cross-cultural study



Final Report to
GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **USA 06/01**

Principal Investigator: **Prof. Larry Lockshin**

Research Organisation: **University of South Australia**

Date: **1 March 2010**

Final report to Grape and Wine Research & Development Corporation

Determining the relative importance to wine consumers of sensory and non-sensory attributes on liking and choice:

A cross-cultural study

Larry Lockshin

Simone Mueller

Ehrenberg-Bass Institute for Marketing Science, University of South Australia

Jordan Louviere

Centre for the Study of Choice, University of Technology Sydney

Leigh Francis

Patricia Osidacz

The Australian Wine Research Institute

Adelaide, 1 March 2010

CONTENTS

1. Abstract **6**
2. Executive Summary **8**
3. Method **12**
Phase 1: Australia 12
Phase 2: United States wine market 17
4. Results / Discussion **20**
Phase 1- Australia 20
1) Online choice experiment using simulated bottles 20
Drivers of wine choice 21
Consumer segments 24
2) Online experiment using 21 real wines 26
Sensory description 26
Wine critics’ scores 27
Star ratings 28
Phase 2- United States 30
1) Analysis of AC Nielsen sales data 30
Wine origin 30
Grape variety 31
Label styles 31
Drivers units sold 32
2) Results of the discrete choice experiment in the US 34
Validity of choice experiment 34
Relative importance of wine choice drivers 34
Individual wine ranking 35
Segmentation 37
Testing the effect of communication 40
3) Chemical analysis of wines sold in the US 41
Country specific chemical and sensory profiles 41
Relationship of chemical components and price 43
Relationship of wine critic ratings and price 43
4) Decision Support Tools 44

5. Project outputs and performance **46**
Project performance against planned output 46
Outputs and Performance Targets 2006-07 46
Outputs and Performance Targets 2007-08 47
Outputs and Performance Targets 2008-09 48
Assessment of practical implications 49
Benefits from the Project 51
6. Recommendations **52**
7. List of all communications **56**
Appendix 1 – Copy of all communications **68**
Part 1: GWRDC presentations 68
Part 3: Academic publications 181
Appendix 2 – IP statement **305**
Appendix 3 – Staff List **307**
Appendix 4 – Budget reconciliation **309**

1. ABSTRACT

The objective of the project was to understand the relative impact of sensory and non-sensory (e.g., packaging, pricing) attributes on consumer wine choice, and to develop methods capable of measuring and predicting consumer reaction to changes in these variables. Four main methods were used in this project: sensory evaluation, chemical analysis, simulated choices of wines, and actual sales based on AC Nielsen data.

The results showed that even after tasting the wines, consumers' future purchases were mainly predicted by their original choices, not by how much they liked the wine. Availability and price were the most important predictors of sales.

2. EXECUTIVE SUMMARY

This project focused on developing, testing, and demonstrating new methods to understand how consumers make wine choices, and the relative impact of sensory and non-sensory factors. The methods developed are science-based and validated against actual sales in the market, rather than on consumer attitudes towards the taste or packaging of wines. The project demonstrates to the wine sector that it can potentially anticipate consumer responses to changes in the product and its marketing and by doing so can design products more likely to succeed in the competitive wine market. These new methods overcome the issue that consumers cannot introspect their own response to packaging and taste, and therefore their responses do not predict their actual behaviour.

The project was conducted in two phases, one in Australia and one in the United States. The **first phase in Australia** focused on Shiraz wines and used three different experiments: an online choice experiment using 21 real wines, an online choice experiment using simulated wine bottles varying a wide range of packaging and prices, and a tasting of the 21 wines (each person tasted 5 of the 21) followed by an evaluation and purchase intention measure. Overall, we found that consumers' choices online of real wine bottles did reflect the actual sales of those wines using AC Nielsen scanner data. Our experiments were good predictors of actual sales. However, after tasting the wines, consumers had higher liking for the more expensive wines, but did not actually choose these wines for repurchase. Their repurchase was linked more strongly to their online wine choices. Consumers could only taste 5 wines, so it is not practical to include actual tastings in future predictive research. We also found that it is impractical to manipulate packaging variables, because there are too many different combinations to test reliably. We found some indication that wine chemistry was useful in predicting consumer purchases. The most important variables predicting choice were (in order): objective ratings of the wines using 1-5 stars, the brand name, the price, medals, price discounts, followed by alcohol level, region, label style, label colour, and finally closure.

The results were used to inform the **next phase of the research in the US**, where we decided not to try and separately test branding and packaging, but to rely on a larger number of actual wine brands, supplemented with extra information, such as point scores, taste descriptions, and medals. Instead of consumer tastings, we purchased a large number of wines (210) in the market and subjected these to chemical analysis to see if we could enhance the predictability of our models. We also manipulated some information in the form of magazine articles about Australian wine regions, Australian innovation, and American wines to see if this affected wine choice.

Our analysis started with the set of 1,169 red wines in two US markets: Chicago and Tampa, Florida. We found that the most important **drivers of the actual prices in the market** were (in order): origin, label style, label colour, label information and grape variety. We did not analyse brands in this part of the research. The most important factors driving units sold were availability and price; greater availability and lower price resulted in greater unit sales based on the AC Nielsen data.

The second part of the project in the US was a **choice experiment**, where we developed a better mechanism to simulate retail shelves and were able to have 8 wines visible rather than only 5 or 6. The first important outcome showed no differences between consumers in Chicago and Florida. Their differences were due to the wines available in the markets, not differences in the people. This means Australian wineries can focus on the 4 segments we found, rather than on differences between geographic regions. We also found, similar to the Australian experiment, that the online simulated choices were very similar to the actual market shares of the wines in the AC Nielsen data, which means our research is valid. We found as well, that the prices chosen represented the share of prices in the market. This allowed us to link the experimental choices with the actual shares of the wines in the market and build a trial decision support tool.

Overall, the **most important drivers of wine choice** in the two US cities were (in order): the combination of brand, package and origin; price; gold medal; a sensory description on the shelf; rating points from Parker or the Wine Spectator; manager's recommendation on the shelf; alcohol level; price discount; in-store tasting available; closure. The combination of the core product and price accounted for 57% of the choice, and the combination of wards and shelf information accounted for 43%.

We identified four **consumer segments** in the US, tow currently purchasing Australian wine, and two that purchase little Australian wine. One segment accounted for 22% of the sample, was older, and tended to purchase wines under $15. The other accounted for 55% of the sample and purchased wines around $12-$15 and was quite affected by gold medals and taste descriptions on the shelf, and less so by critic's scores. They tended to be average in age and more female than male. One segment that purchased less than the overall average of Australia wines accounted for 12% of the sample, but focused on low priced wines under $10 and is not very interesting for Australian wine sales in the future. The other segment was 11% of the sample and tends to purchase more expensive wines, especially European wines over $20, is younger, more male, and tends to shop specialty stores and restaurants, asking for advice. These are high involvement wine buyers, who do not currently focus on Australian wine, but are potentially a valuable segment.

Another useful finding was that the **magazine articles** we provided to the respondents did affect their simulated purchasing. Each respondent received 1 of 3 different articles, or no article. The articles all had an effect on the wines chosen. The article with biggest effect was about the innovativeness of the Australian wine sector, which had a bigger effect on the choice of Australian wines, than the article on Australian wine regions. This might provide an unique platform for Australian wine positioning in the US market.

The **chemical analysis** of the 210 wines from the US, Australia, France, Italy, and Chile showed some major differences between the countries, however, the chemistry was not very predictive of wine sales. There was some relationship between increasing levels of tannin, alcohol, VA, and oak and the price of the wine.

The project successful **developed new methods for predicting consumer response to sensory and non-sensory attributes and validated the predictions with real sales data**. We developed two proof of concept decision support tools, which allow wineries to input their own wine characteristics and then see what effects changing the different information provided would have on sales. These are available to Australian wineries in an Excel spreadsheet. This method could be used to develop similar tools for other countries, e.g., China, or other grape varieties. It also allows the prediction of the impact of packaging and shelf information changes.

The **next stage of research** could build on these methods and findings. It would be important to understand how packaging and price influence sensory expectations and subsequent liking and purchase intent. More understanding of how consumers read and interpret wine labels would provide guidance to label designers and brand owners on how to develop better and more noticeable packaging. The same methods could be used to improve consumer response to wine lists, or to predict changes in trends, such as wine styles and new grape varieities.

The outcomes of the research have been published in 9 academic conference proceedings and 3 academic journals. Seven trade articles have been published and three more are in the draft stage. There will be a presentation and a workshop at the Australian Wine Technical Conference in July 2010. Copies of articles can be found at: www.winepreferences.com.

3. METHOD

The project consisted of two separate phases, one in Australia and one in the United States. There were several sub-projects within each phase and these will be encapsulated below.

Phase 1: Australia

The overall objective of the project was to integrate measures from sensory science and marketing into one science-based model, that could be validated with real world wine purchase data. The project integrates theory and methods from:

- Economics/Psychology (random utility theory based choice models)
- Statistics/Marketing (optimal design of choice experiments)
- Sensory Science (basic wine chemistry & sensory judgments by trained tasters)

Preliminary methodological experiments tested:

a) The applicability of choice in sensory experiments

We compared the standard sensory evaluation method of hedonic liking to letting respondents choose the most and least liked wine out of a set of four wines. The best-worst method produced not sufficient information per respondent to allow segmentation and was not able to significantly differentiate the wines to be evaluated. Accordingly we used hedonic liking measurement for the informed sensory consumer test.

b) On how to reliably measure consumers' wine choice with choice experiments

We tested if consumers were able to state the importance of wine attributes in a best-worst task and compared these findings to a choice experiment with graphically simulated wines that differed in wine attribute levels. Only graphical choice experiments were able to capture subliminal effects from wine packaging. We therefore used graphical shelf simulations for all later choice experiments.

Three separate final experiments were carried out for the Australian project phase:

1) An **online choice experiment** with 1200 red wine consumers from the NSW wine market using **simulated bottles**. We varied 10 different features experimentally:

- functional (region, alcohol, price, price discount, brand)
- non-functional (bottle shape, label colour, label style, closure, medals)

Table 1 provides a summary of the attributes and levels. Consumers saw simulated shelves of 6 wines, with each of the wines composed on one level from each of the attributes. Figure 1 shows an example of one choice set. A comprehensive statistical design controls the combination of attribute levels into simulated wine bottles; in our case it contained more than 1,000 graphical combinations. This design ensures that each attribute level co-appears which each other the same number of times which allows us to separate the effect of each individual attribute level on wine choice.

Respondents chose the wine they would buy if they were buying for dinner that night with friends or families. The relative influence of each attribute and its levels was then calculated based on how it impacted the probability of choice.

Table 1: Summary of wine attributes used in the experiment

Attribute	**Levels**	
Brand	8	Tier 1 (very well known brand) to Tier 4 (unknown brand)
Price	4	$7.99 - $22.99 (4 levels)
Medals	4	no medal - Gold Trophy (4 levels)
Price discount	2	none vs. 20% discount
Alcohol level	4	11.5% to 16% (4 levels)
Region	4	Padthaway, Hilltops, Yarra Valley, Barossa
Label style	4	chateau, traditional, minimalistic, graphical
Label colour	4	cream, yellow, red, black
Closure	2	screw cap vs. cork

Figure 1: Example of a screen from the online choice experiment with simulated wine bottles

2) An **online choice experiment** with 350 red wine consumers using 21 **real Shiraz wines**

We selected 21 Shiraz wines from the New South Wales AC Nielsen Top 100 sales data with a wide range of sensory properties and to cover both more and less well-known brands. Photographs of these wines were included in a shelf simulation showing five bottles at a time and their real market price (see a screen shot in Figure 2). We also included short taste descriptions for 6 of the wines to test the effect of a description or not on the shelf. Finally half the wines received a star rating of 1-5 stars given by independent retailers. The rating system was explained before the choice experiment. Respondents choose the wine they would buy to have with dinner that night with friends or family. The choices of the wines were compared to the actual sales of the 21 wines using AC Nielsen scanner data for NSW.

Figure 2: Example of a screen from the online choice experiment with real bottles

3) An **informed sensory tasting** by 420 red wine consumers of the same 21 real Shiraz wines was the final part of phase one.

Consumers were recruited to match the demographics of typical bottled red wine consumers in Australia. Each consumer tasted 5 of the 21 red wines in an informed condition – an A4 photograph of the bottle and the price was provided for each wine during the tasting. Respondents rated how well they liked the wine and whether or not they would purchase it at the retail price provided.

Figure 2b: Informed sensory tasting in central location test

Phase 2: United States wine market

The US research was comprised of three sections. The third part of the experiment involved purchasing 210 representative red wines from the US market and bringing them to the AWRI for tasting and chemical analysis.

1) First was an **analysis of the AC Nielsen** data from two geographic wine markets in the US: Chicago, Illinois and Tampa, Florida.

This analysis was not part of the original plan, but since we obtained the AC Nielsen data to test the validity of our experiments, we decided to do a thorough analysis of it. We coded the 1,167 red wines that were the same in both markets for country and region of origin, grape variety, label style, label colour, bottle shape, extra information on the label, alcohol content, price, and closure. We then ran a hedonic price analysis, regressing these independent variables against the price of the wine to measure the impact of each on the retail price. We did the same for the units sold, using the independent variable as predictors for the number of bottles sold during one year.

2) A **large choice experiment** was run in the same two areas: Chicago, Illinois and Florida with 1000 red wine consumers from each area.

We expanded the simulated shelf to include 8 wines (Figure 3). We chose 32 real wines to be representative of the packaging, regions, prices, and closures. We added prices, price discounts, tasting descriptions, rating points by two US experts, manager’s recommendations, medals, alcohol levels, and in-store tastings.

A second part of the choice experiment tested consumers’ response to different communication messages. Respondents received one of three different communications, as simulated magazine articles. The fourth group (control) received no communications. The three articles concerned: the US as the largest wine consuming country in the world, Australian wine regions, Australia as an innovative wine producing country. We predicted that each of these articles would affect the choice of wines in the experiment afterwards; the US article would increase the choice of US wines, and the Australian articles would increase the choice of Australian wines as compared to the no communication condition.

Figure 3: Screen shot of online shelf experiment in the US

3) The third part of this phase involved purchasing a representative selection of red wines from the Chicago market, and **chemically analysing** them at the AWRI.

4. RESULTS / DISCUSSION

The results are provided in the same sections and order as the methods section above. Detailed results are available at www.winepreferences.com in the articles published in trade and academic press.

Phase 1- Australia

1) Online choice experiment using simulated bottles

While complex statistical analyses are required to evaluate fully the outcomes of choice experiments, they can be easily understood by calculating how often an attribute level was chosen when it appeared on the simulated wine shelves. This **frequency of choice** gives a measure of the preference for each attribute level; those which are chosen more often are more preferred than rarely chosen levels.

Considering the effect of the four **price levels** investigated, Figure 4 shows that a wine was chosen three out of ten times (29.9%) when its price was $12.99. So this price level was more preferred than $22.99 which was only chosen two out of ten times (19.2%). The preference for price levels of $7.99 and $17.99 were in between these most and least preferred prices. Interestingly, these outcomes indicate that lower prices for Australian wine do not automatically sell more but that consumers actually chose wines around $13 most often. Thus, we could not confirm a linear price-sales relationship as is often assumed. Remember the purchase situation was with family and friends, which may have affected the different choices. This exact same relationship was found in the US experiments as well.

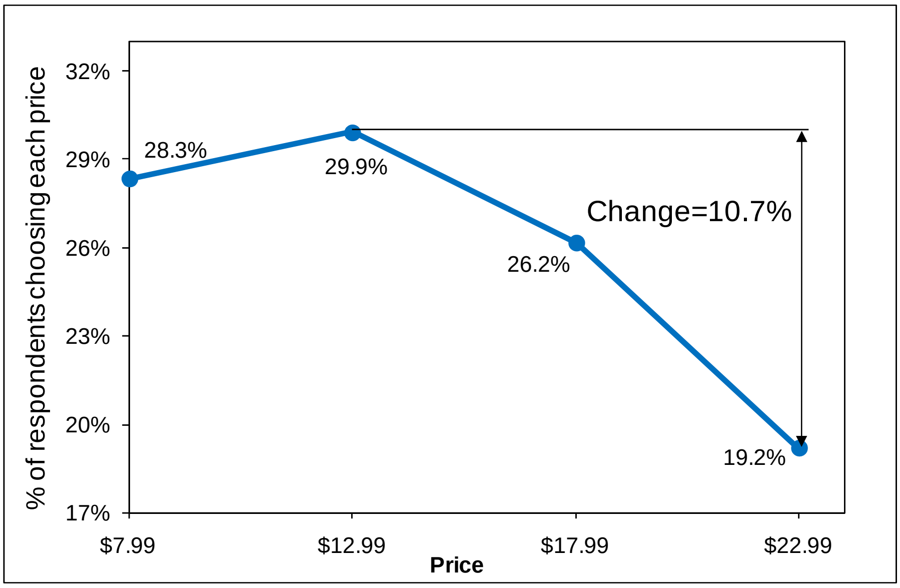


Figure 4: Impact of different price levels on choice

To compare the relative effects of different attributes, like price and label design, one has to look at the **maximum impact on choice of a change of attribute levels**. For price this maximum impact is achieved by switching between the least chosen price of $22.99 (19.2%) and the most often chosen price level $12.99 (29.9%), which represents a relative difference (increase) in choice of 10.7%. To compare the relative importance of attributes for consumer choice this effect can now be compared to the maximum impact of other attributes. From all attributes analysed, price had the second strongest influence after brand (see Table 2).

Comparing the impact of changes in attribute levels **allows wineries to make their own trade-offs** in packaging and labelling, and is the biggest advantage of choice experiments. So a manager of a brand portfolio can calculate if a price discount is necessary to keep the same market share if s/he sources grapes from a less well-known region, and if the region is clearly stated on the label.

It has to be noted that the measured impact depends on the attribute levels chosen by the experimenters; ideally they should cover the maximum range of the relevant market under study. A too narrow range (e.g. only looking at $10-$15 wines) will result in a smaller impact of the attribute while a very wide range (e.g. $8-$35) will increase it.

Drivers of wine choice

Brand was revealed to be the most important for consumers' wine choice, and was just a bit higher than price. We used eight different Australian brands, which represented four different tiers of brand reputation from very well known brands (Tier 1 such as Wolf Blass and Hardy's) to unknown (made-up) brands (Tier 4 such as Basalt Ridge and Duck Hollow). The total effect of 10.8% of difference in choice between these brands is mainly caused by one brand with a very high reputation while we found only small differences between medium known and unknown brands. This shows the strong impact of a very well known and advertised wine brand.

After price **medals** were the third most influential attribute on consumer choice. Not surprisingly a gold medal with a trophy was most often chosen, followed by a single gold medal and a single silver medal (see Figure 5). Compared to having no medal a Gold Medal + Trophy increased the chance of a wine being chosen by 7.3%.

A **price discount** proved to have a high impact on consumer choice. A special price of 20% off the listed price increased choice by 6.4%. Comparing this increase in market share to winning a Gold Medal + Trophy, we find that the medal + trophy outweigh the effect of a price discount.

There has been some recent discussion about Australian wines having too high **alcohol levels** and consumers potentially preferring lower alcohol level wines. We could not confirm this for our sample of regular red wine consumers from NSW. For the four alcohol levels tested we found higher alcohol levels to be preferred. Increasing the alcohol level from 11.5% to 16% increased choice by 4.3%. This might be related to consumers preferring the higher perceived body and viscosity of wines with higher alcohol levels (Gawel et al. 2007). The biggest change happens when raising the alcohol level from 13.0% to 14.5%, after this choice does not increase much further for the highest level.

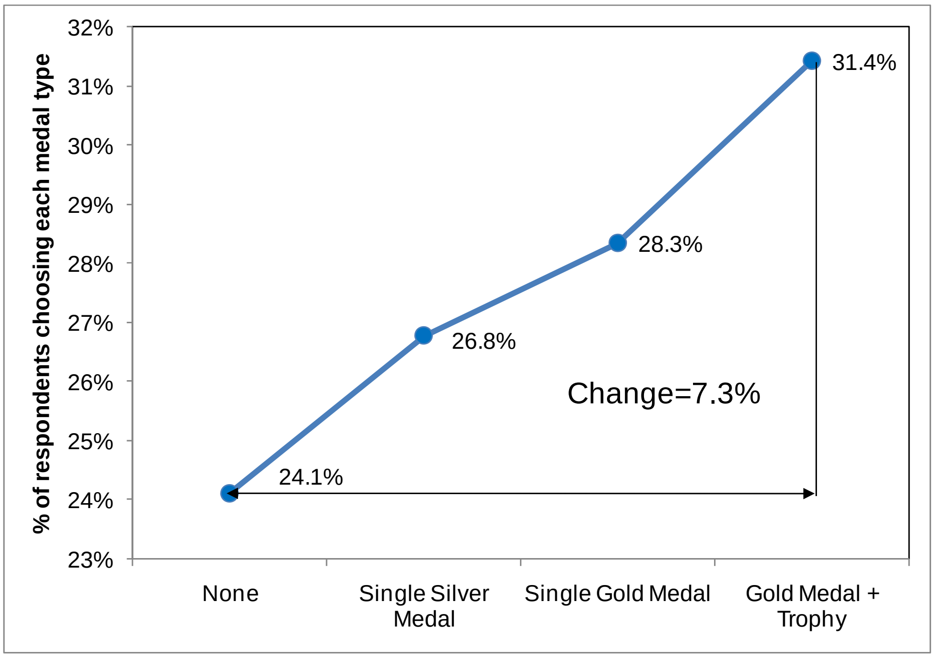


Figure 5: Impact of medal types on relative choice

An emphasis on **regionality** is seen as an important aspect for exports for the Australian industry, but it did not show a very strong effect on wine choice in our experiment with NSW consumers. Changing the region of origin of a wine from less known regions like Padthaway or Hilltops to well known regions like Yarra Valley or Barossa only increased choice by 3.8%. For NSW wine consumers Yarra Valley and Barossa resulted in the same relative choice overall, indicating that they are perceived to be of similar value for Shiraz wine.

Table 2: Summary of relative impact of wine attributes on consumer choice

Attribute	Levels		Maximum difference in % choice
Brand	8	Tier 1 (very well known brand) to Tier 4 (unknown brand)	10.8%
Price	4	$7.99 - $22.99	10.7%
Medals	4	no medal - Gold Trophy	7.3%
Price discount	2	none vs. 20% discount	6.4%
Alcohol level	4	11.5% to 16%	4.3%
Region	4	Padthaway, Hilltops, Yarra Valley, Barossa	3.8%
Label style	4	chateau, traditional, minimalistic, graphical	3.6%
Label colour	4	cream, yellow, red, black	1.2%
Closure	2	screw cap vs. cork	0.6%

For a first proof of concept we also included four different **label styles** and **label colours** into the experiment. Over all respondents both effects were not very strong, with 3.6% difference in choice between a minimalistic and a traditional type label and 1.2% between yellow and grey/black colours. On the individual level we found packaging to be more important for some consumer segments.

Our results for the effect of closure type provide some confirmation that **screw cap** has gained wide acceptance in Australia. While cork was chosen slightly more often, the difference of 0.6% is extremely small. While this may be partly due to limitations of consumers noticing the closure type on a simulated shelf (see Figure 1), this mimics the situation in a retail outlet.

Consumer segments

While the results discussed above refer to the 'typical' NSW red wine consumer we found **three different consumer segments** driven by different wine attributes and who prefer different characteristics (see Table 3).

The **first segment**, representing almost half of NSW regular red wine consumers, is mainly brand and medal driven in their wine choice. These consumers prefer lower and medium high price points and most often chose chateau-style and grey/black labels. While alcohol level had no influence on their choice they slightly preferred Yarra Valley over Barossa.

Table 3: Differences between consumer segments and the red wine attributes most often chosen.

	Segment 1	**Segment 2**	**Segment 3**
	Brand driven	*Value for money*	*Price sensitive*
Segment size	42%	40%	18%
Most important choice cues	brand and medal	star rating and discount	low price and price discount
Preferred price level	low/medium	medium	low
Preferred label style	chateau	traditional	unimportant
Preferred colour	grey/black	cream	unimportant
Most preferred region	Yarra Valley	Barossa	Barossa and Yarra Valley
Preferred alcohol level	unimportant	medium	highest
Brand influence	High (Wolf Blass and Hardy's)	Medium (Wolf Blass and Wynn's)	low
Medal influence	high	medium	low
Sociodemographics	more female		more male

The wine choice of the **second segment**, containing 40% of respondents, was most influenced by price discounts and wine ratings, which is discussed in the next section on the 21 real wines. These consumers seem to be motivated by value for money, most often choosing medium price level wines with a strong preference for a price discount, signalling that they want to get more than they pay for. Regarding packaging they preferred traditional and cream-coloured labels and most valued the Barossa region and medium alcohol levels.

A **smaller third segment** of about a fifth of all consumers is very price sensitive. Their wine choice is mainly determined by the lowest prices and price discounts. While packaging does not seem to influence their choice at all, they prefer the highest alcohol levels. Well known regions have a relatively small influence on their wine choice.

The segmentation helps us understand that not all consumers will react the same way to changes in wine packaging and pricing. The overall sample indicated that brand and price were about equal in importance and that the most chosen price was $12.99. When we look at segments, we see one segment is more brand driven and one mostly price driven. Not all consumers will respond the same to discounts and lower prices, and these should be used only when aiming at one specific segment.

2) Online experiment using 21 real wines

It was found that the wines that respondents chose in the experiment were strongly related to their actual market shares according to AC Nielsen data. A strong and significant correlation of 0.75 showed that an **online choice experiment is a very good approximation for what consumers purchase in reality**. This allows us to be confident that the following simulated bottle experiment could predict sales changes in the market. For this stage, it was not our aim to explain what causes or influences sales (how well known a wine is or how it is packaged), which was the subject of the simulated wine bottles, but rather to test if the choice method is able to give valid predictions.

The second aspect of the real bottle experiment was to investigate the **impact of shelf information on wine choice**. We report here the results from the 21 real wines (Figure 2) plus the use of medals and star ratings from the simulated wines (Figure 1).

Sensory description

The impact of the presence of a **sensory description** was analysed as described previously by calculating how often a wine was chosen when it had a sensory description compared to when it had none. If a sensory description has a positive influence on choice then wines should be consistently chosen more often with a taste description than with no description. On average over all six wines, the presence of a taste description increased choice by 7.4%. As might be expected, the increase in choice was not the same for all six wines but was found to be always positive and varied between 3.9% and 15.1%. .

Further research is necessary to better understand what caused this **differential impact on choice**. At this stage we cannot yet say what the relative contribution of each of the possible aspects of a description is. It might be related to the content and wording of the sensory description; the wine with its unique combination of brand, region and packaging, or the price of the wine. All these variables will have to be combined independently in a new choice experiment to disentangle their individual influences from each other.

There are indications that the wording of sensory descriptions used in the marketplace can be improved to be **more understandable by consumers**. In a recent study more than a quarter of Australian wine consumers stated that they find it hard to identify flavours indicated on wine back labels when they tasted the wine (Mueller et al., 2009). Nonexpert consumers have previously been found to be best able to match wines to short instead of long sensory descriptions (Hughson and Boakes, 2002). Nonexperts are also better able to match wines to concrete flavour descriptions made by experts than to their own abstract descriptions (Lawless, 1984). But despite the fact consumers might find simpler taste descriptions easier to understand, it seems to be the case that they find elaborate taste descriptions more appealing when choosing a wine. In the study by Mueller et al. (2009) an elaborate taste description on the back label had on average a more positive influence on choice than a simple taste description. More research is required into the optimal translation between the inherent sensory characteristics of a wine and consumer understanding and appeal.

Wine critics' scores

Wine quality ratings are not widely used in the Australian wine retail market to assist consumer purchase, and there is not such a clear single critic's influence on the Australian scene compared to markets such as the US, where Robert Parker or the Wine Spectator are very influential. Because there are a number of different sources of opinions in Australia, we were not only interested in the effect of **lower or higher critic's scores** but also in the effect of the **degree of agreement** among several critics.

On the 'shelf talker' of the choice experiment we displayed three hypothetical ratings: one indicated to be from Kemenys, one from Vintage Cellars and one from Winestate magazine, with a maximum of 100 points each (see Figure 2). The ratings varied in both their average score (the low average was 85 points and the high one 90 points) and in the degree of agreement between the three scores (low and high agreement), resulting in four conditions in total.

Table 4: Relative impact of wine critic's point ratings with high and low average and different degrees of agreement between the critics (ratings are shown in brackets).

	Increase in choice (%)	
	Low average rating	High average rating
High agreement	1.9% (85, 83, 87)	9.8% (90, 88, 92)
Low agreement	5.9% (85, 75, 95)	7.2% (90, 85, 95)

Table 4 summarises the average impact of the four rating conditions on relative wine choice. For a low wine rating where all three sources highly agreed with each other the impact was as expected low (1.9%). Not surprisingly the condition in which all three rating sources agreed on a high rating had the highest impact, with an average increase in relative choice of 9.8%.

One could expect that disagreement between the three scores would signal to the consumers a higher risk. We would then expect ratings with a high variation to have a lower impact on choice than those with lower variance at the same average level. We found that the effect of disagreement differs for the low and high average rating conditions. As expected, the strongly deviating rating scores on the high average had a somewhat lower impact on choice (7.2%) than those agreeing on the same high average (9.8%). Interestingly, if wine raters disagreed on the quality rating of the wines at the lower average level then consumers seem to be more influenced by the single high score of 95 and hardly consider the very low score.

At this stage we can conclude that high expert wine ratings indeed have a positive impact on consumer choice. For the highest influence on consumer choice, retailers should consider picking the highest score available from different expert ratings and only show several ratings when they agree on a high value (e.g. above 90 points).

Star ratings

With thousands of wines available in Australia only a relatively small group are rated by external wine experts. However, a **retailer could develop its own quality rating system**. To investigate the effect of such a retailer specific system we integrated a five star quality rating into the shelf choice experiment with simulated wine bottles (see Figure 1). Before the experiment, respondents were informed about the definition of the quality ratings, from no star to a maximum of five stars for an outstanding wine. Half of all wines in the experiment had no star rating (blank) while 12.5% showed either one, two, four or five stars as a quality rating.

As shown in Figure 6 while a wine without any star was chosen 21% of the time, a wine that had a five star rating was chosen 38.6% of the times it appeared. Keeping all other attributes constant, the relative impact on choice from having no rating to a five star rating was thus 17.6%. This equates to about a 3.5% increase in relative choice per incremental star.

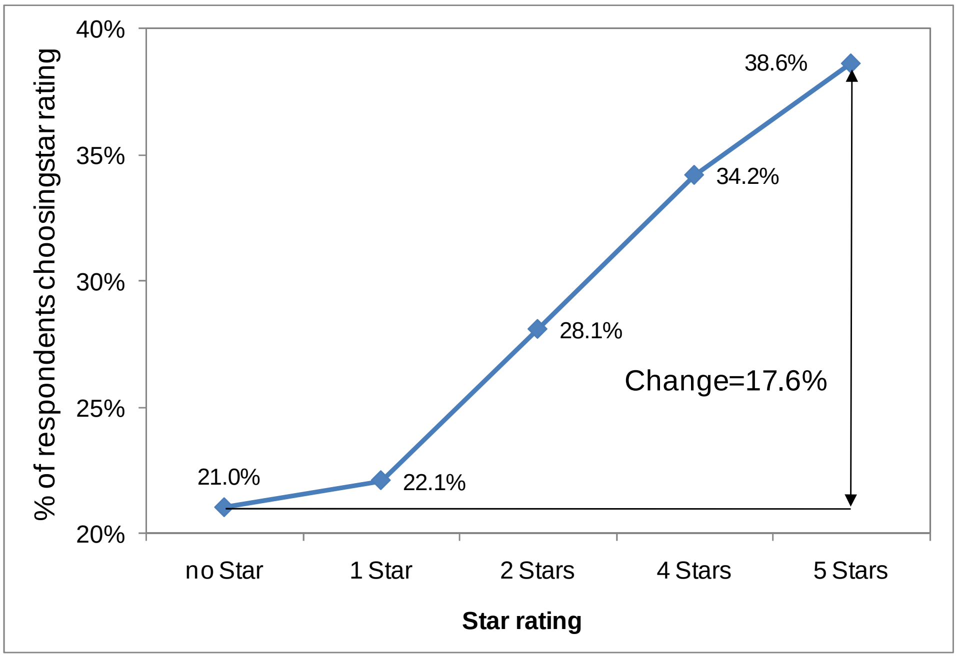


Figure 6: Impact of star ratings on relative choice.

As discussed in more detail in our previous article, choice models allow wine marketers to assess how consumers trade off attributes against each other. An attribute beneficial to consumers such as a quality rating could be compensated by an attribute that is less preferred such as a higher price. While adding a beneficial attribute at a constant price would increase the likelihood of the wine being chosen (i.e. more volume sold) a producer could also consider raising the price by a certain amount. One might also assume that a wine that aims to achieve a five star rating is more expensive in its production than an average commercial wine. Taking into account the relative choice impact of price, where a decrease of choice by 10.7% was found for an increase from $7.99 to $22.99, a producer could potentially raise a wine's price by about $6 if the star rating is increased from four to five stars. Similarly, an additional star from three to four might justify a price increase by about $4.

Phase 2- United States

1) Analysis of AC Nielsen sales data

Results from the analysis of AC Nielsen data from 2 wine markets are based on regression analysis of the sales and prices of 1,167 wines common to our two test markets. The sample showed a wide range of wines, prices and availability (Table 5).

Table 5: Characteristics of the wine sample from Chicago and Tampa

	average	min	max
Price	$ 14.76	$ 3.09	$ 157.43
Availability %	34.8	1.0	96.0
Units sold	16,537	28	303,420
Sales	$ 165,686	$ 407	$ 2,438,080

Wine origin

The **origin of the wines** in our sample gives a good indication of the structure of the US wine market (Table 6). We can see that California in general leads the US market with an overrepresentation of sales for the number of SKUs on the shelf. Australia, on the other hand is overrepresented in lower priced wines from SE Australia, but has a small share (even less than the SKUs on the shelf) of sales from other regions. This situation of small sales from a greater percentage of SKUs is typical also of other importing countries.

Table 6: Origins of wines by SKUs, sales share, and average price in 2 US markets

Origin	% SKU		% SKU	% sales	av. price
Domestic	56%	California general	17%	28%	$ 8.69
		Californian other regions	29%	31%	$ 13.06
		Napa Valley	10%	8%	$ 23.65
Import	44%	Australia SEA	6%	11.1%	$ 6.62
		Australia other	6%	2.8%	$ 12.12
		Argentina	4%	1%	$ 8.69
		Chile	5%	2%	$ 8.38
		France	5%	5%	$ 9.56
		Italy	10%	7%	$ 10.98
		South Africa	2%	1%	$ 7.93
		Spain	5%	3%	$ 11.09
		other import	2%	0.0%	$ 10.26

Grape variety

The structure of the US market in terms of the **red grape varieties** is presented in Table 7. Cabernet and Merlot dominate the market, with Pinot Noir also large. Shiraz is similar in size to Pinot. The rest of the grape varieties are small in the market. Australia will have difficulty competing in the Pinot Noir area, and tends to be low-priced in the other varietal areas.

Table 7: Structure of US market by grape variety from 2 major cities

Grape Variety	% SKU	% sales	av. price
Cabernet Sauvignon	23%	32%	$10.88
Merlot and blends	17%	19%	$8.88
Pinot	13%	13%	$11.64
Shiraz and blends	12%	10%	$7.78
Zinfandel	7%	5%	$10.88
Cabernet blends	3%	2%	$8.43
Malbec	3%	1%	$9.94
Tempranillo	2%	1%	$10.34
other	22%	16%	$10.57

Label styles

We also coded each of the 1,167 wines by the **type of label**. We downloaded all the labels and printed out approximately 500 of these. These were given to 8 different consumers, who were asked to categorise them in any way that made sense to them. From this, we developed a categorisation scheme based on label type (clean unicolour, clean with highlight, chateau basic, chateau with highlight, animal graphic, or graphical), label colour, bottle form, closure, and whether or no the label had extra information.

The results of this analysis showed some **major differences between countries**. Australia and South Africa were dominated by animal labels, and those clean with highlights on the edges (typically brand name label, such as Jacob’s Creek). France and Chile were mainly basic chateaux labels and chateau with highlights. France also had many graphical labels (but not with animals). Argentina and Italy were similar to France, but they also had a large share of clean unicolour (non-white) labels. Spain was mainly clean and graphic labels. The US had the most graphic labels (all very different) plus a wide range of clean highlight and unicolour labels.

Table 8 provides the **results of the hedonic price regression** based on a range of packaging attributes and information. We did not test brands, because there are too many different ones to get a useful coefficient. We did find that the origin plays a large role in explaining prices for domestic and imported wine, followed by label colour and bottle form for imported wines, but by label style and grape variety for domestic wines.

Table 8: Relative importance for attributes in explaining prices

	Imported wines	US domestic wines
Origin	40%	34%
Label colour	14%	8%
Bottle form	12%	5%
Label information	11%	9%
Label style	10%	21%
Grape variety	9%	14%
Closure	4%	9%

Drivers units sold

We also considered what the **key drivers were for units sold**, rather than prices.

It is not surprising that **availability** and **price** account for approximately 75% of the variance in units sold. There is a clear positive relationship with availability (Figure 7) and a less clear negative relationship with price (Figure 8). It is obvious that some low priced wines sell a lot of units and some do not; price is not the sole determinant of sales, but there are no high priced wines with lots of sales. We did find some other significant attributes that were related to unit sold. Those that increased the number of units sold were: Pinot Noir, being from south eastern Australia, and having a red or animal label. Negative influences were: Zinfandel, black coloured labels, and unicolour labels.

Figure 7: Relationship of availability and units sold

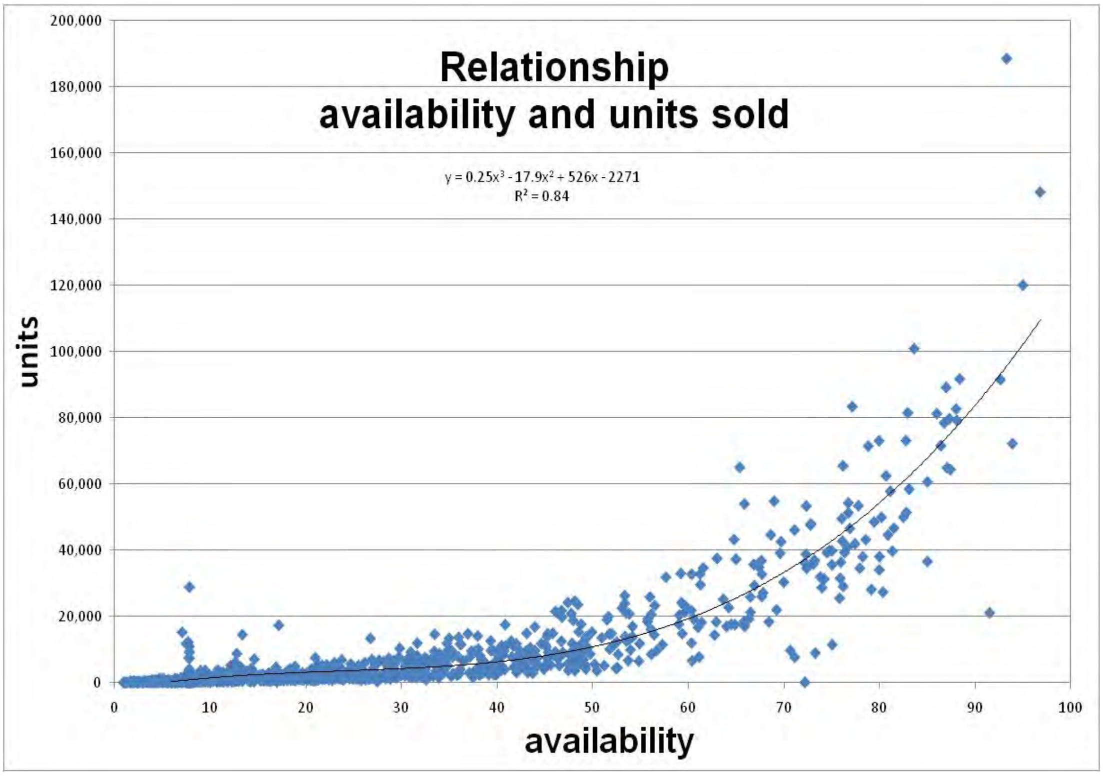
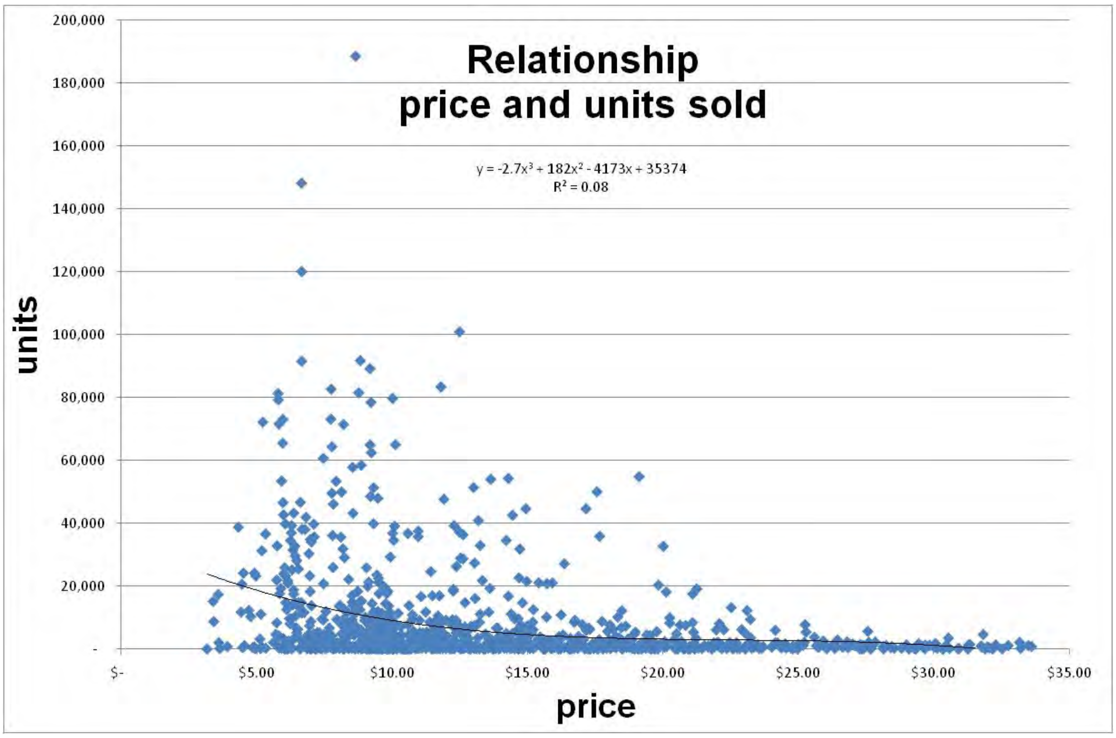


Figure 8: Relationship of price and units sold



2) Results of the discrete choice experiment in the US

The experiment was conducted in Chicago and initially Tampa, Florida. When we could not recruit enough wine drinkers from Tampa, we expanded the range to all of Florida. The first part of the analysis was **to compare the results from Chicago and Florida**, to see if we had two different samples, or whether we could combine the two samples in our analysis. The correlation between the two samples choices was 0.95, so we decided to combine them. This in itself is important; average wine consumers in two different US markets are very similar on their choices for wines. The differences in the markets are more based on what wines are available, rather than differences between the consumers.

Validity of choice experiment

The next stage of analysis looked at how closely the consumer choices of the 32 real wines reflected the actual shares of those wines in the market (from now on we use the term market to stand for the combination of Chicago and Florida). After adjusting the sales for availability, we found that our DCE (discrete choice experiment) **choices explained 65% of the variance in real world sales**. If we removed the single outlier of Hess Select wines, the R^2 was 0.71.

We also compared the choices of the different prices with the actual market sales at those prices. Our data closely reflect the actual number of units sold at the different **price points**. We see the highest choices at approximately $10 as compared to between $7-$10 in the sales data, but both sets of data show fewer sales below $4, rising in sales to about $10, and then declining after. Both of these validity checks show clearly that DCEs are a good approximation of the real market and allow us to model the effect of different attribute combinations on real consumer purchasing.

Relative importance of wine choice drivers

Table 9 provides a summary of the importance of different factors in wine choice based on our DCE. We can see that the **combination of brand, packaging, and the origin** accounts for over a third of the choice decision. We decided we could not clearly and easily separate the effects of brand and package, since they are linked by consumers' recognition of all of these at the same time. We measured the level of importance of origin in the hedonic regression and showed it was very important on its own. Here it is part of the brand, since the vast majority of brands come from a single country and often a single region.

Price is also very important but only marginally more than medals and a description of the taste of the wine. These are interesting findings, since medals are not very common in the US market, yet are more important than rating points in our experiment. This may be because **medals** are simpler to understand than rating points for the average consumer, or that many consumers do not agree with the rating scales used by wine writers or wine magazines. Sensory descriptions are a simple, yet powerful means to provide information to typically risk adverse wine buyers. These could be provided by the winery either on the bottle, or to the retailer as shelf talkers. Much less important were manager's recommendations, alcohol level, price discounts, in-store tastings, and closures. The **low importance of price discounts** and closures indicates that many Australian wine brand managers do not clearly understand consumer choice behaviour in the US market. The overall effect of core product and pricing is just over 50% of the overall impact, while awards and shelf communication provide just over 40% of the choice importance. This indicates there is a slot of scope for wineries to manipulate information for consumers beyond the already chosen brand and price point.

Table 9: Relative importance of choice drivers in the US market

Attribute	Levels	Importance
Brand, packaging, origin	32	36.1%
Price	8	16.0%
Medal	4	15.0%
Wine sensory description	2	12.4%
Rating points	2	8.4%
Managers recommendation	2	5.6%
Alcohol level	4	2.5%
Price discount	4	2.3%
In store tasting available	2	1.3%
Closure	2	0.4%

Core product and pricing	57%
Awards and shelf communication	43%

Individual wine ranking

Table 10 provides a **complete list of the 32 wines used in the experiment**. The two columns provide the ranking (out of 32) of the consumers' best and least liked wines. We have colour coded the results to show wines that are polarised (both highly liked and highly disliked), wines that are overall liked, and wines which are overall disliked. The Australian wines are also identified. We can see of the top 5 wines, three are polarising and 2 are overall well-liked. They are not all the lowest priced wines either. More of the less-liked wines were also ones of low market share and near the bottom in overall liking.

The most chosen Australian wines are well known and widely distributed, mainly from south eastern Australia, under $15, with colourful labels, made from Cabernet, Merlot, and Pinot. The Australian brands chosen less often were smaller market share brands often made from Shiraz and Cabernet. These results represent what we found form analysing actual sales with the AC Nielsen data.

Table 10: List of wines by most and least liked

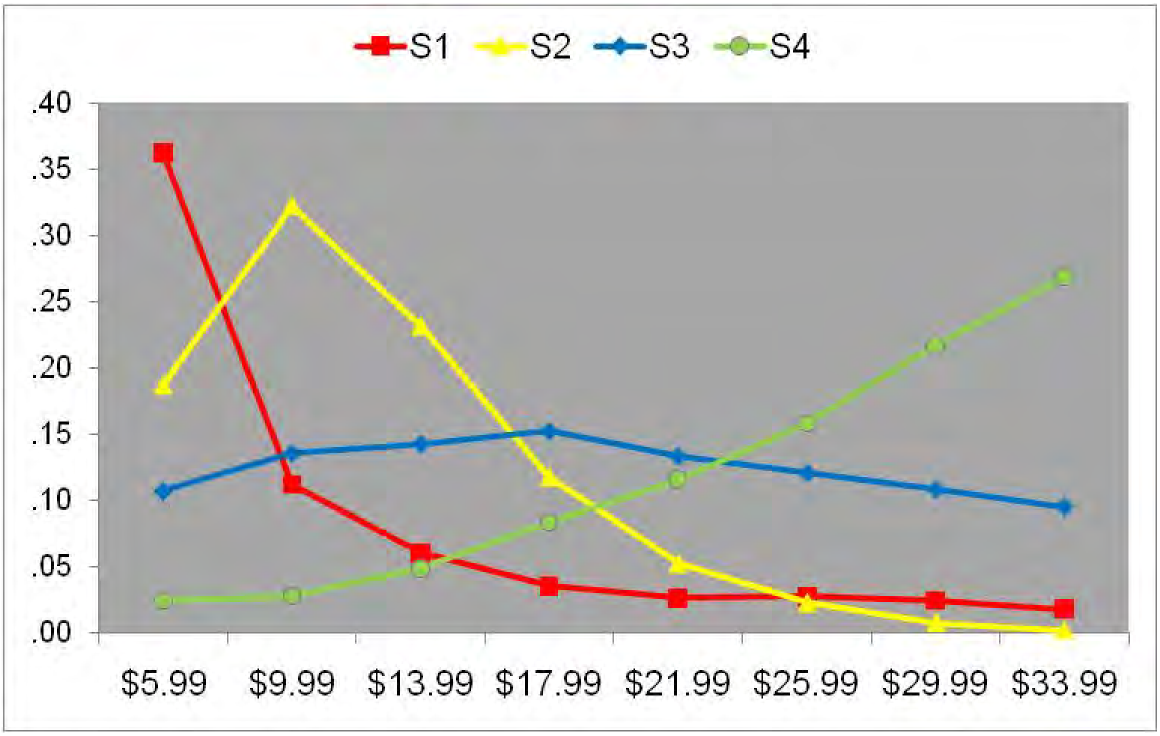
	rank most liked	rank least liked
Yellow Tail Pinot	1	1
Louis Jadot Pinot	2	12
Ruffino Chianti	3	6
Francis Coppola Merlot	4	3
Rosemount Estate Cab Merlot	5	23
Meridian CabSauv	6	17
Bella Sera Pinot	7	11
Ridge Geyserville Zinfandel	8	2
Woop Woop Shiraz	9	5
Bivio Tuscan Red	10	26
Peter Lehmann CabSauv	11	16
Bodega Norton Malbec	12	14
Weinstock Cellar Select Zinf.	13	9
Hess Select CabSauv	14	19
St Hugo CabSauv	15	32
Murphy-Goode CabSauv	16	30
Marques de Caceres Rioja	17	14
Pepperwood Grove Pinot	18	3
Yalumba Shiraz Viognier	19	27
True Earth Cab blend	20	20
Secco-Bertani Valpolicella	21	28
Penfolds Bin 128 Shiraz	22	25
Red Diamond Shiraz	23	7
Dona Paula Malbec	24	13
Thorn-Clarke Terra Barossa Shiraz	25	31
Allegrini Valpolicella	26	29
Lyeth Meritage	27	22
Hob Nob Shiraz	28	8
D'Arenberg The Footbolt Shiraz	29	23
Tir Na N'OG Grenache	30	10
Turner Road Shiraz	31	18
Penascal Tempranillo	32	21

Australian wines
Polarising wines (liked and disliked)
Agreement wines (mainly liked)
Not liked wines

Segmentation

The results presented above represent the overall market. We also segmented the respondents based on their choices among the 32 wines. After the segmentation we analysed the members of each segment to better understand their demographics and preferences. We found **four segments**, two of which already buy Australian wines and are therefore less interesting for the future; one segment that buys very low-priced and wines and is also not that interesting for Australian producers; and a fourth segments that buys more expensive wines, especially European and Californian wines, but buys less Australian wines. This **segment holds promise for Australian wine producers**.

Figure 9: Mapping of four consumer segments based on prices chosen



We can see that segment 3 has a similar probability across all **prices**. It is the biggest segment at 53% of the sample. Segment 1 is very much a low price buying segment and represents 12% of the sample. Segment 2 is 22% of the sample and bys wines typically at prices below $15 a bottle. Segment 4 is 11% of the sample, but is much more likely to buy wines at prices.

Tables 11 and 12 show the **makeup and preferences of the four segments**. Table 11 shows those already purchasing Australian wines, of which segment 3 is the most important due to its size. This segment is impacted by medals, critic's scores, and sensory descriptions much more than segment 2.

Table 11: Description of segments already buying Australian wines in the US

	Segment 2	Segment 3
Size	**22%**	**55%**
Preferred origins	US 70%, Aus 10%	US 60%, Aus 11%, Italy 12%
Preferred grape variety	> Merlot, Shiraz, blends < Cabernet	average
Preferred price	lower (<$15)	medium
Effect price discount (none to -20%)	+3%	+1%
Effect medal (none to Gold)	+2.8%	+8.2%
Effect of critic's scores (none to any)	+2.3%	+3.7%
Effect sensory description	+0.6%	+7.5%
Age	older	average
Gender		> female
location	> Chicago	
Australian image	> regions	
Purchase location	> Grocery store	
Purchase behaviour	more impulsive, less planned	
Wine involvement	low	medium

Segment 2, though 22% of the sample does not respond strongly to many of the promotions or communications. Segment 1 is only 12% of the sample and is focused on low prices and not influenced much by promotion and communication. Segment 4, 11% of the sample is a group Australia is not currently doing well in targeting. These people buy the most expensive wines, are younger, male, and buy through specialty stores, rather than supermarkets. A close look at the analysis shows they are most influenced by other’s opinions: medals, critic’s scores, and salespeople in the shops. Australia needs to target these specialty stores and their employees as well as gaining critic’s scores to impact this segment. Also, wine lists are a good mechanism to get exposure to these wine buyers. Because they are young, this segment holds promise for long term purchasing of Australian wine.

Table 12: Description of segments with less current buying of Australian wine

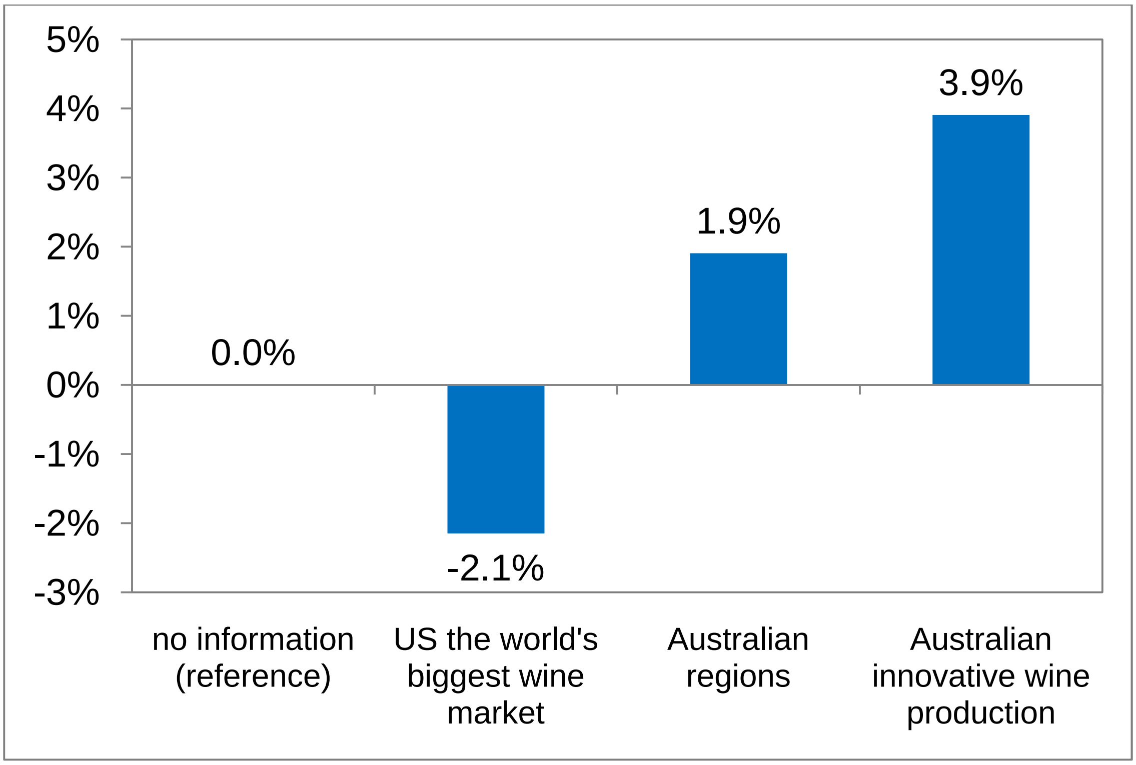
	Segment 1	Segment 4
Size	**12%**	**11%**
Preferred origins	US 65%, Aus 8%, >Spain, Chile	US 55%, Aus 7%, Italy 17%, France 12%
Preferred grape variety	> Merlot, Zinfandel < Cabernet	> Cabernet, Pinot, Shiraz < Merlot, Zinfandel
Preferred price	lowest (<$10)	Highest >$20
Effect medal (none to Gold)	+1.2%	+4.2%
Effect of critic's scores (none to any)	+1.7%	+3.4%
Effect sensory description	+1.9%	+1.9%
Age & gender		younger, > male
Income & education	lowest	highest
Location	> Tampa	Florida
Australian image		>> innovation
Purchase location		Liquor store
Purchase behaviour		> planned, ask for help
Wine involvement	lowest	highest
Dining out – hosting guest	least frequent	most frequent

Testing the effect of communication

We also conducted an experiment within the DCE, where different respondents were exposed to different **magazine articles** regarding the US as the largest wine consuming country, Australian wine regions, or Australia as an innovative wine producing country, or no communication (control).

Figure 10 provides the results of this part of the experiment. It shows clearly that communication (simulated magazine articles) effects future purchase behaviour. The US manipulation caused people to choose more US wine, and less Australian wine. Both Australian articles increased the probability of consumers choosing Australian wine, but the **most effective was the article on innovation in Australia**, not regionality. This clearly demonstrates that among average US wine consumers messages about innovation are more effective than regionality. Regions are important to a small proportion of high-end consumers, but a more modern approach could be used to increase consumption of Australian wine.

Figure 10: Relative change in choice by different communication strategies



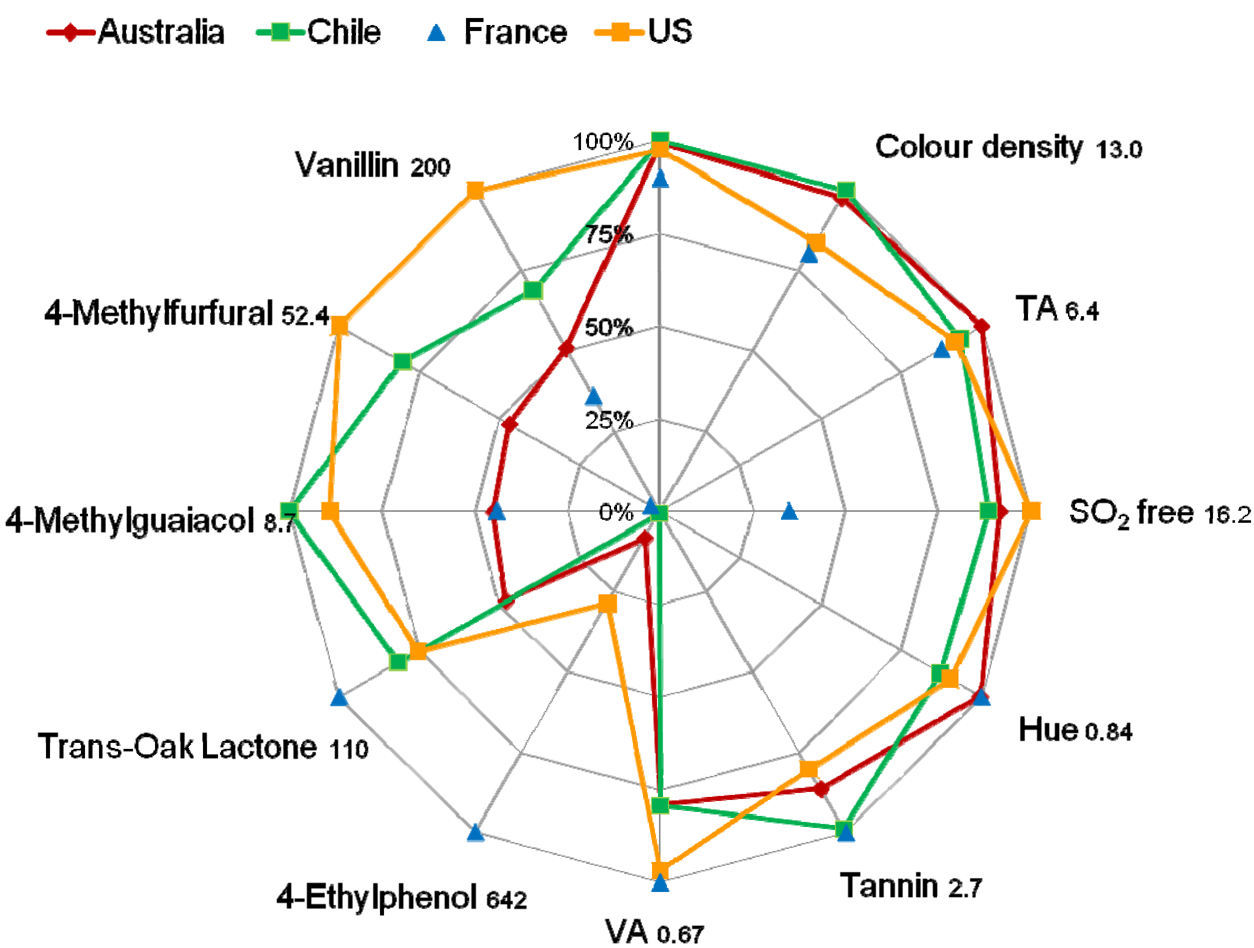
3) Chemical analysis of wines sold in the US

210 wines were sourced from Chicago and shipped to Australia. The wines consisted of roughly equal numbers of Cabernet Sauvignon predominant wines (n=74), Merlot (n=69) and Shiraz (n=67), randomly selected from wines available in the market from $12 -$40. The wines were selected on the basis of variation in sales, distribution, label styles and countries of origin, with a stratified sampling method used to ensure reasonable numbers of wines from the major producer countries were represented.

Country specific chemical and sensory profiles

The wines were analysed for **basic chemical composition**, including alcohol, sugar, acidity, as well as more complex analyses such as oak and *Brettanomyces* flavour components and colour and tannin measures. The wines were also informally assessed by a group of highly experienced AWRI wine judges.

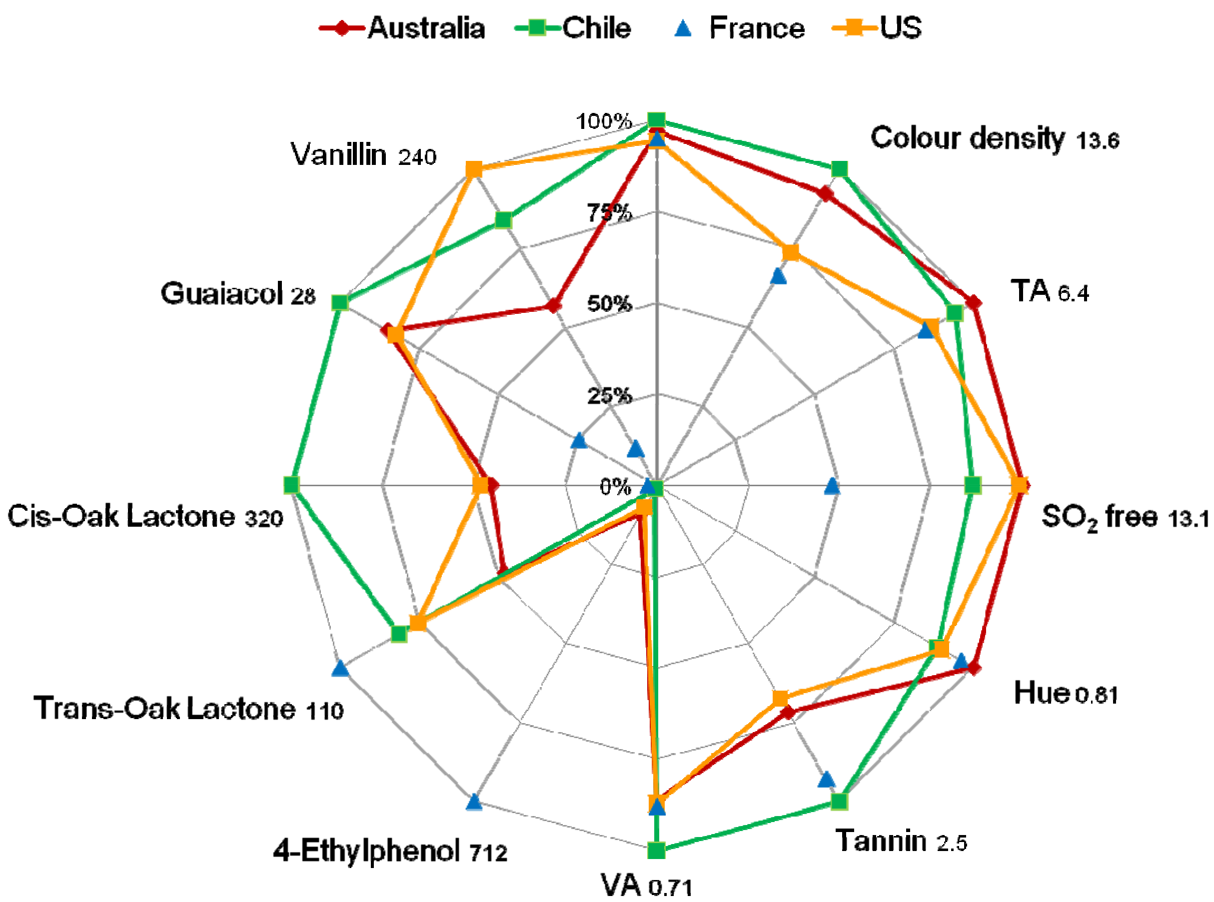
Figure 11: Country specific profiles of Cabernet Sauvignon wines



One of the outcomes of the chemical results is that they provide a **valuable set of survey data regarding wines in the US market**. The results showed that for most wines sourced from France there were substantially lower levels of alcohol, acidity and colour compared to Australian wines and much higher levels of tannin and *Brettanomyces* flavour (Figures 11 and 12). The US wines had similar high levels of alcohol as the Australian samples, but lower colour, and higher levels of the oak component vanillin. While Chilean wines were a smaller proportion of the total sample, they were generally similar in composition to Australian wines but with higher tannin concentration and levels of oak flavour components.

In the sensory assessment of the wines most Chilean samples were noted as having a strong degree of reductive off-flavour. It was noteworthy that the Australian wines were overall higher in titratable acidity compared to wine from other countries, which might be an issue that Australian producers should take note of with regard to consumer taste preferences.

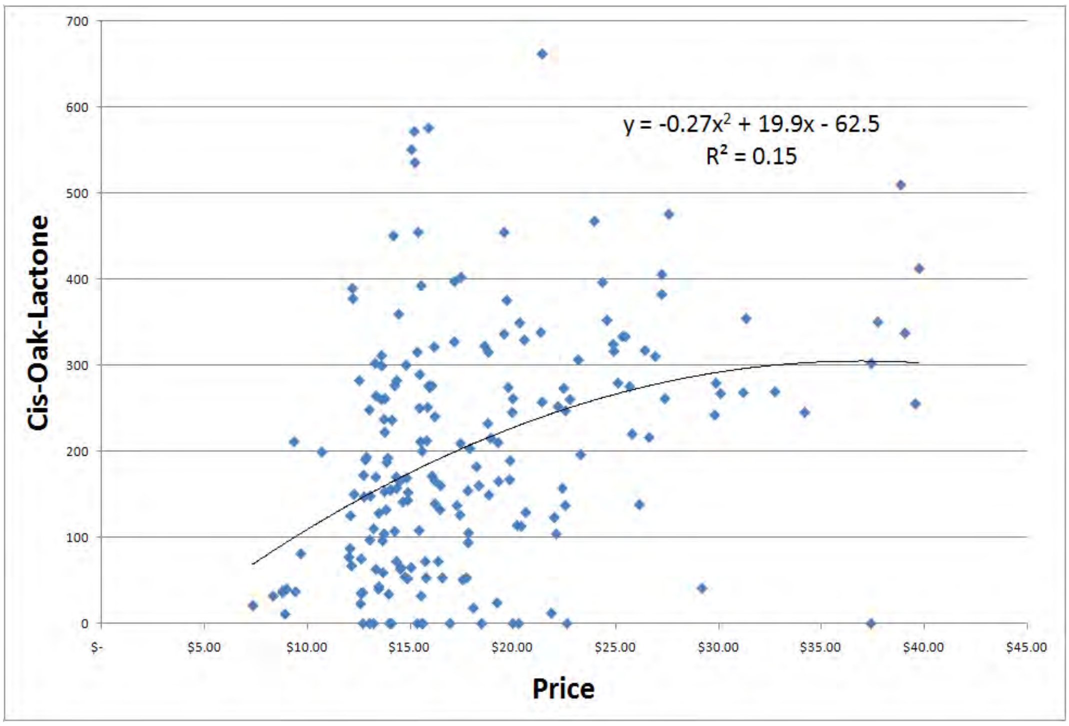
Figure 12: Country specific profiles of Shiraz wines



Relationship of chemical components and price

In including chemical composition in regression models there was a **relationship with price with some components**, but not with sales (Figure 13). Alcohol, colour, tannin and oak flavour related positively to price. The highest priced Cabernet Sauvignon based wines were either from Bordeaux and high in tannin and moderate to high in colour, or else American and moderate in tannin and high in colour. In contrast, the highest priced Shiraz wines were Australian and moderate to high in tannin and highest in colour density.

Figure 13: Relationship of alcohol, tannin, VA, and oak with price



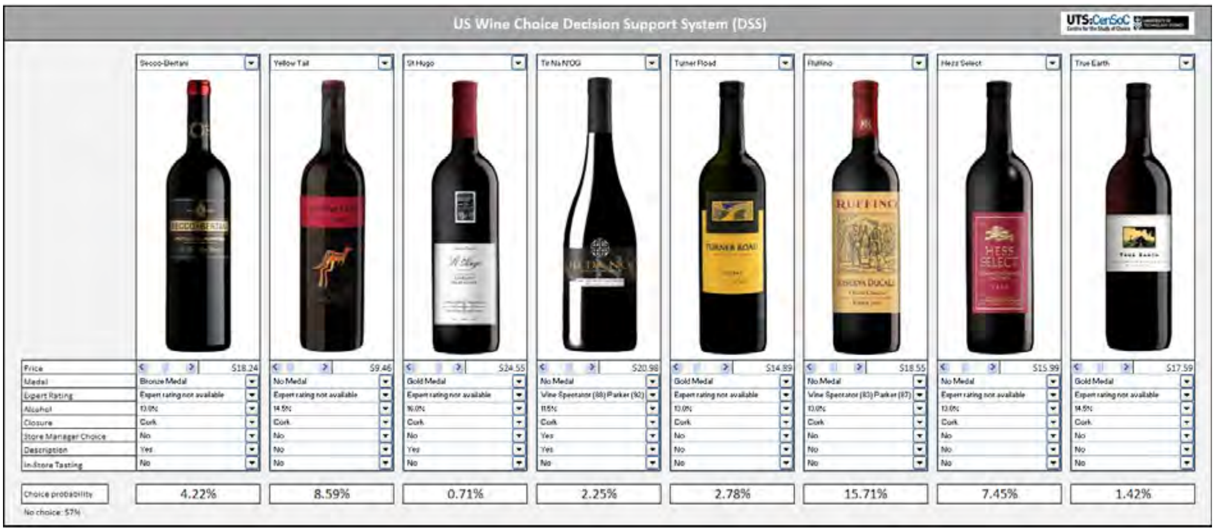
Relationship of wine critic ratings and price

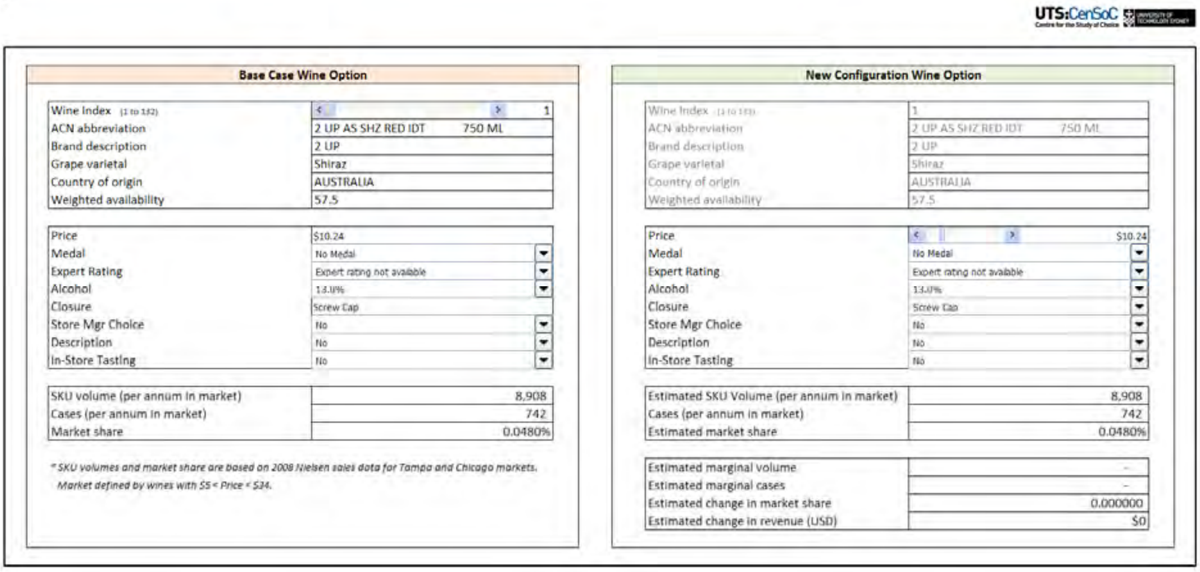
We conducted some other analyses that were not part of the original project. We retrieved Robert Parker and Wine Spectator scores for as many of the 210 wines as possible. These wines were also rated informally by 7 AWRI tasters as noted above. We found the Parker and Wine Spectator scores to be closely related and significantly correlated with the price of the wines, Parker 0.53, Wine Spectator 0.32. These wines were tasted in an informed condition. The AWRI tasters did not know the identity of the wines and their scores were not correlated with price. More sophisticated analysis showed that the wine critics and the AWRI tasters were tapping different dimensions of quality. This is an area for further investigation. Do wine critics from different countries use different measures of quality?

4) Decision Support Tools

We provided two proof of concept decision support tools using Excel. These tools are available directly from UniSA to all wineries and grape growers in Australia. They allow users to select specific wines in the US market and change various attributes, such as price, medals, and critic's scores, and then to see what each of these (or in combination) changes in sales and market share. These tools demonstrate the usefulness of the choice experiment technique, not only in showing the importance of each attribute, but also allowing these market simulations to be used by individual companies depending on their own positioning and needs.

Figure 14: Screenshot of proof of concept decision support tools





5. PROJECT OUTPUTS AND PERFORMANCE

Project performance against planned output

The following tables list performance targets as outlined in the project contract and later contract amendments.

Outputs and Performance Targets 2006-07

Outputs	Performance Targets	Performance
Stage 1		
1. Measurement of the capacity of respondents to undertake BW choices, number wines per flight and number of flights.	Have completed pre-tests using a range of wines per flight and numbers of fights in a Latin Square design to measure the time taken and the variance associated with increasing samples.	**Achieved** Result: maximum is two sets of four wines
2. Measurement of the error (variability) and viability (number of samples per person, etc.) of the Best – Worst method as compared to conventional hedonic ratings, and information regarding the optimal experimental design for Best-Worst wine studies. Decision on design of Stage 2 (2007-8 research overseas).	Have completed an experimentally designed study comparing best-worst and hedonic scoring using a minimum of 64 Australian consumers, with a set of red wines varying in three or four sensory attribute factors (high and low). Repeating the above study with at least one different sensory factor to measure each technique's variability under replication.	**Achieved** Result: decision to use hedonic rating for future experiments
3. Ability to determine non-sensory drivers of purchase intent of Australian wine consumers using web-based label design experiments.	Have tested and compared a broad selection of the drivers of wine choice, as recommended by the advisory panel, to choose the most important for the web experiment. Have completed and tested website using non-sensory factors. Have completed the web-based label optimisation experiments. Have completed development of the information acceleration website.	**Achieved** One experiment with verbal descriptions and one separate experiment with visual shelf simulation Result: visual presentation required

Outputs and Performance Targets 2007-08

Outputs	Performance Targets	Performance
Stage 2	Have submitted a manuscript to an appropriate journal regarding the comparative methods study.	**Achieved** Paper published in AJGWR
1. Information regarding the relative importance of sensory and non-sensory attributes in red wines for Australian consumers and degree of segmentation. Information regarding the repeat purchase rate for sensory and non-sensory attributes in red wine for Australian consumers. Information regarding the usefulness of information acceleration for predicting the purchase of wines in Australia. Decision on design of Stage 3	Have carried out a study assessing red wine consumer preference with idealised combinations of sensory and non-sensory attributes for red wines, using a minimum of 150 Australian consumers. Have carried out a study measuring choice rates for idealised combinations of sensory and non-sensory attributes for red wine. Have carried out a study using information acceleration on Australian wine consumers.	**Achieved** Combined experiment with n=420 consumers **Achieved** Simulated graphical shelf choice experiment with n>1,200 consumers **Achieved** Information acceleration experiment (wine shelf information) with n>300 consumers
Stage 3		
2. Information regarding the applicability of the methods designed and tested in Australia to a selected export market. Decision on design of Stage 4.	Have carried out a detailed market analysis of two markets of the US based on wines sold (e.g. AC Nielsen data).	**Achieved** Market analysis of Chicago and Tampa wine market

Outputs and Performance Targets 2008-09

Outputs	Performance Targets	Performance
	Have submitted a manuscript to an appropriate journal (and an Australian wine trade journal) regarding the sensory and non-sensory choice in Australia study. Have submitted a manuscript to an appropriate journal (and an Australian wine trade journal) comparing the information acceleration results with the sensory and non-sensory results.	**Achieved** Submitted to Food Quality and Preference **Achieved** 2 articles published in Wine Industry Journal 2008
Stage 4		
1. Knowledge regarding the degree of importance of label information, packaging and market communications for red wines in two markets of the US.	Have completed a study in two US markets quantifying, using Choice Experiment methods and display information, the relative effect of at least four non-sensory influences with a minimum of 512 consumers tested.	**Achieved** Online choice experiment with n>2,000
2. Information regarding the relative importance of chemical and non-sensory attributes in red wines in two US markets based on prior market transactions (AC Nielsen data).	Exploring the contribution of chemical characteristics as proxies for sensory wine attributes for explaining wine market share with a minimum of 50 wines from the market analysed.	**Achieved** Chemical composition of 210 wines analysed
3. Information regarding the contribution of chemical and non-sensory attributes to the prices and market share of Australian red wine for two markets in the US. 4. A Proof of Concept Framework for Decision-Making incorporating these findings in a simple to use interface.	Have completed an exploratory analysis of market transactions (price, market share) combining chemical and non-sensory attributes for Australian red wine in two US markets.	**Achieved** Analysed chemical and non-sensory drivers of price and unit sales for n=210 wines
	Late 2009 to mid 2010: publication and presentation of the results of the overseas studies in Australian trade journal, academic journals and in seminars directly to the wine sector.	**Achieved** Workshop and presentation AWITC 2010 For detailed communications see Appendix 1

Assessment of practical implications

Development of a new method to validly predict consumer choice

The project has developed a method to elicit consumers' wine choices in simulated visual wine shelves. The method of online choice experiments proofed to have a high external validity. That is its predictions reflect what consumers are choosing on the real market and allow companies an accurate forecast.

The scientifically grounded and evidence based method can be used to anticipate consumer response to changes in product and marketing activities. It is able to overcome prior measuring and predicting issues by capturing choice drivers that consumers cannot introspect and that may affect them subliminally.

The developed method can now be applied fast and cost-effective to a large number of marketing questions (as outlined in recommendations) from individual wineries or national wine bodies.

Relative importance of sensory and non-sensory characteristics

We found extrinsic packaging characteristics to stronger effect consumer choice and liking than sensory characteristics. We identified sensory characteristics that were able to cut through the strong impact of packaging and labelling characteristics: faults such as Brettanomyces, aged aromas and reductive sulfid aromas had a negative impact and should be reduced to increase the likelihood of a repurchase. Fresh fruit aromas and sweetness were positive driver for purchase intent.

Practical insights for Australian wine market

Our project allows producers to optimise their wine offerings for the Australian market and their communication with domestic retailers by providing insights into:

- The relative importance of wine characteristics for wine choice
- The existence of different segments with specific requirements
- The valuation of wine information in form of sensory descriptions, rating points and medals on the retail shelf

Practical insights for US wine market

Our project allows producers to optimise their wine offerings for the US market and their communication with distributers and retailers by providing insights into:

- Price premiums and discounts for packaging and regions of origin on two US red wine markets (Chicago and Florida)
- The existence of different segments with specific requirements and targeting options
- The valuation of wine information in form of sensory descriptions, rating points and medals on the retail shelf

Benefits from the Project

The project supported a number of wine industry's strategic initiatives.

1) Anticipating the market

Our new method is able to give the industry insights into consumers' perception of Australian wine. It can quantify differences amongst consumers and how they respond to different wine characteristics. It allows the industry to better understand consumer preferences and to deliver products that better match consumer taste.

2) Targeting the Consumer

By providing insights into what consumers want, where and how they purchase the insights derived with our method is a valid basis for positioning and targeting.

The choice method can predict the impact of communication tools on consumers' wine choice and can be used to test the effectiveness of national and international communication strategies before media investments.

3) Sustainability

Our method can be used to test newly developed products, new brands and wine styles that allow Australia to predict its success and optimise them before entering a new market or introducing new products into existing markets.

6. RECOMMENDATIONS

Investment in Marketing Research

The key focus of this project was to develop new techniques to be able to predict consumer response to sensory and non-sensory attributes of wine. Investing in research techniques for marketing is just like investing in research techniques for any other research. It has long term benefits and multiple uses. The **multi-media shelf simulations** we developed allow the testing of shelf information, pricing and even advertising and communication strategies with more flexibility and lower cost than doing these directly in the market. Our simulations were validated with real market data and show the ability of this approach to predict changes in sales and dollars.

Simulation of packaging changes

We found it difficult to simulate changes to specific packaging attributes, such as brand names, logos, colours, and label styles. There are so many variations to these that no experimental design can account for enough of them to make a wide range of wineries happy. On the other hand, these techniques would work well for a single winery, or for a few brands contemplating changes to packaging and wanting to see the effects before investing in wholesale changes.

Dominance of extrinsic wine attributes

We found that changes to overall packaging, distribution, and price predict sales better and have a greater effect than changes to wine sensory attributes. Consumers are not good judges of wine taste and respond more to the price paid (in terms of liking) than wine style. Wine style does have an effect on preference and choice, but it is smaller than the packaging and pricing effects. Wine chemistry is complex and it is difficult to establish a relationship between individual measures and sales, though there are some useful relationships between certain chemicals and the price charged.

It may not be big news, but **distribution intensity** has the highest correlation with sales. Wineries striving to increase sales should focus on increasing availability before anything else. Even price effects are less powerful than distribution effects. Wine closures, often a point of disagreement in the US market, have little effect on sales, either using AC Nielsen data or our simulated choices. Wineries should use the packaging they prefer and approach the market with confidence. More surprising is the small role of discounts as compared to distribution, pricing overall, branding, and origin. Wineries should set their pricing structure to include the necessary discounts depending on the channels they choose (grocery stores, wine shops, on-premise); they should avoid large discounts and unplanned price reductions, because these will not result in concomitant increases in sales.

Importance of shelf information

A major finding is that shelf information can **have a large effect on sales**. Individual wineries or even regions can work to get short taste descriptions, critic's scores, medals, or even in-store recommendations placed with their wines. This effort will be well-rewarded by increasing sales, especially if other wineries do not try this at the same time. Another finding is that promoting innovation as a tenet of the Australian wine sector has a larger effect on preference than promoting wine regions. Regionality is strong part of every wine country's promotion. It is important to wine writers and to a small proportion of important wine consumers, who buy expensive wines. Innovation, on the other hand, is a different position, one that is not in conflict with other wine producing countries. It may be a very useful way of differentiating the Australian offer, especially to lower involvement consumers. Any message, however, will increase sales compared to no publicity.

Similarity of preferences between US markets

We also found that consumers in two different geographic markets (Chicago and Florida) have similar buying preferences and responses to various stimuli. From a consumer perspective there is no reason to develop different strategies for different geographic markets, but there could be need to react to different distribution systems. There clear **segments** in the markets, which can be targeted with different strategies depending on the price point and positioning of the brand. We identified a 'sweet spot' for Australian wine between $11 and $20, both through our experiments and through the AC Nielsen data. Many Australian wines seem underpriced, and this is creating a low end positioning across the board.

Decisions support tools

The proof of concept decision support tools demonstrate the strength of our approach. These tools could be built to monitor the US market for changes overall, to look at changes in price sensitivity, or even to compare the coastal US markets with the heartland. The **same method could be applied to other markets**, such as China to better understand the drivers of choice and how manipulating various attributes affects those choice. It could be applied to market sectors, like Sauvignon Blanc in Australia to test how different varieties might compete with it. It can be used by individual companies to look at packaging comparisons before launching into the market.

Further research

This research, as all research, provides some guidelines for further investigation. We found that **branding, packaging and pricing influence sensory liking**. This area needs further investigation so that Australian wineries can use the right combination of packaging and pricing to set sensory expectations for their target markets.

Packaging in general is a new an important area that could help Australia sell more wine. **Packaging fluency**, how consumers read a package (before even picking up the bottle) and what information they get from it as the look over the shelf is an important determinant of choice, yet we understand very little about how packaging cues are processed while someone looks at a shelf. Our research focused so far on the processing of cues, once the bottle is picked up, but not on what happens prior to that time, when thousands of potential choices are quickly narrowed to a few.

The same techniques we used on retail buying could be applied to wine lists. We could measure the impact of various cues on **wine lists** and help Australian wineries work with their agents to develop more effective listings. We could also develop an instrument to predict trends in **grape varieties** and wine styles using the same techniques. This would be used annually or biennially in any market to act as an indicator of changes in preferences.

One final area to conduct future research is **how wine critics from different countries evaluate wines**. It is possible that Australian wines are being made for a different palate (among critics) and are not garnering the attention they should. Initial measures of wine chemistry showed Australian wines to have greater levels of acidity than our major competitors. We don't know if this has an effect on critics' scores or if this affects consumer preference. No research has **linked wine chemistry, critics' scores and consumer preferences**, which could lead to important changes in some wine styles resulting in greater scores and higher preferences.

7. LIST OF ALL COMMUNICATIONS

The following table lists all project related communications ordered by time. From the beginning it was our focus to share our findings with the Australian wine industry. This reflects in a total of *7* industry presentations and *12* industry or trade journal publications.

We presented and discussed the methodological insights from the projects with international academic peers. So far *10* conference presentations and/or refereed conference papers resulted from the project. From the early academic insights we have so far *3* academic journal papers published and *1* paper is currently under review at an international leading food research journal. We are currently starting to transform some conference papers into journal papers and expect number of academic papers to follow after the completion of the project.

The following table specifies the type, topic, venue, audience and date of our communications and indicates to which project part (extrinsic cues, sensory cues or combination of both) they covered. The first column indicates which of the communications are enclosed in Appendix 1 of this report.

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	Presentation	AWBC and WFA Directions to 2025 research capacity meeting	Australian Wine Industry	17/11/06	Yes	-	-
X	Presentation	Project Update - GWRDC	GWRDC, AWBC, Advisory Board	24/07/2007	Yes	Yes	Yes
	Presentation	Consumer Wine Marketing Research – Australian Institute of Food Science and Technology (AIFST) Convention in Melbourne	Australian Food and Wine Industry	26/07/2007	Yes	partial	partial
	Presentation + Poster	Consumer Preferences for Brett – Australian Technical Wine Conference	Australian Wine Industry	28/07-02/08/07	-	-	partial
	Article	Project Portray – GWRDC R&D AT WORK, August 2007, p. 4-6.	Australian Wine Industry	04/08/07	Yes	-	-
X	Article	Project Results – What's important in choosing wine, Wine Business Monthly, August 2007, p. 32-33.	Australian Wine Industry	August/2007	Yes	Yes	-
X	Article	Project Results – Packaging is important, Wine Business Monthly, October 2007, p. 36-37.	Australian Wine Industry	October/2007	Yes	Yes	-

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	Presentation	BW vs HR for wine preferences, 7th Pangborn Sensory Science Symposium, Minneapolis (later published as academic journal article)	International Sensory Science Researchers	13/08/07	-	-	Yes
X	Presentation/ Article	'Do respondents use extra information provided in online Best-Worst choice experiments?' Australian and New Zealand Marketing Academy Conference (ANZMAC), 3-5 December 2007, Dunedin, New Zealand	Australian and NZ marketing researchers	04/12/07	-	Yes	-
X	Presentation	Project Update - GWRDC	GWRDC, AWBC, Advisory Board	30/05/08	Yes	Yes	Yes
X	Presentation/ Article	The relationship between wine liking, subjective and objective wine knowledge: Does it matter who is in your 'consumer' sample?	Proceedings of 4th International Conference of the Academy of Wine Business Research, Siena,	17/07/08	-	-	Yes

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
X	Presentation/ Article	How important is wine packaging for consumes? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods *Received Runner-up Best paper award*	Proceedings of 4th International Conference of the Academy of Wine Business Research, Siena, 17-19 July, 2008.	17/07/08	-	Yes	-
X	Presentation	2nd Annual Meeting of the American Association of Wine Economics in Oregon: Modelling consumer sensory preference heterogeneity – A case study on how the choice of clustering method impacts implications for optimal product design	International wine economics researchers	15/08/08	-	-	Yes
X	Presentation	Project Update – GWRDC, deliverables phase 2	GWRDC, AWBC, Advisory Board	19/09/08	Yes	Yes	Yes
	Presentation	Project Update – results Australian experiments	Vivian Boghossian, Chair Sensory and Consumer Science Group, Fosters	25/09/08	Yes	Yes	Yes

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	DVD	Recording of presentation Project Update from 19/09/08	GWRDC, Advisory Group	26/09/08	Yes	Yes	Yes
X	Article	How consumers choose wine, Wine Business Monthly, October 2008, p. 32-33.	Australian Wine Industry	October/08	Yes	Yes	-
	Article	Daily Wine News: Australian wine researchers a step closer to predicting consumer choice	Australian Wine Industry	15/10/08	Yes	Yes	Yes
	Written Report	Understanding consumer preferences for Australian Shiraz wines with informed tasting Detailed results of Australian experiments Copy provided to GWRDC in December 2008	GWRDC, Advisory Group, 11 Wineries providing wine	13/12/08	Yes	Yes	Yes

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	Presentation	Mueller, S., Szolnoki, G. (2009): Does packaging influence the price of wine?: A hedonic price analysis of US scanner data, invited presentation at the Australian Agricultural and Resource Economics Society, SA branch Later written up as conference paper for Auckland	Australian Agricultural Economists	17/03/2009	-	Yes	-
X	Article	Lockshin, L., Mueller, S., Louviere, J., Francis, L., Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, The Australian and New Zealand Wine Industry Journal, Vol. 24 (2), 35-40.	Australian Wine Industry	04/05/2009	Yes	Yes	-
X	Article	Mueller, S., Lockshin, L., Louviere, J., Francis, L., Osidacz, P. (2009), How does shelf information influence consumers' wine choice?, The Australian and New Zealand Wine Industry Journal, Vol. 24 (3), p.50-58.	Australian Wine Industry	30/06/2009	Yes	Yes	-

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	Presentation	Mueller, S., Osidacz, P., Francis, L., Lockshin, L. (2009), The relative importance of sensory and non-sensory product characteristics: Combining discrete choice and informed sensory testing, 8th Pangborn Sensory Science Symposium, Florence, 26-30 July 2009. Later written up as academic journal article for FQP.	International Sensory Science Researchers	28/07/2009	Yes	Yes	Yes
X	Article	Journal paper Mueller, S., Francis, L., Lockshin, L. (2009), Comparison of Best-Worst and Hedonic Scaling for the Measurement of Consumer Wine Preferences, Australian Journal of Grape and Wine Research, Vol. 15 (3), 205-215.	International wine researchers	Oct 2009	-	-	Yes
X	Article	Lockshin, L., Don't Ask Consumers, Wine Business Monthly,October 2009	Australian Wine Industry	October 2009	-	Yes	-

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
X	Article	Article accepted for publication Mueller, S., Lockshin, L., Louviere, L. (2010): What you see may not be what you get: Asking consumers what matters may not reflect what they choose. Marketing Letters. Available Online First.	International Marketing researchers	Oct 2009	-	Yes	-
	Article	Submitted to Journal Food Quality and Preference Combining discrete choice and informed sensory testing of extrinsic and intrinsic wine attributes: can it predict real world market share?	International food consumer preference researchers	30/10/2009	Yes	Yes	Yes
X	Presentation	Project Update – GWRDC, US market results	GWRDC, AWBC, Advisory Board	24/11/2009	Yes	Yes	Yes

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
X	Article	Mueller, S., Lockshin, L., Saltman, Y., Blanford, J. (2010), Message on a bottle: The relative influence of wine back label information on wine choice, Food Quality and Preference, Vol. 21(1), 22-32.	International food consumer preference researchers	Jan 2010	-	Yes	-
X	Article and conference presentation	Lockshin, L., Mueller, S., Louviere, J. (2010), The influence of shelf information on consumers' wine choice, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).	International wine marketing researchers	Feb 2010	-	Yes.	-
X	Article and conference presentation	Mueller, S., Osidacz, P., Francis I.L., Lockshin, L. (2010), Combining discrete choice and informed sensory testing to measure extrinsic and intrinsic wine attributes, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).	International wine marketing researchers	Feb 2010	Yes	Yes	Yes

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
X	Article and conference presentation	Mueller, S., Szolnoki, G. (2010), Wine packaging and labelling - do they impact market price? A hedonic price analysis of US scanner data, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).	International wine marketing researchers	Feb 2010	-	Yes	-
X	Article	Mueller, S., Kweh, H., Lockshin, L. (2010), Can bottle weight be taken lightly for premium wine?, The Australian and New Zealand Wine Industry Journal, Vol. 25 (1), 28-30.	Australian Wine Industry	Feb 2010	-	Yes	-
X	Article	Mueller, S., Lockshin, L. (2010), Message on a bottle: The relative influence of wine back label information on wine choice, The Australian and New Zealand Wine Industry Journal, Vol. 25 (1), 32-35.	Australian Wine Industry	Feb 2010	-	Yes	-

enclosed App. 1	Type	Topic & Venue	Audience	Date	Project Sections - primarily related to		
					Overall	Extrinsic	Sensory
	Workshop	Lockshin, L., Mueller, S., Francis, L., Osidacz, P. What most influences consumer wine choices? The wine, the package or external information? Workshop at Australian Wine Technical Conference	Australian wine industry	July 2010	Yes	Yes	Yes
	Presentation	Mueller, S. Filling the gap – how do sensory and marketing attributes interact in consumer choices? Invited for presentation at Australian Wine Technical Conference	Australian wine industry	July 2010	Yes	Yes	Yes

APPENDIX 1 – COPY OF ALL COMMUNICATIONS

Part 1: GWRDC presentations

1) Project Update GWRDC, Preliminary Results, 24.07.2007
2) Project Update GWRDC and Advisory Board: Australian Method, 30.05.2008
3) Project Update GWRDC and Advisory Board: Deliverables Phase 2, 19.09.2008.
4) Project Update GWRDC and Advisory Board, US Market Results, 24.11.2009

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

Wine Marketing Project

- GWRDC status report and update –

24 July 2007

Prof Larry Lockshin (UniSA)
Dr Simone Mueller (UniSA)
Dr Leigh Francis (AWRI)
David Hackman (CenSoC, UTS)

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

Presentation Structure

1) The Team
2) Project Mandate and Delivery to Date
3) Experiments, Results and Implications
4) Future Project Stages
5) Summary and Discussion

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

Organisations & People

UniSA
Prof Larry Lockshin (PS)
Dr Simone Mueller (PM, CI)

AWRI
Dr Leigh Francis (CI)
Brooke Travis
Belinda Bramley Patricia Osidacz

CenSoC
Prof Jordan Louviere
David Hackman
Scott Gillespie

Advisory Board
Rodney Sammut (Fosters)
Nick Blair (Pernod Ricard)
Miriam Leenders (Hardy Wines)
Ali Hogarth (AWBC)
Ian Hollick (Hollick Wines)

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

Project Mandate & Outcomes

- Develop a method to determine the relative importance of sensory and non-sensory attributes on wine liking and choice

  GWRDC outcome:
  - Creation and application of a new method examining market response to different Australian wines
- Apply choice method to wine purchase in Australia and one overseas market

  Industry outcome:
  - Ability to simulate market response to different wine types for the Australian and one overseas market (DSS)
  - Presentation to Wine Technical Conference 2010

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Project Deliverables

- GWRDC deliverables:
  - Final report and presentation
  - DSS for Australia and one country for the grape variety Shiraz
  - Report for the GWRDC web site
  - Academic and trade publications describing our results and their applications
- Industry deliverables:
  - DSS for Australia and one overseas market
  - Presentation to Wine Technical Conference 2010

Project Objectives

1) The Directions – ANTICIPATING THE MARKET
   - give the industry insights into consumers' perception of Australian wine
   - quantifying differences amongst consumers and how they respond to different wine characteristics
   - Leadership in R&D: keynote research and collaboration between research agencies in the wine sector
2) TARGETING THE Consumer
   - Providing insights into consumers' wine choice and repurchase behaviour
3) Sustainability – THE COMMON PLATFORM
   - fostering a more planned approach for the development of new wine brands and/or wine styles

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA

Australian Government
Grape and Wine Research and Development Corporation

Project Plan

		2006	2007				2008			
Responsible	**Sensory**	q4	q1	q2	q3	q4	q1	q2	q3	q4
AWRI/ UniSA	B-W capacity test									
AWRI/ UniSA	B-W vs. Hedonic Rating									
AWRI/ UniSA	Sensory mapping of red wines									
	Extrinsic information									
CenSoC	B/W (Importance of information types)									
CenSoC	DCE (effect of various information types)									
	First Experience Decision Support									
CenSoC	Develop FEDS website									
	Combined									
UniSA/ CenSoC/ AWRI	Develop combined Sensory/ DCE/ FEDS									
	Overseas									
UniSA/ CenSoC/ Advisory B.	Decide which overseas market to export									
UniSA/ CenSoC/ AWRI	Repeat process									

The Australian Wine Research Institute

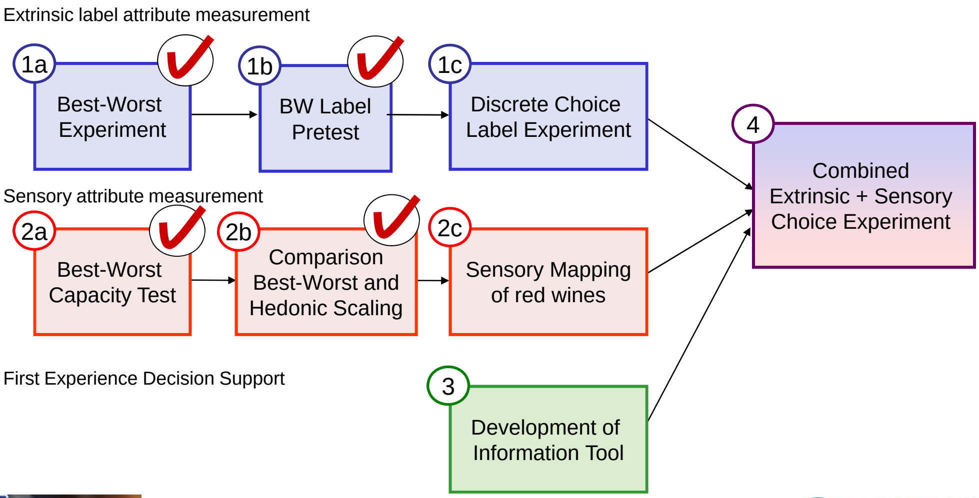
24 July 2007 6-montly GWRDC update v1-0 - Slide 7

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA

Australian Government
Grape and Wine Research and Development Corporation

Work completed to date



The Australian Wine Research Institute

24 July 2007 6-montly GWRDC update v1-0 - Slide 8

CenSoC
Centre for the Study of Choice

Results & Insights

In reviewing the following materials included in the July 2007 update please keep in mind:

- The results and insights are 'preliminary'
- The results of the first stage will be final when the research team (UniSA, AWRI and CenSoC) and the client (GWRDC) sign off.

We welcome your feedback on this presentation.

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
UniSA
Australian Government Grape and Wine Research and Development Corporation

Overview of Insights

1) Brand, price and region are important drivers of consumers' wine choice.
2) Wine packaging is important to consumers' wine choice, but they do not self-report this. To measure its influence consumers have to be provided with simulated bottles.
3) Different consumers like different wines.
4) Consumers have a low consistency in stating their preferences in blind wine tasting.
5) Different sensory methods measure different aspects of wine preferences (HR/BW).

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Australian Government | Grape and Wine Research and Development Corporation

Overview of Publications so Far

- Wine Business Monthly publication on consumer wine choice
- 40th AIFST presentation on Wine Marketing
- 13th AWITC Poster & Workshop "Brett and consumer preferences"
- Website: www.winepreferences.com

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Australian Government | Grape and Wine Research and Development Corporation

Overview of Experiments so Far

1) **Best-Worst Experiment**
   → Objective: to reduce the number of extrinsic wine attributes

2) **Discrete Choice Label Pretest (added to scope)**
   → Objective: to refine method for the influence of packaging variables

3) **Sensory Best-Worst Capacity Pretest**
   → Objective: to determine comparison design

4) **Comparison of Best-Worst and Sensory Scaling**
   → Objective: to determine sensory method for later stages

The Australian Wine Research Institute

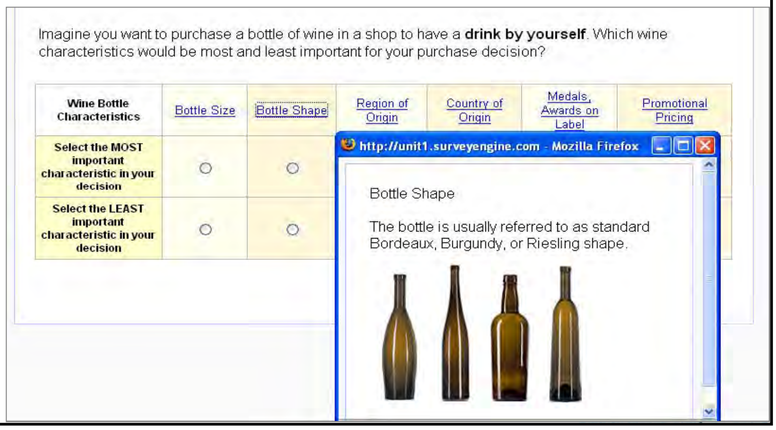
CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

1) Best-Worst Experiment

- Tested importance of 16 extrinsic wine attributes
- Examined 7 different wine purchase situations
- Online experiment with 740 regular wine drinkers around Australia



The Australian Wine Research Institute

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

1) Preliminary Results & Insights

- Importance of attributes for wine purchase decision

Attribute	Importance	Attribute	Importance
Brand	100	Closure Material	14
Mid price	75	Organic	11
Promotional Pricing	64	Capsule Material	10
Region of Origin	60	Label Style	7
Medals and Awards	54	Bottle Shape	6
Country of Origin	53	Bottle Colour	5.4
Bottle Size	21	Label Colour	5.4
Alcohol Level	19	Label Shape	5.0

- Minor deviations for different purchase situations

→ **Insight:** Consumers who self-report tell what *they think* should be important

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

2) Choice Label Pretest

- Online experiment using 16 different simulated wine bottles
- Refined approach for measurement of packaging attributes relative to brand, price and region

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

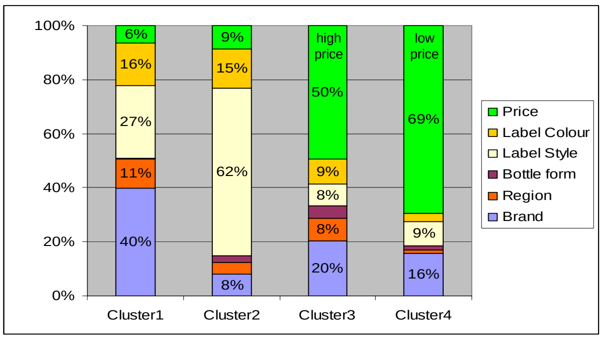
Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

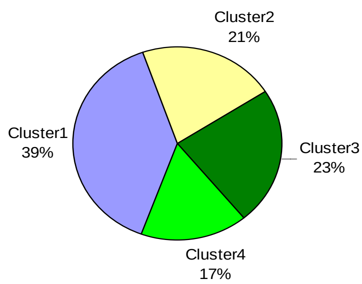
2) Preliminary Results & Insights

- Label style and label colour are important for consumer choice

Groups (clusters) of similar types of consumers



Size of clusters



→ **Insights:** Importance of packaging can only be tested by simulating wine bottles
Heterogeneous consumers can be segmented based on preferences

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

3) Capacity Pretest

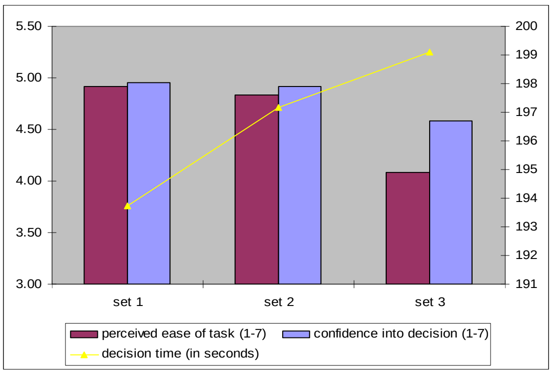
- 24 wine consumers evaluated 3 sets of 4 wines and chose the best and the worst wines
- Wine volume drunk and blood alcohol were measured
- Perceived ease of task, confidence in the decision and time necessary for each set were recorded

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Australian Government Grape and Wine Research and Development Corporation

3) Preliminary Results & Insights



Objective results after 12 wines:

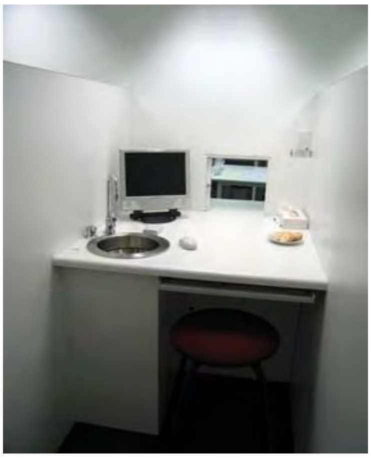
- 20% of respondents above or close to blood alcohol limit
- Decision time increases with each set
- Critical decrease in perceived ease of task and confidence in the decision after 2nd set
- Very low consistency of wine evaluation between sets

→ **Insight:** self-reporting is not a reliable source of information

CenSoC Centre for the Study of Choice

4) Comparison B-W and Hedonic Scaling

- 8 wines prepared from one base wine by adding 3 components:
  - Oak Flavour
  - Brettanomyces
  - Alcohol
- 8 wines were evaluated with Hedonic Rating and Best-Worst by 112 wine consumers in two different tasting sessions



UniSA
Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

4) Preliminary Results & Insights

- Consumers have heterogeneous wine preferences
  - e.g. Brett likers, dislikers and non-sensitive consumers
- Low consistency between evaluations of two tasting sessions
- BW and Hedonic Rating derive different aspects of wine preferences
- Hedonic rating had greater statistical power due to more data points
- Low but slightly higher explanation of wine choice by Hedonic Rating

→ **Insight:** consumer discriminative ability is low and sensory memory is short (cannot reliably differentiate wines)

→ **Research insight:** more data points and higher flexibility make use of Hedonic Rating for future experiments very likely

Summary of Implications

Heterogeneous consumers can be segmented based on preferences

1) **Extrinsic wine attributes**
   - Brand, label style, price and region are important drivers of wine choice
   - Packaging is important but requires simulated bottles to investigate the characteristics

2) **Sensory wine attributes**
   - Consumer's taste preferences for wine differ – people have highly individual wine preferences – segmentation necessary
   - Measuring taste preferences blind (without other info) does not predict choice very well

UniSA | Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Next Project Stages

1) **Finish Australian Project Part (2007-08)**
   - Complete test of extrinsic attributes (80% done)
   - Sensory mapping of Australian red wines
   - Build information influence testing tool
   - Combined experiment

Refining and validating method

2) **Prepare Overseas Project Part (2007)**
   - Overseas market choice

Customising approach

3) **Repeat Project Overseas (2008-09)**

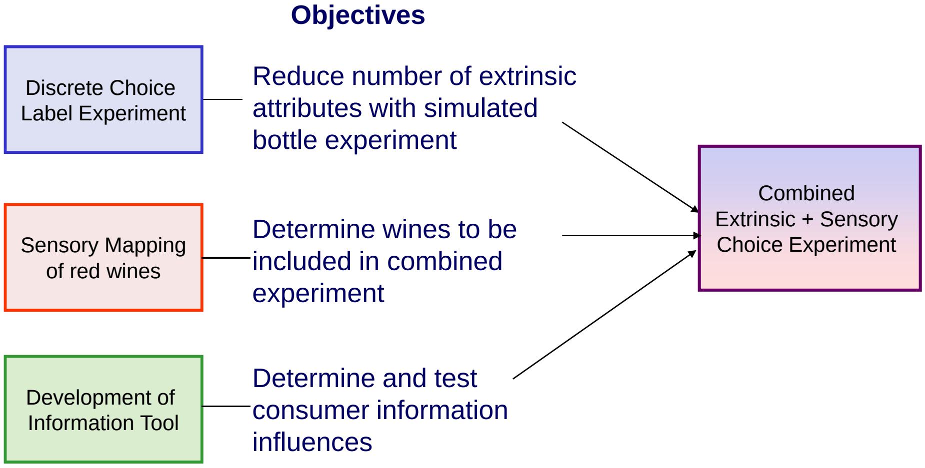
Executing based on insights

Project Management – Next Steps

		2006	2007				2008				2009	
Responsible	**Sensory**	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2
AWRI/ UniSA	B-W capacity test		■									
AWRI/ UniSA	B-W vs. Hedonic Rating		■	■								
AWRI/ UniSA	Sensory mapping of red wines				■	■						
	Extrinsic information											
CenSoC	B/W (Importance of information types)	■										
CenSoC	DCE (effect of various information types)			■	■							
	First Experience Decision Support											
CenSoC	Develop FEDS website				■	■						
	Combined											
UniSA/ CenSoC/ AWRI	Develop combined Sensory/ DCE/ FEDS					■	■	■				
	Overseas											
UniSA/ CenSoC/ Advisory B.	Decide which overseas market to export			■	■							
UniSA/ CenSoC/ AWRI	Repeat process								■	■	■	■

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation

Next Research Experiments



Questions for GWRDC (1)

- Simulating consumer information sources (FEDS)
  - Do you have any specific material to be included?
  - Do you have a strong preference for video, audio or print material?
- Feedback on www.winepreferences.com
  - Which messages for industry?

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation

Questions for GWRDC (2)

- **Which consumers** do you want us to focus on?
  - Wine drinkers or non-wine drinkers?
  - Red wine drinkers or white only drinkers?
  - Shiraz-drinkers or non-drinkers?
- Which **purchase situations** do you want us to focus on?
  - Purchase in a bottle shop from shelf
  - Purchase online
  - Purchase in café or restaurant
- Is it your aim that the project insights are focused on short or medium-term gains for the industry?

Overseas Country Choice

- **Meeting with Advisory Board on 9 May**
  - Short-term highest value growth perspective is the **US** market
  - What drives US consumer's wine choice? – Australian wine industry lacks information
  - **China** is seen as very interesting in medium-term, still too low value per litre wine
- AWBC market report will provide further information on both markets
- **Market decision necessary by September 2007**

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Questions & Issues for Market Choice

- **US = Emerging Market?**
  - US is not an emerging market as outlined in the project application and existing mandate
- **Market Choice**
  - Which market in the US should we concentrate on?
- **Consumer Type Choice**
  - Which consumers in the chosen US market should be included?
  - Frequent/ infrequent, Australian wine consumer or not?
- **Attribute choice DCE**
  - Should Wine Australia logo be included in DCE or FEDS?

Project Summary

- On track to deliver insights and outcomes on schedule
  - Primary methodology questions resolved – focus more on market issues
- Industry outcomes
  - AWITC conference workshop and poster on Brett July 2007
- Academic outcomes
  - Pangborn Sensory Science Symposium Presentation Aug 2007
- Require input into target consumer and purchase situation

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Wine Marketing Project

A Status Report and Update for GWRDC

30 May 2008

Presented by
Prof Larry Lockshin
Ehrenberg-Bass Institute for Marketing Science, UniSA
Prof Jordan Louviere
Centre for the Study of Choice (CenSoC), UTS
Dr Leigh Francis
The Australian Wine Research Institute (AWRI)

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Preview

- Project is about developing, testing, & demonstrating new methods
- Project methods are science based and market validated (tested) for modelling & predicting consumer wine choices
  - One Australian market (Sydney), Shiraz wines
  - Validated against actual Nielsen scanner data
- Project demonstrates to the wine sector that it potentially can anticipate consumer responses to changes in product & marketing
- Project developed ways to overcome issues related to measuring & predicting consumer responses to choice drivers that consumers CANNOT introspect, or that may affect them subliminally
- Project is on track and on budget

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Traditional Marketing Research

- Source(s) of current and future information about markets:
  - Scanner panel and store scanner data
  - Consumer surveys with one-at-a-time questions
  - Focus groups
- Well-known limitations:
  - The future often differs from the past
  - Many key factors are correlated
  - Consumers trade-off multiple factors that are hard to capture
  - Some factors drive choices that consumers cannot express
  - Display and other information hard to capture

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Better Methods for Better Insights

- Sector wants scientifically grounded, evidence based methods that can capture:
  - Consumer trade-offs of wine characteristics;
  - Information effects on choices; and
  - Likely consumer responses to variants and innovations
- That can deal with factors that consumers cannot fully express because they are non-obvious or may be subliminal
- Is practical for all players in the Australian wine industry

By Supporting the Sector's Strategic Initiatives

1) The Directions – ANTICIPATING THE MARKET
   - give the industry insights into consumers' perception of Australian wine
   - quantifying differences amongst consumers and how they respond to different wine characteristics
   - Leadership in R&D: keynote research and collaboration between research agencies in the wine sector

2) TARGETING THE Consumer
   - Providing insights into consumers' wine choice

3) Sustainability – THE COMMON PLATFORM
   - proach for the development of new wine brands and/or wine styles

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP
Australian Government | Grape and Wine Research and Development Corporation

By Supporting GWRDC's 5-year R&D Plans

- GWRDC Plan(s) - Australian wine industry aims to better understand consumer preferences and deliver products that better match consumer tastes
  - Project – develop methods to capture and predict consumer preferences and expectations
- GWRDC Plan(s) – research partnerships that will help identify new market opportunities and the preferences of consumers within these markets
  - Project – develop methods to practically elicit consumer preferences before entering a market

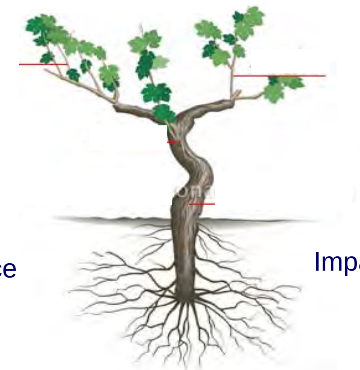
With Relevant Project Objectives

- Planting the right seeds
  - Develop and test a practical consumer research approach that can:
    - Quantify the relative importance of sensory and non-sensory factors in wine choices
    - Predict how wine choices are likely to respond to changes in product and/or information
  - Apply the approach to test proof of concept In one Australian and one overseas market

UniSA
Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

Grafting the right pieces on strong rootstock

(An Integrated Research Approach)



Sensory Science

Impact of Information on Choices

Science of Discrete Choice

Project Team

UniSA

Prof Larry Lockshin (PS)
Dr Simone Mueller (PM, CI)

AWRI

Dr Leigh Francis (CI)
Patricia Osidacz

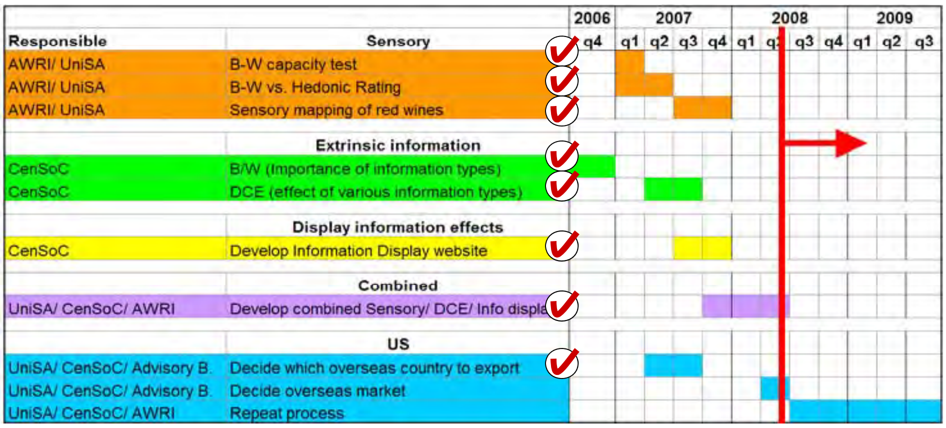
CenSoC

Prof Jordan Louviere
David Hackman
Scott Gillespie
Edward Wei

Advisory Board

Lawrie Stanford (AWBC)
Libby Nutt (Casella)
Miriam Leenders (Constellation)
Ric Anderson (d'Arenberg)
Kathy Barber (Fosters)
Ian Hollick (Hollick Wines)
Edouard Beaslay, Fiona Keen (Pernod-Ricard)

Project Plan



Project Deliverables

GWRDC deliverable:

- Develop and test practical research method(s) to predict consumer response(s) to Australian and competing wines

Sector deliverable:

- A practical way to simulate consumer response(s) to different wine choice drivers
- Tested in one Australian and one overseas (USA) market

About The Deliverables …

In reviewing the materials for this May 2008 update, please keep in mind:

- Results and insights are 'preliminary'
- Results of Stage 1 will be final when research team (UniSA, AWRI, CenSoC) and client (GWRDC) sign off

All feedback on this presentation welcomed

Overview of Prior Research Stages

- Best-Worst Survey
  - Outcome – reduced the number of extrinsic wine attributes
- Discrete Choice Label Pretest
  - Outcome – refined method to test influence of packaging variables
- Sensory Best-Worst Capacity Pretest
  - Outcome – determined sensory test comparison design
- Comparison of Best-Worst and Sensory Scaling
  - Objective – determined sensory method for future stages

UniSA | Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Overview of Insights Delivered Extrinsic Attributes

- Wine packaging matters in consumer wine choices, but they cannot accurately self-report these factors
- To measure packaging influences ~ design and show consumers simulated bottles

GWRDC Insight ~ use multi-media (simulations) in future

Industry Insight ~ internet-based surveys are an efficient and valid way to test holistic concepts and packaging factors

Overview of Insights Delivered Sensory Attributes

- Different consumers like different wines
- Consumers show low consistency in reporting preferences for wines in wine tastings
- Sensory choice methods are difficult and expensive to apply to measure consumer wine preferences

GWRDC Insight ~ Consumer testing seems unnecessary to predict choices

Industry Insight ~ Consumer preference reports in tastings may be unreliable and not predictive of what they buy

Integrated Australian research insights

- Preliminary insights from Australian study
- Modelling the New South Wales market

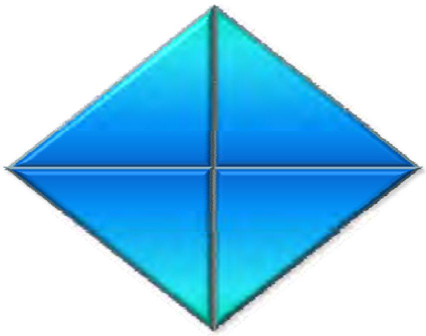
Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Integrated Approach

1) Multi-media choice surveys

4) Sensory Research



2) Real Bottle Choice surveys

3) Display Information Effects

The Australian Wine Research Institute

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Multi-Media Choice Surveys

- Tested importance of 10 extrinsic wine attributes on **switching** and wine choice for “dinner with friends”
  - Price and price discount
  - Brand
  - Country and region of origin
  - Alcohol level
  - Label style and label colour
  - Closure
  - Medals
  - stars
- Online survey with 807 regular NSW red wine consumers
- Sensory + online surveys of 426 Sydney regular red wine consumers

The Australian Wine Research Institute

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Sample Screen

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Implications from Multi-Media Surveys: Key Take Aways

- **GWRDC:** approach worked well in the concept tests
  - Can identify intrinsic and extrinsic wine choice drivers; and
  - Can identify segments of wine consumers who choose differently
- **Wine sector:** approach provides new capabilities
  - Can quantify the influence of many wine factors (wine styles, labels, graphics, prices, etc); and
  - Can forecast likely consumer responses to changes in factors.

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Real Bottle Validation Surveys

- What we did:
  - Studied switching and choice among 21 real wines from AC Nielsen Top 100 - to represent different Shiraz styles;
  - Used standardised photos to present similar information for all 21 wines;
  - Modelled probability of switching from last choice; and
  - Modelled probability of wine choice for dinner with friends

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Sample Screen

Australian Government
Grape and Wine Research and Development Corporation

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Real Bottle Validation Survey Implications

- **GWRDC**
  - High external validity of model predictions for AC Nielsen scanner data for sales ($) and litres in NSW for full year 2007 and 4th quarter 2007
  - Gives confidence to trial approach in overseas market
- **Wine sector**
  - Suggests high potential to be able to forecast and anticipate consumer responses to variations in wine factors (wine styles, labels, prices, etc.)

Display Information Influence Tests

- Measured impacts of display information on switching and choices:
  - Star quality ratings;
  - Wine reviewers'/retailers' ratings and variation in those ratings for a given bottle of wine; and
  - Verbal descriptions of what a wine tastes and smells like (as in many wine reviews displayed on retail shelves)

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Sample Screen

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Information Display Insights

- Found 15% - 25% lift in average choices of a wine due to:
  - Information displayed as a sentence description; and
  - Ratings by reviewers or retailers
- Preferences measured for wines in the surveys were strongly positively related to choices
- Implication
  - Can simulate likely consumer responses to different information

The Australian Wine Research Institute

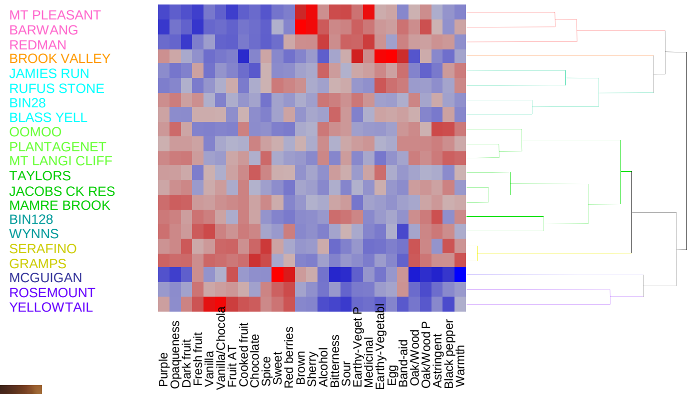
CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Selection of 21 wines

- Selection based on expert panel sensory analysis
- Wines selected cover the widest possible sensory space



The Australian Wine Research Institute

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Sensory Consumer Study

- 426 regular wine consumers tasted 5 of 21 wines in Sydney
- Consumers similar to overall wine consumer population of NSW
- Tasted wine 'informed' by wine bottle photo

The Australian Wine Research Institute

CenSoC
Centre for the Study of Choice

Implications from Sensory Study

- Found large differences in preferences among the wines
  - High variability in the preferences
  - Large order effects
- Drivers for liking and disliking of informed sensory tasting
  - Sensory attributes
  - Price of wine
- Weak relationship of liking with Nielsen data

Insights From Combining Methods

- Tested models combining
  - Consumer choice of 21 real wines
  - Chemical analysis of the 21 wines
  - Trained sensory panel wine characterisation (sensory dimensions)
- Findings suggest:
  - Combined model more accurate in predicting AC Nielsen data
  - Including consumer choice results of 21 wines most important, but chemistry and sensory factors add predictive power
    - Many consumers choose wines with higher sugar levels and what experts described as a “chocolate taste”
    - Many consumers avoid wines with high tartaric acid levels

Implications of Combined Method

- **GWRDC implications**
  - Integrating display information and sensory measures into choice models is possible
  - Need to use as many real wines as possible that differ on as wide a range of factors as possible
- **Wine sector implications**
  - Can simulate likely consumer responses in advance of making changes to wines or marketing activities

Summary of Implications

- Can measure and model wine choices with on-line choice surveys
- Can anticipate changes in wine preferences and choices with the results of online choice surveys
- Can show that survey results predict real wine sales
- Can incorporate expert sensory evaluations in choice models to better understand how sensory measures are likely to impact consumer choices
- Showed that consumer wine ‘liking’ or ‘purchase intent’ are not required to predict real purchase behaviour

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation

Project Management – Next Steps

		2006	2007				2008				2009		
Responsible	**Sensory**	q4	q1	q2	q3	q4	q1	q2	q3	q4	q1	q2	q3
AWRI/ UniSA	B-W capacity test												
AWRI/ UniSA	B-W vs. Hedonic Rating												
AWRI/ UniSA	Sensory mapping of red wines												
	Extrinsic information												
CenSoC	B/W (Importance of information types)												
CenSoC	DCE (effect of various information types)												
	Display information effects												
CenSoC	Develop Information Display website												
	Combined												
UniSA/ CenSoC/ AWRI	Develop combined Sensory/ DCE/ Info display												
	US												
UniSA/ CenSoC/ Advisory B.	Decide which overseas country to export												
UniSA/ CenSoC/ Advisory B.	Decide overseas market												
UniSA/ CenSoC/ AWRI	Repeat process												

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation

Build on Achievements So Far

- In summary, the Australian project has thus far:
  - met the project objectives
  - delivered insights for GWRDC and industry
  - provided insights with significant potential value
- Project lessons learned can now be considered in new market context (next test USA)
  - Identify and test wine characteristics in overseas test market

Next Stage Challenges

- Test wines may pose issues
  - sector cooperation, number of SKUs
- Legal and/or channel differences may need consideration
- Non-Australian markets pose project management and other challenges like finding suitable research providers

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation

For Consultation with Advisory Board

- US market choice – advice on sub market:
  - Chicago
  - Atlanta
  - Phoenix or Houston
  - Other?
- Simulating consumer wine choice in one US sub market
  - Specific factors/levels to be included beyond Australian surveys?

The Australian Wine Research Institute
CenSoC
Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Australian Government | Grape and Wine Research and Development Corporation

Project Summary

- On track to deliver outcomes on schedule and budget
  - Successful application to one Australian market
  - Refine and include ‘lessons learned’ to one US market (new stage)
  - Project is developing, testing and demonstrating new methods
  - Project trialed a science-based research approach to anticipate consumer wine choices (tested/validated)
- Applied project outcomes
  - Project is demonstrating that industry can anticipate consumer responses to changes in product & marketing
  - Project is demonstrating methods to overcome issues related to measuring and predicting consumer responses to factors that consumers can not self-report or that may affect them subliminally
  - Industry update in spring 2008, including DSS

The Australian Wine Research Institute

30 May 2008 GWRDC update v1-0 slide 37

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Australian Government | Grape and Wine Research and Development Corporation

More detailed update in Spring

Developing good science and good wine take time

Watch www.winepreferences.com

The Australian Wine Research Institute

30 May 2008 GWRDC update v1-0 slide 38

CenSoC Centre for the Study of Choice

Wine Marketing Project

Status Report and Update for GWRDC

19 September

Presented by

Prof Larry Lockshin
Ehrenberg-Bass Institute for Marketing Science, UniSA
Prof Jordan Louviere
Centre for the Study of Choice (CenSoC), UTS
Dr Leigh Francis
The Australian Wine Research Institute (AWRI)

Project Team

UniSA
Prof Larry Lockshin
Dr Simone Mueller

AWRI
Dr Leigh Francis
Patricia Osidacz
Belinda Bramley

CenSoC
Prof Jordan Louviere
Maria Lambides
Scott Gillespie
Edward Wei

Advisory Board
Lawrie Stanford (AWBC)
Libby Nutt (Casella)
Marc Allgrove (Constellation)
Ric Anderson (d'Arenberg)
Kathy Barber (Fosters)
Ian Hollick (Hollick Wines)
Edouard Beaslay, Fiona Keen (Pernod-Ricard)

Presentation Overview

- Research Approach
- Australian Study Results
- Lessons Learned
- Project Summary
- Simulation System Demonstration
- Next Phase

Recap from May Presentation

- Project is about developing, testing, & demonstrating new methods
- Project methods are science based and market validated (tested) for modelling & predicting consumer wine choices
  - One Australian market (Sydney), Shiraz wines
  - Validated against actual Nielsen scanner data
- Project demonstrates to the wine sector that it potentially can anticipate consumer responses to changes in product & marketing
- Project developed ways to overcome issues related to measuring & predicting consumer responses to choice drivers that consumers CANNOT introspect, or that may affect them subliminally
- Project is on track and on budget

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Research Approach

- The project is the first in wine to integrate work in different fields into a science-based model validated on real market consumer purchases.
- The project integrates theory & methods from
  - Economics/Psychology (random utility theory based choice models)
  - Statistics/Marketing (optimal design of choice experiments)
  - Sensory Science (basic wine chemistry & sensory judgments by trained tasters)

- To develop models that predict consumers' likely wine choices, which include wine product features & potentially sensory measures.

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Research Approach

- Approach tested & used by many companies in many other product areas with great success
- Successful application completed in NSW market.
  - Measures what consumers 'do' + what they 'say'
  - Measures subliminal or not able to be verbalised effects on choices
  - Validates against real world sales
  - Shows potential to incorporate wine chemistry into modeling sales

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA

Australian Government
Grape and Wine Research and Development Corporation

Research Approach

- Benefits to industry
  - Can anticipate future purchases
  - Can be adapted to different sized producers and even wine regions
  - Is an easier, faster, more accurate way to test consumer responses to packaging changes
  - Can test consumer responses to specific communication strategies for Australia, wine regions, wine producers

The Australian Wine Research Institute

19 September 2008 GWRDC Phase 2/Part 2 slide 7

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA

Australian Government
Grape and Wine Research and Development Corporation

Australian Study Results

Three distinct outputs from the Australian Study:

1. **Discrete Choice Surveys** (combining a range of product features)
2. **Real Bottle Choice Surveys** (combining shelf information and experts' ratings)
3. **Sensory testing** (combining trained panel ratings of sensory attributes, large-scale consumer preference testing and wine chemistry)

The Australian Wine Research Institute

19 September 2008 GWRDC Phase 2/Part 2 slide 8

© University of South Australia

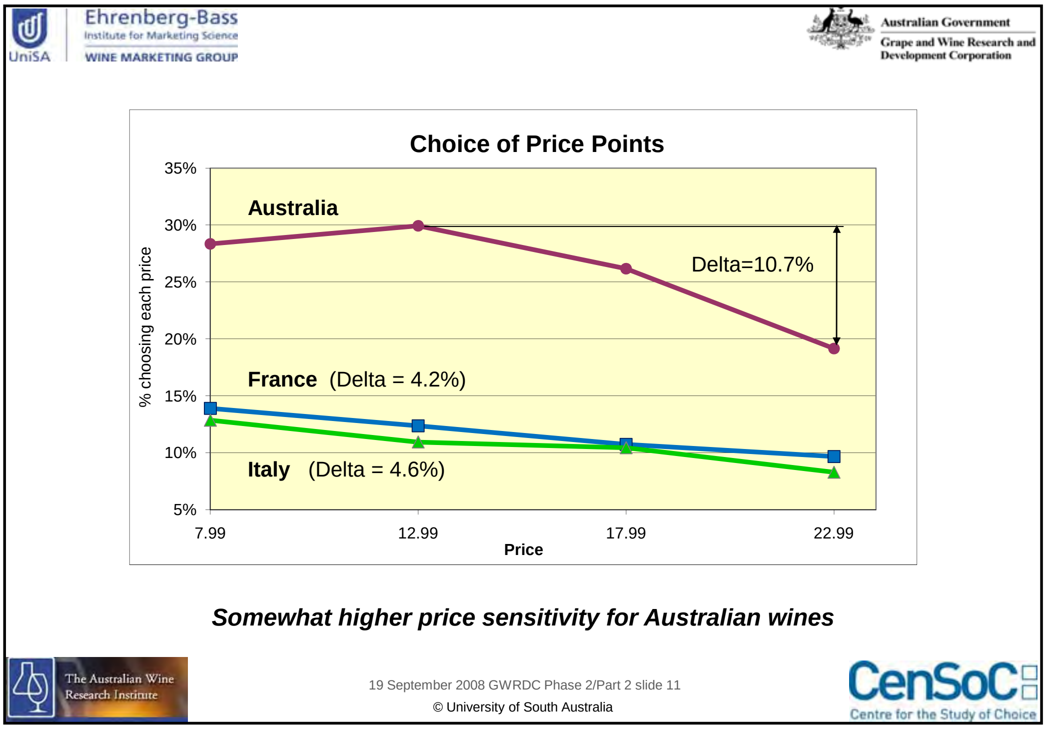
CenSoC
Centre for the Study of Choice

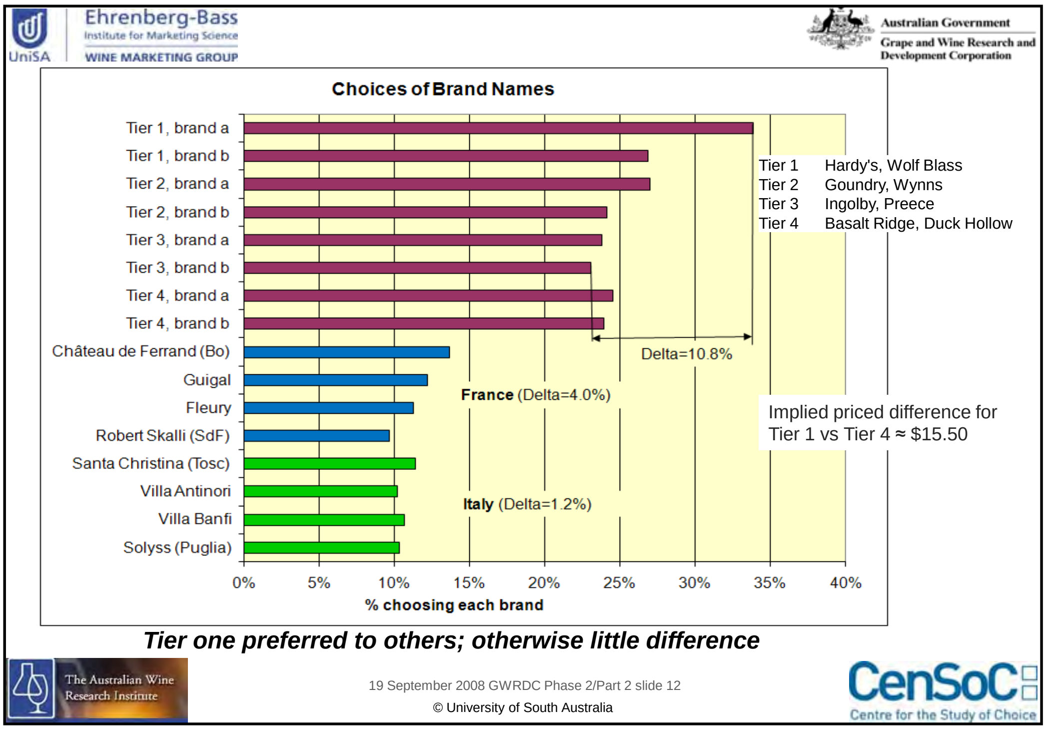
1. Discrete Choice Surveys (Feature choice survey)

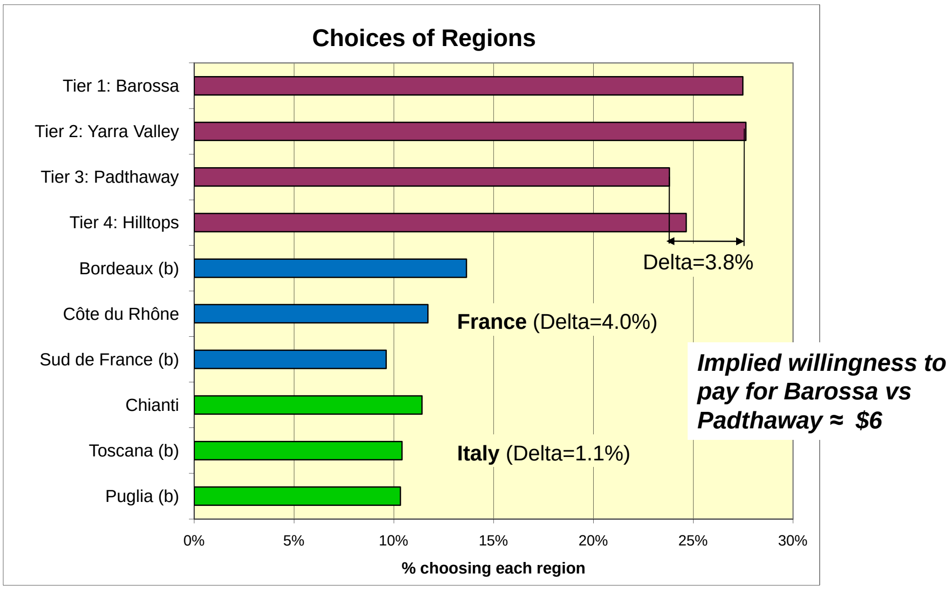
>1,200 consumers choose wine in simulated bottle experiment

Feature Choice Experiment

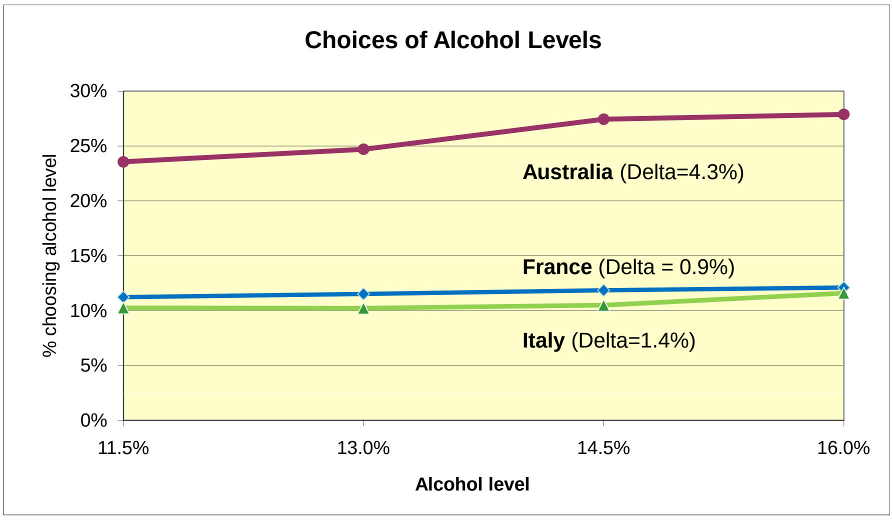
- We varied 10 features of wines experimentally
  - functional (region, alcohol, price, price discount, brand) &
  - non-functional (bottle shape, label colour, label style, closure, medals)
- We calculated the proportion of people who choose each feature level across all scenarios (simulated retail wine shelves)
  - The proportions measure the preferences for each feature level
- Differences in choice proportions across feature levels measures the size of the impact of the feature on choices
  - Also can estimate the implied dollar value of each feature level or differences in feature levels - eg, how much would consumers be willing to pay for 3 vs 5 stars?


Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation
Choice of Price Points
Australia
Delta=10.7%
France (Delta = 4.2%)
Italy (Delta = 4.6%)
% choosing each price
35%
30%
25%
20%
15%
10%
5%
7.99
12.99
17.99
22.99
Price
Somewhat higher price sensitivity for Australian wines
The Australian Wine Research Institute
19 September 2008 GWRDC Phase 2/Part 2 slide 11
© University of South Australia
CenSoC
Centre for the Study of Choice


Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation
Choices of Brand Names
Tier 1, brand a
Tier 1, brand b
Tier 2, brand a
Tier 2, brand b
Tier 3, brand a
Tier 3, brand b
Tier 4, brand a
Tier 4, brand b
Château de Ferrand (Bo)
Guigal
Fleury
Robert Skalli (SdF)
Santa Christina (Tosc)
Villa Antinori
Villa Banfi
Solyss (Puglia)
Tier 1 Hardy's, Wolf Blass
Tier 2 Goundry, Wynns
Tier 3 Ingolby, Preece
Tier 4 Basalt Ridge, Duck Hollow
Delta=10.8%
France (Delta=4.0%)
Italy (Delta=1.2%)
Implied priced difference for
Tier 1 vs Tier 4 ≈ $15.50
0%
5%
10%
15%
20%
25%
30%
35%
40%
% choosing each brand
Tier one preferred to others; otherwise little difference
The Australian Wine Research Institute
19 September 2008 GWRDC Phase 2/Part 2 slide 12
© University of South Australia
CenSoC
Centre for the Study of Choice



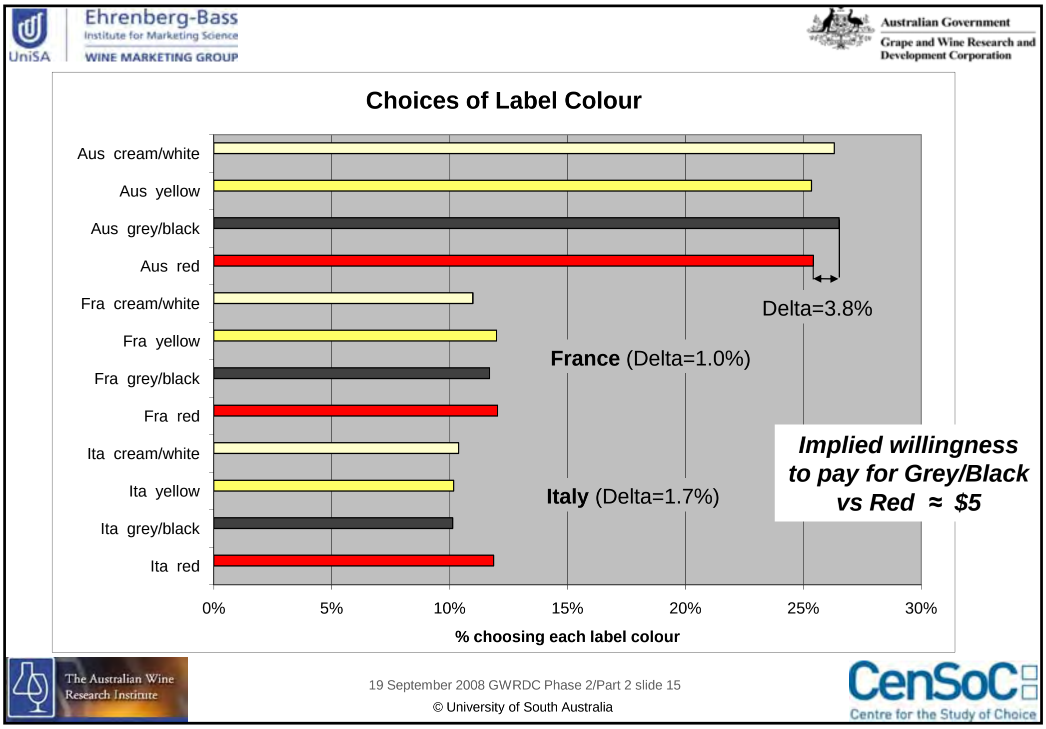
UniSA
Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

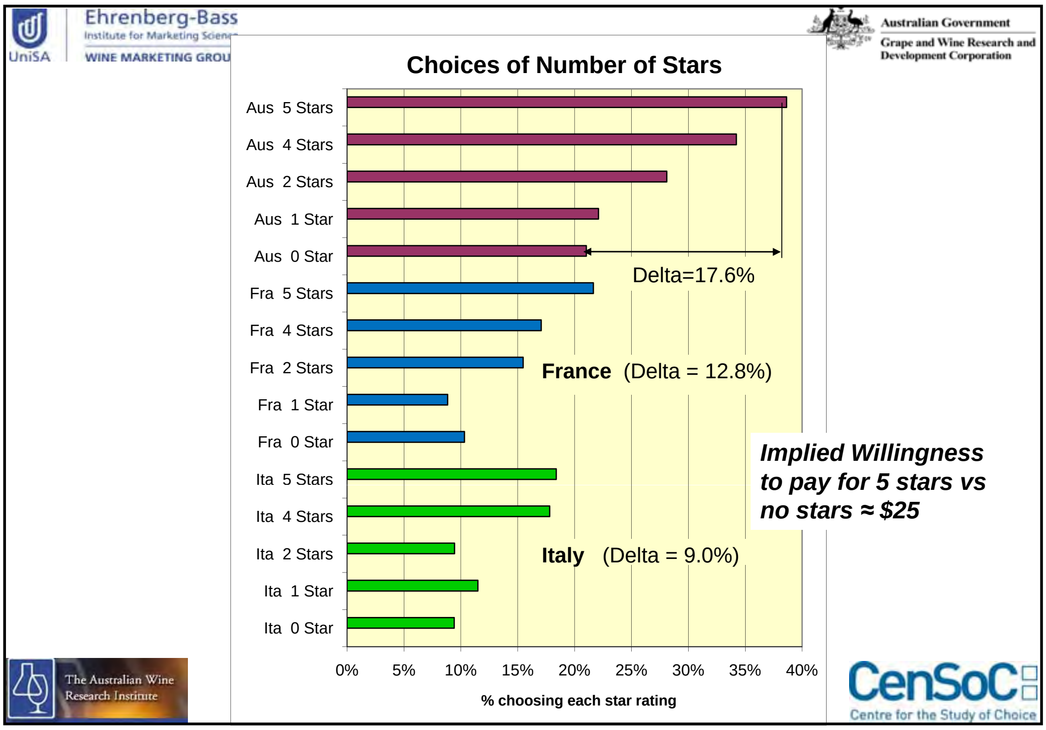


Implied willingness to pay for 11.5% vs 16% ≈ $5.50

The Australian Wine Research Institute

© University of South Australia
CenSoC
Centre for the Study of Choice


Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
Australian Government
Grape and Wine Research and Development Corporation
Choices of Label Colour
Aus cream/white
Aus yellow
Aus grey/black
Aus red
Fra cream/white
Fra yellow
Fra grey/black
Fra red
Ita cream/white
Ita yellow
Ita grey/black
Ita red
Delta=3.8%
France (Delta=1.0%)
Italy (Delta=1.7%)
Implied willingness to pay for Grey/Black vs Red ≈ $5
0%
5%
10%
15%
20%
25%
30%
% choosing each label colour
The Australian Wine Research Institute
19 September 2008 GWRDC Phase 2/Part 2 slide 15
© University of South Australia
CenSoC
Centre for the Study of Choice


Ehrenberg-Bass
UniSA
Australian Government
Grape and Wine Research and Development Corporation
Choices of Number of Stars
Aus 5 Stars
Aus 4 Stars
Aus 2 Stars
Aus 1 Star
Aus 0 Star
Fra 5 Stars
Fra 4 Stars
Fra 2 Stars
Fra 1 Star
Fra 0 Star
Ita 5 Stars
Ita 4 Stars
Ita 2 Stars
Ita 1 Star
Ita 0 Star
Delta=17.6%
France (Delta = 12.8%)
Italy (Delta = 9.0%)
Implied Willingness to pay for 5 stars vs no stars ≈ $25
0%
5%
10%
15%
20%
25%
30%
35%
40%
% choosing each star rating
The Australian Wine Research Institute
CenSoC
Centre for the Study of Choice

Summary of relative attribute importance

Attribute	Levels	Max difference in % choice	Implied difference in $
Star rating	0 to 5 stars	17.6%	≈ $25
Brand	Tier 4 to Tier 1	10.8%	≈ $15
Price	$7.99 - $22.99	10.8%	≈ $15
Medals	no medal to Gold Trophy	7.3%	≈ $10
Price discount	20% discount vs none	6.4%	≈ $9
Alcohol level	11.5% to 16%	4.3%	≈ $6
Region	Padthaway to Barossa	3.8%	≈ $5.50
Label style	chateau, traditional, minimalistic, graphic	3.6%	≈ $5
Label colour	cream, yellow, red, black	1.2%	≈ $5
Closure	screw cap vs. cork	0.6%	≈ $0.80

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

2. Real Bottle Experiment / Display information

- Real bottle choice experiment - validation
  - 21 of top 100 selling NSW wines – picked to maximise sensory differences
  - Features mapped into feature choice
- Nielsen volume & sales data - validate
- 2nd Real bottle choice experiment – test effect of information
  - Same 21 wines – present/absent description of 6 wines + ratings from credible sources (Kemenys, Winestate) + range of ratings (Low, High)
  - Online experiment with >300 respondents

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

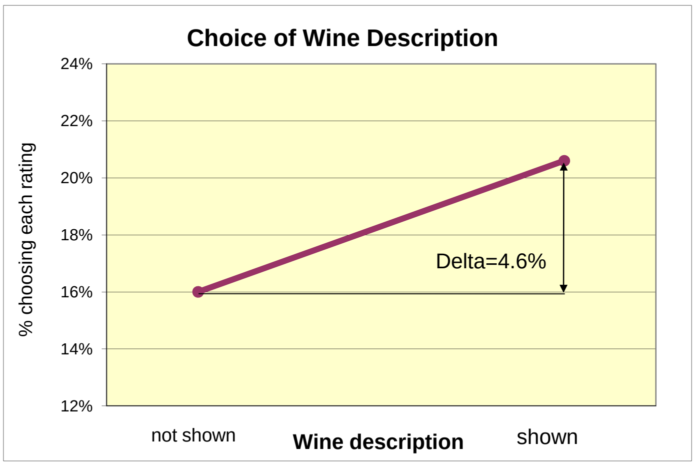
Australian Government | Grape and Wine Research and Development Corporation

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Australian Government | Grape and Wine Research and Development Corporation



16.99

Description:

Fruity Shiraz with eucalyptus mint aromas

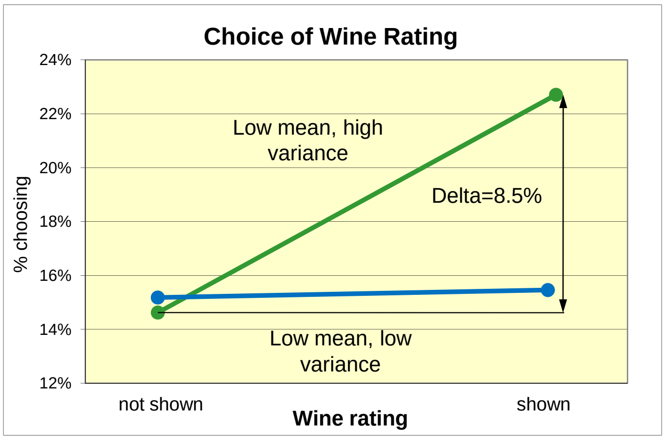
Giving consumers a description of a wine has a considerable impact on choice. (4.6% ≈ $7)

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation



$14.99

Rating (of 100):
Kemenys: *87*
Vintage Cellers: *83*
WineState: *85*

Consumers appear to choose based on high ratings, regardless of whether there is a discrepancy among raters

The Australian Wine Research Institute

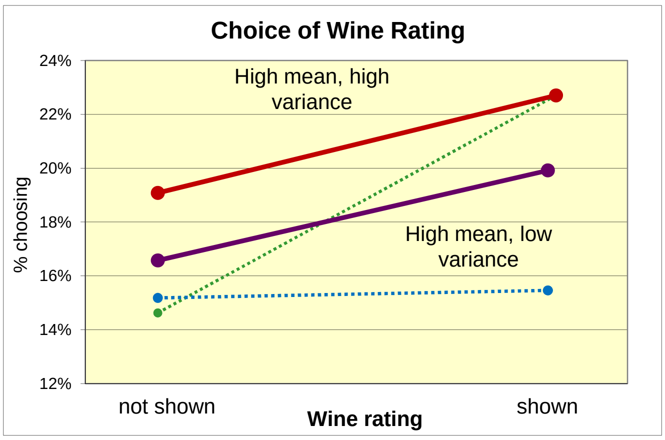
CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Low mean, high variance

Low mean, low variance



$14.49

Rating (of 100):
Kemenys: *95*
Vintage Cellars: *85*
WineState: *90*

Consumers appear to choose based on high ratings, regardless of whether there is a discrepancy among raters

The Australian Wine Research Institute

CenSoC
Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Validation with Real Wine Sales in NSW

1. Compared choices in both real bottle choice surveys (very high correlations >0.9).
2. Compared real bottle choices with ACN data (high correlation >0.75).
3. Compared feature survey choices with ACN data (moderate correlation >0.6).
4. Estimated choice model from ACN data (21 data points).
   - Includes real bottle choices, wine chemistry, wine sensory & prices (very high correlation >0.97).
   - Too many chemistry/sensory measures & too correlated to do more.

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

3. Sensory study

Understanding consumer preferences for Australian Shiraz wines with informed tasting

- ❑ How important is price and label compared to wine taste on consumer liking and purchase intent?
- ❑ 21 Shiraz studied: $8-26, 2001-2006
  - Diverse sensory properties (fruit intensity, oak, astringency, spice, 'aged', sweetness…..)
  - Range of price points, sales, brands, well known/less known, region, label type…..

The Australian Wine Research Institute

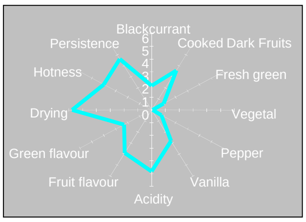
CenSoC Centre for the Study of Choice

Three data sets on the 21 wines

Trained AWRI panel
Sensory attributes

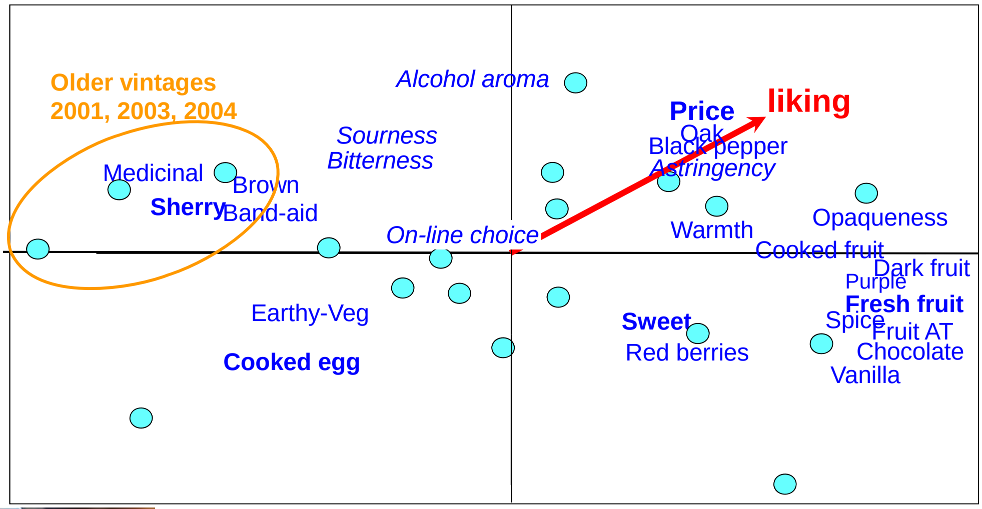
Sydney consumer sensory central location test
420 consumers
informed basis

On-line choice study
Real wine labels
Extrinsic attributes



UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP
Australian Government Grape and Wine Research and Development Corporation

Consumer liking scores relate to some key wine attributes

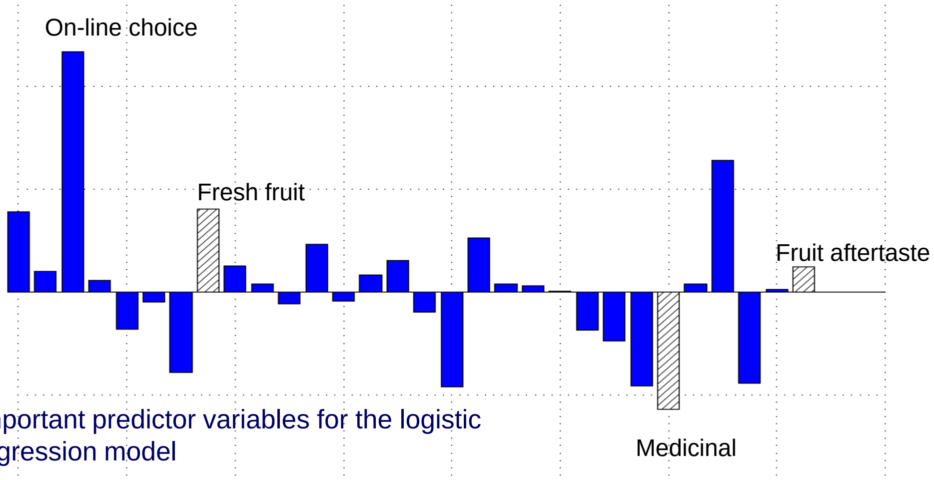


Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Purchase intent involves a greater non-sensory influence

(Proportion of the consumers who would purchase for dinner with friends)



Important predictor variables for the logistic regression model

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Lessons Learned

1. Consumer wine choices can be modeled & wine feature impacts quantified/valued.
2. Accurate descriptions of wines at POS can boost sales, as can high credible ratings.
3. Wine choices in choice surveys (real bottle & features) relate to sales.
4. Sensory judgments of trained tasters & basic wine chemistry relates to sales.

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Lessons Learned

5. Asking consumers how much they like the wines they taste is unrelated to sales.
   – Little relation between liking & ACN data.
6. Results suggest, that if correlations permit, one can combine various sources of choice data + sensory data to build models to predict consumer choices.
   – No guarantee correlations between measures will be sufficiently low to allow sophisticated statistical analysis
7. Suggests focus on modeling consumer feature choices + real bottles and wine chemistry.

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
Australian Government
Grape and Wine Research and Development Corporation

Communicating Insights to Industry

- Research insights:
  - Practical, efficient & valid way to test consumer responses to packaging and pricing
  - Can forecast and anticipate market responses to a wide range of possible variations in wine factors
  - Sensory tests of liking or preference are not required to predict consumer purchase behaviour

- Delivery of insights:
  - 3 articles in trade publications
  - Website links and reports of key findings
  - Presentation at industry conferences

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP
Australian Government | Grape and Wine Research and Development Corporation

Communicating Insights to Academia

- Research insights:
  - Methods
  - Scaling
  - Sensory
- Delivery of insights:
  - Six academic conference presentations, plus two articles published in proceedings
  - One academic journal paper under review
  - One ready for submission, several more to come

The Australian Wine Research Institute

19 September 2008 GWRDC Phase 2/Part 2 slide 31

CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP
Australian Government | Grape and Wine Research and Development Corporation

Next Stage: Phase 3 - United States

- Two cities are being tested: Chicago and Tampa
  - only one is required per market
- AC Nielsen sales for previous year for all red wines in hand
- 1400 red wines common across two markets
- Download all available wines/labels to classify them as input to the simulated label choice survey (experiment)
- Investigate how to maximize the number of wines for chemical analysis

The Australian Wine Research Institute

19 September 2008 GWRDC Phase 2/Part 2 slide 32

CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian Government
Grape and Wine Research and Development Corporation

Developing good science and good wine take time

Watch www.winepreferences.com

The Australian Wine Research Institute

CenSoC Centre for the Study of Choice

Wine Marketing Project

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

Project report: US Market

24 November 2009

Prof Larry Lockshin, Dr Simone Mueller
Ehrenberg-Bass Institute for Marketing Science, UniSA

Prof Jordan Louviere
Centre for the Study of Choice (CenSoC), UTS

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

Presentation Overview

- Research Approach
- US Study Results
- Lessons Learned
- Proof of Concept Framework for Decision Making
- Project Summary

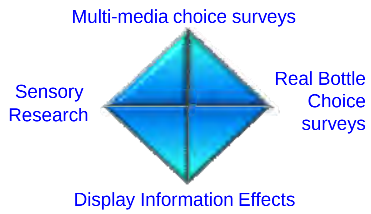
Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Research Approach

- Project is about developing, testing, & demonstrating new methods
- Project methods are science based and market validated (tested) for modelling & predicting consumer wine choices
  - Validated against actual Nielsen scanner data
- Project demonstrates to the wine sector that it potentially can anticipate consumer responses to changes in product & marketing
- Project developed ways to overcome issues related to measuring & predicting consumer responses to choice drivers that consumers CANNOT introspect, or that may affect them subliminally
- Tested two ways of linking sensory and non-sensory measures

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Recap from Australian phase



- Decisions taken to refine and validate method for two US markets
  a) Integrate market data (ACN)
  b) Not separate branding and packaging
  c) Promising part DCE: shelf display information effect
  d) Promising but not tested: communication effects
  e) Sensory: expensive, limited to few wines, not predictive of sales
  f) Promising: chemical influence

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Australian graphical bottle DCE

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Summary of relative attribute importance

Attribute	Levels	Max difference in % choice	Implied difference in $
Star rating	0 to 5 stars	17.6%	≈ $25
Brand	Tier 4 to Tier 1	10.8%	≈ $15
Price	$7.99 - $22.99	10.8%	≈ $15
Medals	no medal to Gold Trophy	7.3%	≈ $10
Price discount	20% discount vs. none	6.4%	≈ $9
Alcohol level	11.5% to 16%	4.3%	≈ $6
Region	Padthaway to Barossa	3.8%	≈ $5.50
Label style	chateau, traditional, minimalistic, graphic	3.6%	≈ $5
Label colour	cream, yellow, red, black	1.2%	≈ $5
Closure	screw cap vs. cork	0.6%	≈ $0.80

UTS:CenSoC Centre for the Study of Choice

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

gwrdc

Wine description: +4.6%

Wine critic rating: +8.5%

Further details Australian results:

Lockshin, L., Mueller, S., Louviere, J., Francis, L., Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, WIJ, Vol. 24 (2), 35-40.

Mueller, S., Lockshin, L., Louviere, J., Francis, L., Osidacz, P. (2009), How does shelf information influence consumers' wine choice?, WIJ, Vol. 24 (3), 50-56.

www.winepreferences.com

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

gwrdc

Aims of the US project

1) Knowledge regarding the degree of importance of label information, packaging and market communications for red wines in two markets of the US

2) Information regarding the relative importance of chemical and non-sensory attributes in red wines in two US markets based on prior markets transactions (AC Nielsen data)

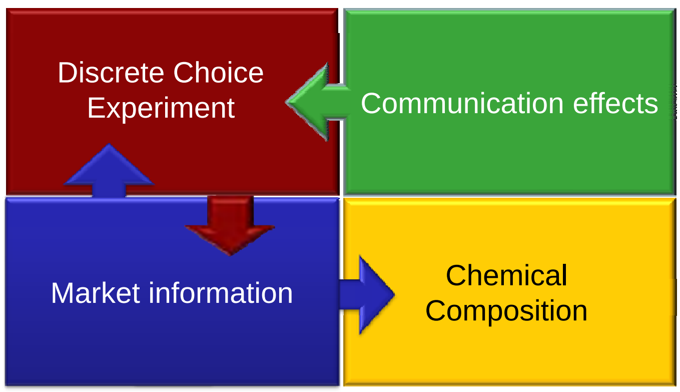
The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Objectives of the US project

- Analyse AC Nielsen data in conjunction with experiments
- Validate predictive models with actual sales data
- Use real wine bottles
- Test shelf information and market communication
- Develop a broader DSS across the range of Australian wines
- Analyse a larger sample (~200 wines) for chemistry linked to sales

Research approach US



Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Market information

1) Background on chosen US markets
   - Chicago and Tampa (Florida)
   - Wine market overview
2) Drivers of market price
   - Premiums for origins and packaging styles
3) Drivers of units sold
   - Availability, price, region of origin

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Two markets: Chicago and Tampa (FL)

- Chicago (IL)
  - 3rd most populous city US
  - 90 ML wine market (60% domestic, 40% import)
  - Larger share of Shiraz, Italian, Spanish, Argentinean wines
- Florida
  - 2nd largest wine market with 2nd strongest growth after California
  - 204 ML wine market (70% domestic, 30% import)
  - Large share of Cabernets and Merlots, French wines

Chicago metro area:		Florida overall:	
Non-hispanic whites:	31%	Non-hispanic whites:	61%
Hispanic or Latino:	31%	Hispanic or Latino:	20%
Black	37%	Black	15%

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

ACN scanner data set (July 2007 –July 2008)

Chicago (IL) 2,447 SKU
Food, Drug, Liquor

Tampa (FL) 2,536 SKU
Food, Liquor

Jointly shared 1,169 SKU of 750ml

	average	min	max
Price	$ 14.76	$ 3.09	$ 157.43
Availability	34.8	1.0	96.0
Units sold	16,537	28	303,420
Sales	$ 165,686	$ 407	$ 2,438,080

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Origins of wines

- Origins by number SKU, sales share and average price (n=1,169)

Origin	% SKU		% SKU	% sales	av. price
Domestic	56%	California general	17%	28%	$ 8.69
		Californian other regions	29%	31%	$ 13.06
		Napa Valley	10%	8%	$ 23.65
Import	44%	Australia SEA	6%	11.1%	$ 6.62
		Australia other	6%	2.8%	$ 12.12
		Argentina	4%	1%	$ 8.69
		Chile	5%	2%	$ 8.38
		France	5%	5%	$ 9.56
		Italy	10%	7%	$ 10.98
		South Africa	2%	1%	$ 7.93
		Spain	5%	3%	$ 11.09
		other import	2%	0.0%	$ 10.26

UTS:CenSoC Centre for the Study of Choice

Grape varieties

- Grape varieties by number SKU, sales share and average price (n=1,169)

Grape Variety	% SKU	% sales	av. price
Cabernet Sauvignon	23%	32%	$10.88
Merlot and blends	17%	19%	$8.88
Pinot	13%	13%	$11.64
Shiraz and blends	12%	10%	$7.78
Zinfandel	7%	5%	$10.88
Cabernet blends	3%	2%	$8.43
Malbec	3%	1%	$9.94
Tempranillo	2%	1%	$10.34
other	22%	16%	$10.57

Origin specific packaging styles (% within country)

	Australia	South Africa	France	Chile	Argen-tina	Italy	Spain	US	Total
Clean: unicolour	5	0	5	5	22	17	25	11	11
Clean: highlight	36	17	32	49	22	24	21	25	27
Chateau basic	3	8	16	16	17	18	1	10	10
Chateau highlight	7	0	0	21	11	13	3	15	12
Animal graphic	21	46	9	4	2	2	3	8	9
Graphic	18	8	35	4	20	22	44	25	24

Drivers of market price

- Relative importance for attributes in explaining market prices (brands not categorised)

	Imported wines	US domestic wines
Origin	40%	34%
Label colour	14%	8%
Bottle form	12%	5%
Label information	11%	9%
Label style	10%	21%
Grape variety	9%	14%
Closure	4%	9%

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA
gwrdc

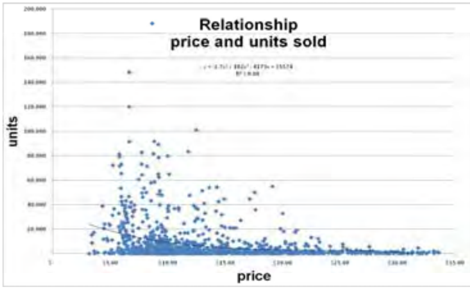
Drivers of market price

Price premium or discount relative to average imported wine

	Price discount	Price premium
Origin	SEA -$1.09	other Australian regions +$6.41
Label colour	multicolour -$1.80	crème +$1.96, black +$1.91
Bottle form	Bordeaux -$1.46	Burgundy +$1.79
Label style	clean highlight -$1.00	clean unicolour +$1.82
Grape variety	Merlot -$1.00	Tempranillo +$1.34, Malbec +$1.10
Closure	screw cap -$0.58	cork +$0.62

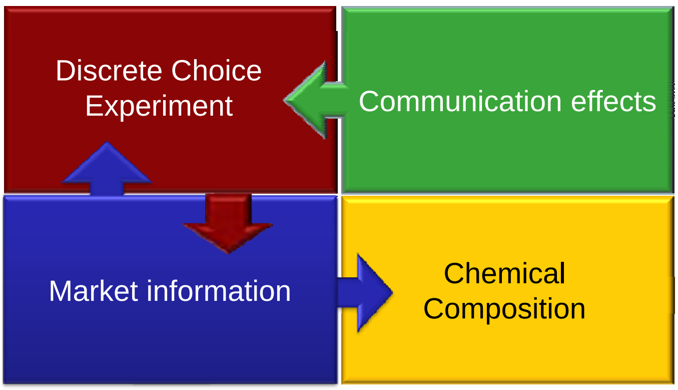
Drivers of units sold

- Most important factors explaining units sold: availability and price



- Other factors
  - Pinot Noir (+), Zinfandel (-), SEA origin (+),
  - Label colour black (-), red (+); animal label (+), unicolour label (-)

Overview



Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Discrete Choice Experiment

1) Improved shelf simulation and wine selection process
2) Predictive validity
3) Difference between Chicago and Tampa?
4) Relative importance of attributes
5) Profiles of four segments

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Shelf simulation

- Realistic shelf setting (8 wines)
- Wines represent archetypes from ACN market data
- Shelf talkers with additional information
- Respondents

  2,048 in Chicago and Florida

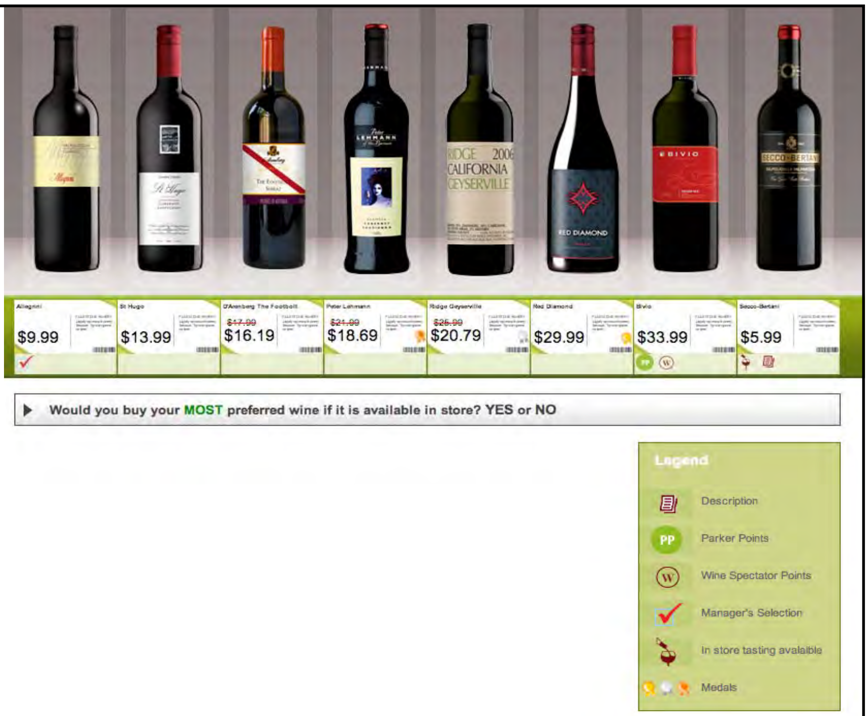
  1) reviewed each wine

  2) choose their most preferred

  3) indicated purchase intent


$9.99
$13.99
$17.99
$16.19
$21.99
$18.69
$25.99
$20.79
$29.99
$33.99
$5.99
Review each bottle of wine before selecting anything.
Peter Lehmann
was $21.99 now $18.69
Region
Barossa Valley, Australia
Alcohol
16.0%
Grape Type
Cabernet Sauvignon
WINE CRITICS CHOICE BRONZE MEDAL WINNER
Legend
Description
Parker Points
Wine Spectator Points
Manager's Selection
In store tasting avalaible
Medals


$29.99
$23.99
$33.99
$5.99
$9.99
$13.99
$17.99
$21.99
$19.79
$25.99
$22.09
Click here to choose this wine as your MOST prefered one
Tir Na N'OG
$9.99
Region
McLaren Vale, Australia
Alcohol
13.0%
Grape Type
Grenache
WINE CRITICS CHOICE BRONZE MEDAL WINNER
Legend
Description
Parker Points
Wine Spectator Points
Manager's Selection
In store tasting avalaible
Medals

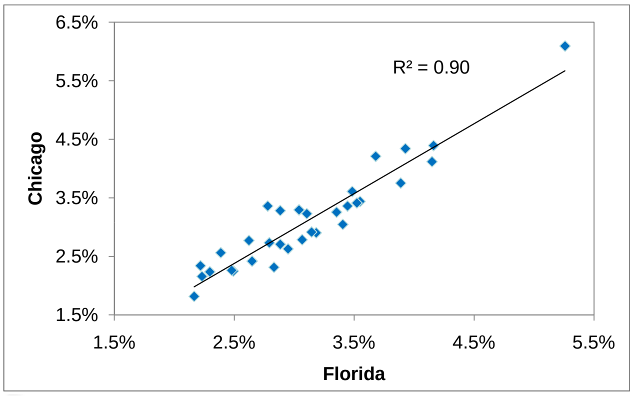


Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Discrete Choice Experiment

Differences between Chicago and Florida

- Consumers in Chicago and Florida agree in their preferences
  - Example: relative choice share of 32 wines



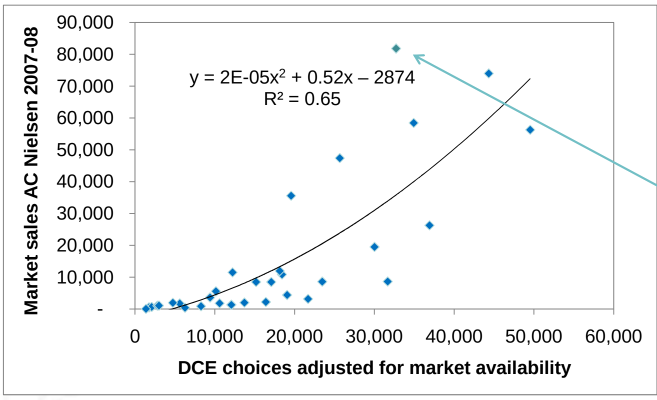
The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Discrete Choice Experiment | Market information

Predictive Validity

- Relating availability adjusted choices of 32 wines to AC Nielsen market sales in 2007-08



Discrete Choice Experiment | Market information

Predictive Validity: Prices

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Discrete Choice Experiment

gwrdc

Relative importance for choice drivers

Attribute	Levels	Importance
Brand, packaging, origin	32	36.1%
Price	8	16.0%
Medal	4	15.0%
Wine sensory description	2	12.4%
Rating points	2	8.4%
Managers recommendation	2	5.6%
Alcohol level	4	2.5%
Price discount	4	2.3%
In store tasting available	2	1.3%
Closure	2	0.4%

Core product and pricing:	57%
Awards and shelf communication:	43%

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science

	rank most liked	rank least liked
Yellow Tail Pinot	1	1
Louis Jadot Pinot	2	12
Ruffino Chianti	3	6
Francis Coppola Merlot	4	3
Rosemount Estate Cab Merlot	5	23
Meridian CabSauv	6	17
Bella Sera Pinot	7	11
Ridge Geyserville Zinfandel	8	2
Woop Woop Shiraz	9	5
Bivio Tuscan Red	10	26
Peter Lehmann CabSauv	11	16
Bodega Norton Malbec	12	14
Weinstock Cellar Select Zinf.	13	9
Hess Select CabSauv	14	19
St Hugo CabSauv	15	32
Murphy-Goode CabSauv	16	30
Marques de Caceres Rioja	17	14
Pepperwood Grove Pinot	18	3
Yalumba Shiraz Viognier	19	27
True Earth Cab blend	20	20
Secco-Bertani Valpolicella	21	28
Penfolds Bin 128 Shiraz	22	25
Red Diamond Shiraz	23	7
Dona Paula Malbec	24	13
Thorn-Clarke Terra Barossa Shiraz	25	31
Allegrini Valpolicella	26	29
Lyeth Meritage	27	22
Hob Nob Shiraz	28	8
D'Arenberg The Footbolt Shiraz	29	23
Tir Na N'OG Grenache	30	10
Turner Road Shiraz	31	18
Penascal Tempranillo	32	21

gwrdc

Polarising wines (loved and hated)

Agreement wines (+) fewer rejecters than supporters

Agreement wines (-) many rejecters, few supporters

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Four Consumer Segments based on choices

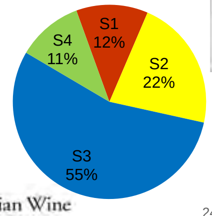
Choice of price

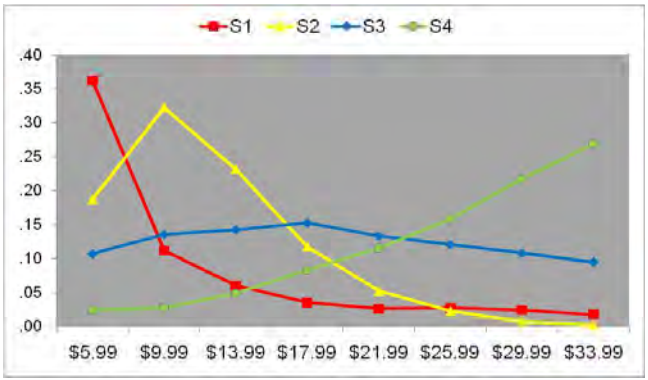
S1: very low prices (<$10)

S2: low prices (<$15)

S3: medium prices

S4: high prices





UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Current Australian Purchasers

	Segment 2	Segment 3
size	**22%**	**55%**
Preferred origins	US 70%, Aus 10%	US 60%, Aus 11%, Italy 12%
Preferred grape variety	> Merlot, Shiraz, blends < Cabernet	average
Preferred price	lower (<$15)	medium
Effect price discount (none to -20%)	+3%	+1%
Effect medal (none to Gold)	+2.8%	+8.2%
Effect of critic's scores (none to any)	+2.3%	+3.7%
Effect sensory description	+0.6%	+7.5%
Age	older	average
Gender		> female
location	> Chicago	
Australian image	> regions	
Purchase location	> Grocery store	
Purchase behaviour	more impulsive, less planned	
Wine involvement	low	medium

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Less frequent Australian Purchasers

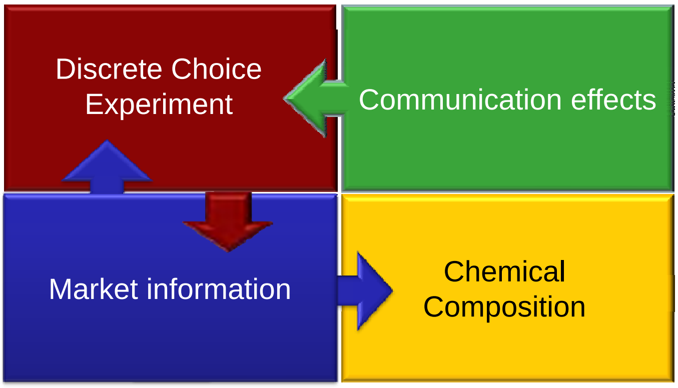
	Segment 1	Segment 4
size	12%	11%
Preferred origins	US 65%, Aus 8%, >Spain, Chile	US 55%, Aus 7%, Italy 17%, France 12%
Preferred grape variety	> Merlot, Zinfandel < Cabernet	> Cabernet, Pinot, Shiraz < Merlot, Zinfandel
Preferred price	lowest (<$10)	Highest >$20
Effect medal (none to Gold)	+1.2%	+4.2%
Effect of critic's scores (none to any)	+1.7%	+3.4%
Effect sensory description	+1.9%	+1.9%
Age & gender		younger, > male
Income & education	lowest	highest
location	> Tampa	Florida
Australian image		>> innovation
Purchase location		Liquor store
Purchase behaviour		> planned, ask for help
Wine involvement	lowest	highest
Dining out – hosting guest	least frequent	most frequent

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Overview



The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Communication effects

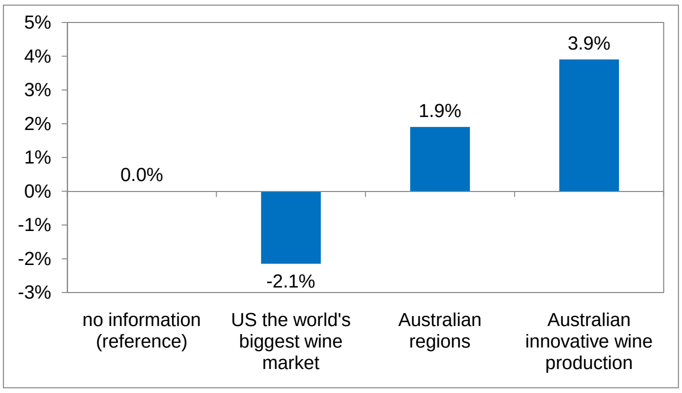
- Tested the integration of three communication strategies into experiment
- Which consumer information can most effectively increase choice for Australian wines?
- 4 information conditions as magazine articles before choice experiment
  - a) No information
  - b) US world's largest wine market
  - c) Australia has distinctive wine regions
  - d) Australia's innovative wine production

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP
UniSA
gwrdc

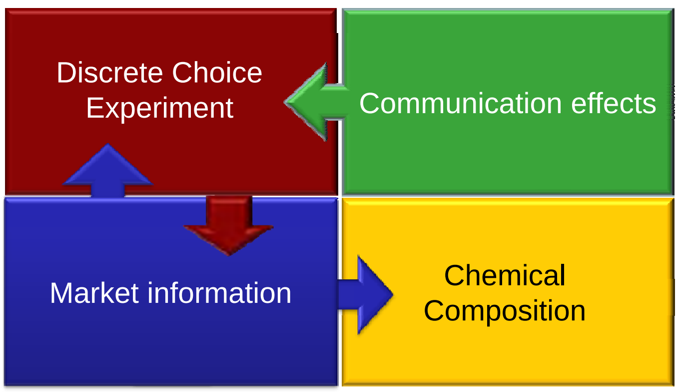
Discrete Choice Experiment
Communi-cation effects

Results of communication strategies

- Relative change of choice of Australian wine in choice experiment



Overview



Chemical Composition

1) Country specific profiles
2) Relationship to price
3) No relationship with units sold
4) Further analysis

210 wines selected

- Selected from AC Nielsen sales data
  - Three main grape varieties Cabernet, Merlot and Shiraz and blends
  - Australia and other major country of origins
  - Price range mainly from $12 - $40
  - Varying in distribution, label styles and regions of origin
- Ordered from Chicago

Cabernet (n=74)		Merlot (n=69)		Shiraz (n=67)	
Australia	20	Australia	5	Australia	41
Chile	6	Chile	3	Chile	3
France	11	France	0	France	11
Other	4	Other	6	Other	2
US	33	US	55	US	10

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Analysis

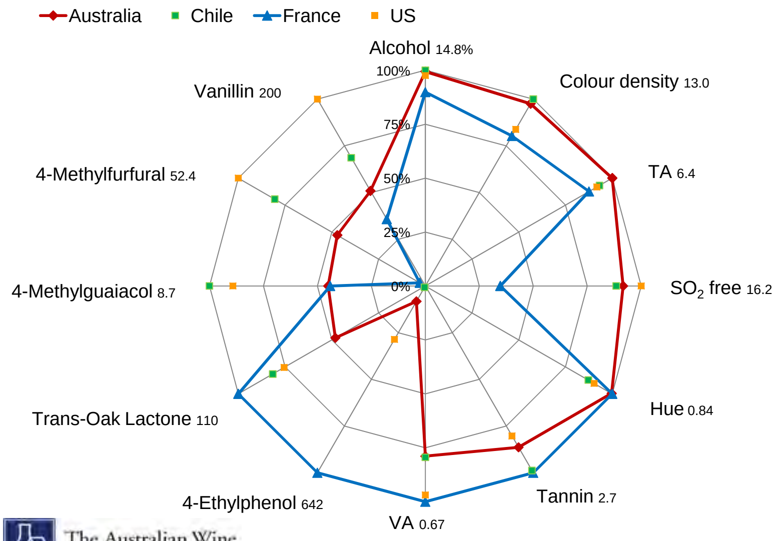
- Chemical analysis
  - Alcohol, sp. Gravity, pH, Acidity, Glucose/Fructose
  - Tannin, Colour, Hue, Phenolics
  - Free and total SO_2
  - Oak flavour
  - Brettanomyces / Dekkera flavour
- Indicative small sensory panel description by AWRI expert
  - Characteristics not covered by chemical analysis, faults

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

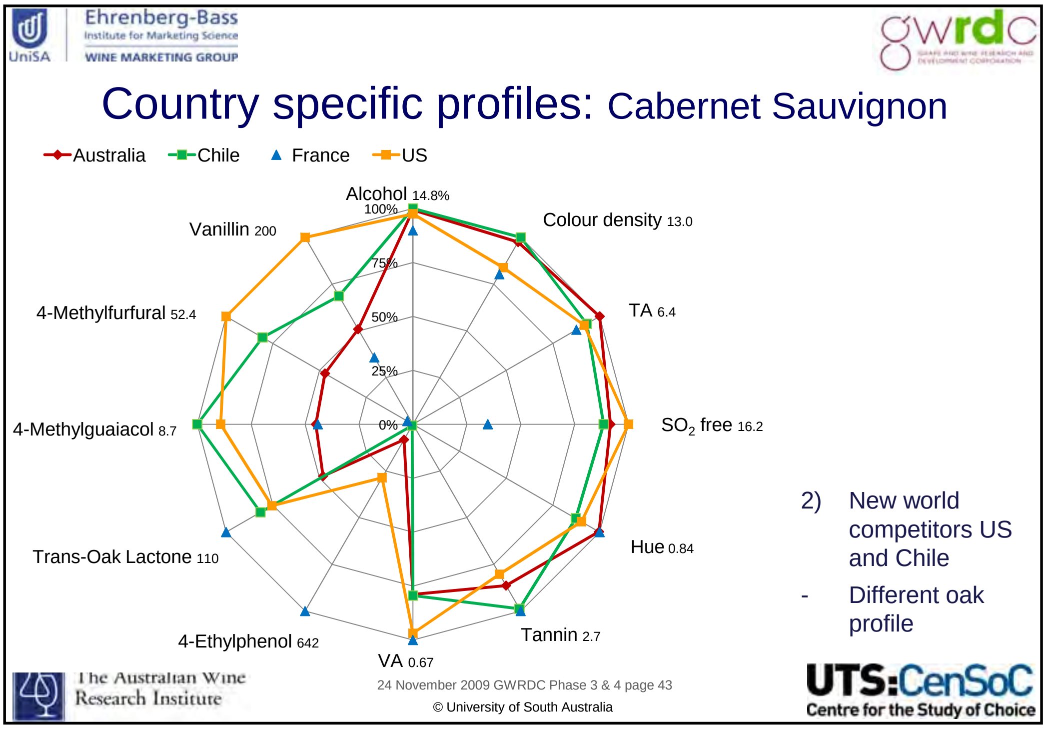
Country specific profiles: Cabernet Sauvignon

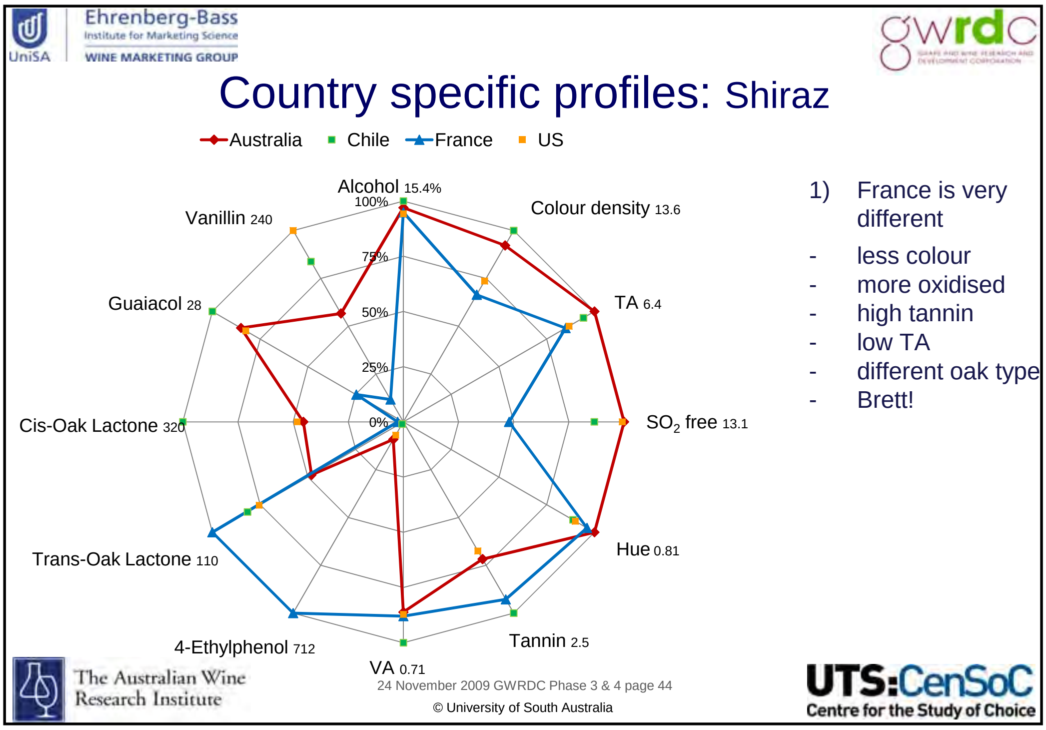


1) France is very different
- lower alcohol
- less colour
- more oxidised
- high tannin
- low TA
- high VA
- Brett!

The Australian Wine Research Institute

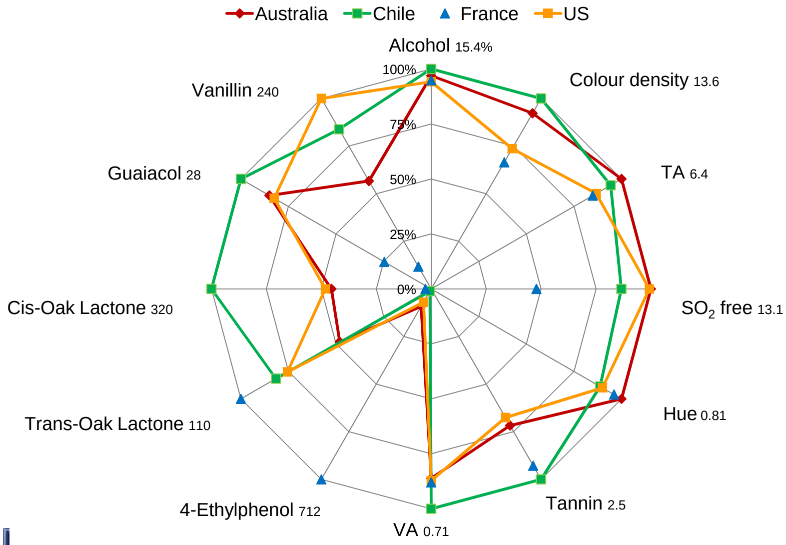
UTS:CenSoC Centre for the Study of Choice


Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
gwrdc
Country specific profiles: Cabernet Sauvignon
Australia
Chile
France
US
Alcohol 14.8%
Colour density 13.0
TA 6.4
SO2 free 16.2
Hue 0.84
Tannin 2.7
VA 0.67
4-Ethylphenol 642
Trans-Oak Lactone 110
4-Methylguaiacol 8.7
4-Methylfurfural 52.4
Vanillin 200
100%
75%
50%
25%
0%
2) New world competitors US and Chile
- Different oak profile
The Australian Wine Research Institute
24 November 2009 GWRDC Phase 3 & 4 page 43
© University of South Australia
UTS:CenSoC
Centre for the Study of Choice


Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP
UniSA
gwrdc
Country specific profiles: Shiraz
Australia
Chile
France
US
Alcohol 15.4%
Colour density 13.6
TA 6.4
SO2 free 13.1
Hue 0.81
Tannin 2.5
VA 0.71
4-Ethylphenol 712
Trans-Oak Lactone 110
Cis-Oak Lactone 320
Guaiacol 28
Vanillin 240
100%
75%
50%
25%
0%
1) France is very different
- less colour
- more oxidised
- high tannin
- low TA
- different oak type
- Brett!
The Australian Wine Research Institute
24 November 2009 GWRDC Phase 3 & 4 page 44
© University of South Australia
UTS:CenSoC
Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP | gwrdc

Country specific profiles: Shiraz



2) New world competitors

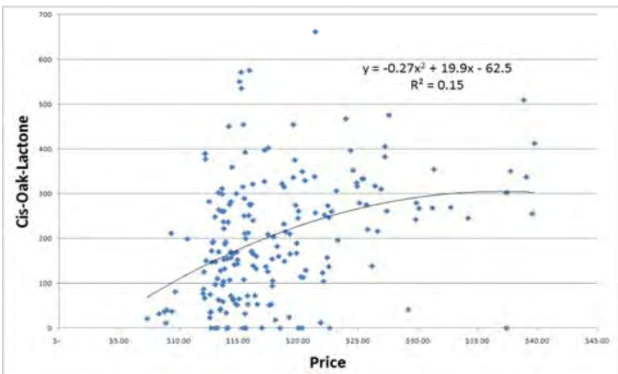
- Chile is slightly different

The Australian Wine Research Institute | UTS:CenSoC Centre for the Study of Choice

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP | gwrdc

Relationship with price

- Positive quadratic relationship of price with: Alcohol, Tannin, VA, Oak



- No relationship found for sales and availability

The Australian Wine Research Institute | UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Other analysis

- Relate wine critic ratings (Parker, Wine Spectator) and sensory descriptors to chemical composition
- Different dimensions of quality (blind vs. informed tasting)
  - Wine critics and AWRI expert panel rating unrelated
  - Wine critique rating strongly correlated with price

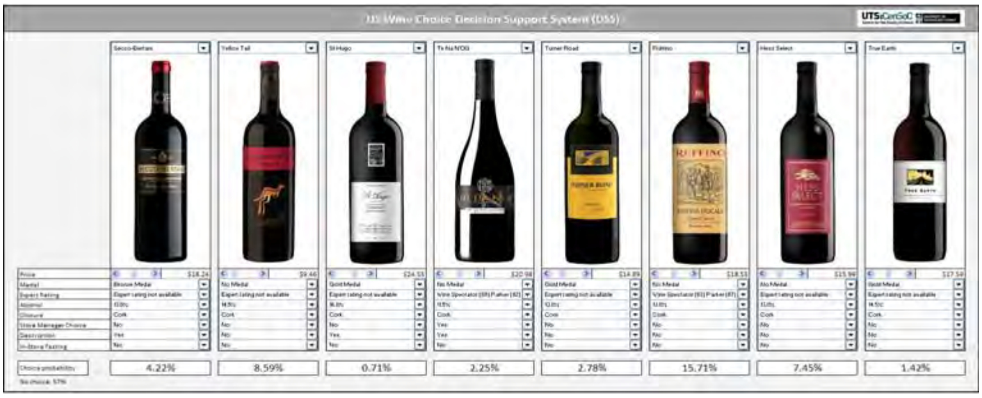
    Robert Parker (r = 0.53), Wine Spectator (r = 0.32)
- Further analysis to include Australian and UK critics

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Proof of Concept Framework for Decision Making



The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Potential applications

1) Monitor US market for changes
   - Specific brands
   - Changes to price sensitivity and information
   - Compare to ‘coastal’ US markets
2) Apply methods to other markets, e.g. China
3) Investigate alternatives to Sauvignon Blanc in Australia
4) Packaging comparisons and changes for brand owners

Possible further related research

1) Opportunity to train Australian managers to understand US consumers’ choice behaviour
2) How branding, packaging, and price influence sensory expectations and therefore liking and purchase intent
3) Packaging fluency – how consumers read and interpret signals, especially visual ones on wine packaging
4) Applying multi-media choice experiments to wine lists
5) Develop an instrument to predict trends in wine styles/varieties
6) Wine chemistry, critic’s wine language, and consumer preference

Learnings - Market Knowledge

1) Branding plays a bigger role than price in predicting sales
2) Price and distribution intensity predict sales the best, while closure, and wine chemistry have little power
3) Packaging, variety, and origin influence consumers
4) There is a 'sweet spot' for price in the US around $11 and sales opportunity up to $20
5) Discounts are not a big driver of sales in the US
6) Shelf information is one avenue for smaller wineries to have a direct impact on increasing sales
7) Publicity increases sales; Australia as a wine innovator is a more powerful message than regionality in the US
8) Consumer buying behaviour is similar across the 2 markets tested
9) Opportunity to engage a high income, high value segment

Learnings- Research Methods

1) Investing in *marketing research techniques* is like investing in any other research (long term benefits), multiple uses
2) Multi-media consumer choice simulations allow testing of shelf information, pricing, and even advertising/communication
3) Simulations validated with actual sales: can predict effects and $ value
4) Brand/ distribution/ price/ packaging predict sales much better than wine style (sensory)
5) Basic wine chemical measures do not predict sales

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP

Communicating Insights to Industry

- Delivery of insights:
  - 7 articles in trade publications + 3 in drafting
  - Presentation at industry conferences
  - Regular project updates
  - Website links and reports of key findings
  - Workshop at AWITC in July 2010

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP

Communicating Insights to Academia

- Research insights:
  - Methods, Scaling, combination of choice and sensory
- Delivery of insights:
  - 9 academic conference presentations
  - 6 articles published in proceedings
  - 3 academic articles published / accepted for publication (AJGWR, Food Quality and Preference, Marketing Letters)
  - One academic journal paper under review

The Australian Wine Research Institute

UTS:CenSoC Centre for the Study of Choice

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP

Thank you!

www.winepreferences.com

The Australian Wine Research Institute

UTS:CenSoC
Centre for the Study of Choice

Part 2: Industry publications

1) Lockshin (2007), What's important in choosing wine, Wine Business Monthly, August 2007, p. 32-33.

2) Lockshin (2007), Packaging is important, Wine Business Monthly, October 2007, p. 36-37.

3) Lockshin (2008), How consumers choose wine, Wine Business Monthly, October 2008, p. 32-33.

4) Lockshin, L. (2009), Don't Ask Consumers, they can't tell; Wine Business Monthly, October 2009.

5) Lockshin, L., Mueller, S., Louviere, J., Francis, L., Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, The Australian and New Zealand Wine Industry Journal, Vol. 24 (2), 35-40.

6) Mueller, S., Lockshin, L., Louviere, J., Francis, L., Osidacz, P. (2009), How does shelf information influence consumers' wine choice?, The Australian and New Zealand Wine Industry Journal, Vol. 24 (3), p.50-58.

7) Mueller, S., Kweh, H., Lockshin, L. (2010), Can bottle weight be taken lightly for premium wine?, The Australian and New Zealand Wine Industry Journal, Vol. 25 (1), 28-30.

8) Mueller, S., Lockshin, L. (2010), Message on a bottle: The relative influence of wine back label information on wine choice, The Australian and New Zealand Wine Industry Journal, Vol. 25 (1), 32-35.

What's important in choosing a wine?

Larry Lockshin
Simone Mueller
Jordan Louviere
David Hackman
Scott Gillispie

Our research group, along with our partners at The Australian Wine Research Institute and the University of Technology Sydney, have received a $1.4 million grant from the Grape and Wine Research and Development Corporation (GWRDC) to develop a means of predicting the success of new wines launched into new markets.

The project started in October last year and has moved through several preliminary stages. We plan to publish the results of each stage in *WBM* as well as have some workshops across Australia as we get more results. The project has an advisory group of marketing managers representing large and small wineries, plus representatives from the Australian Wine & Brandy Corporation and GWRDC, who help us focus on the most important aspects to the overall Australian wine sector.

The first stage was designed to reduce the potential number of attributes or cues that consumers use to choose a bottle of wine to a manageable number. At this time, we were only concerned with the bottle and label; another experiment (to be published later) looked only at flavour components. We came up with 16 different aspects of the bottle and label that could be changed by wine marketers (see Table 1 for a complete list and ordering).

We tested the importance of these 16 attributes using what is known as 'Best-Worst' scaling. This technique provides respondents with sets of items (in this project four to a set) and asks them to choose the most important and least important item in the set when making a purchase of wine. Respondents see a range of sets, where over all of them each attribute is seen the same number of times itself and paired equally with every other attribute. Because respondents have to choose the most and least important, the technique compensates for many of the weaknesses of the standard rating scale, e.g. 'how important is attribute x, please rate from 1-7'.

Table 1: Overall importance* of attributes for choosing wine averaged across occasions

Attribute	Importance
Brand	100
Mid price ($12-$15)	80
Promotional pricing	80
Region of origin	77
Medals and awards	72
Country of origin	65
Bottle size	31
Alcohol level	29
Closure material	22
Organic	17
Capsule material	16
Label style	9
Bottle shape	7
Bottle colour	5
Label colour	2
Label shape	0

* the importance weights have been scaled to 0-100 for ease of comparison

Figure 1: Sample screen from the most recent choice experiment.

Rating scales are subject to a range of problems, including the fact that most items end up being 'relatively important', so it is hard to discriminate between items. Also different people use rating scales differently. What is a 7/7 to one person may only be a 5/7 to another. This differential use of scale numbers is even more pronounced across different cultures, where in more polite cultures (e.g. in Asia), many people refrain from using the lower ends of the scales. There is only one way to choose the 'best' or the 'worst', regardless of culture or rating style. Therefore, Best-Worst scaling is more accurate and discriminates between close items.

We threw in a couple of extra factors into our experiment, which was conducted online with a random sample of wine drinkers from across Australia. Three versions of the survey were provided with different ways of explaining the label and package attributes. The first was the standard with merely the words as in Table 1. The second method had descriptions of the items available by clicking. So, for example, brand was explained by 'Jacob's Creek' or 'Wolf Blass' and bottle shape by 'Bordeaux' or 'Burgundy'. The third method used the same words for descriptive items, like brand, region, price, but used actual pictures for the packaging items like bottle shape, label shape and closure.

We also used seven different purchase occasions. Each person responded to only one purchase occasion, so the different occasions were compared across different respondents. The occasions were to buy to: drink by oneself, drink with friends, drink at home with family, drink in a café, drink for a special occasion, drink in a fine dining restaurant, and give as a gift.

The data were collected through an Australian internet panel provider of people who had bought at least one bottle of wine in the last month. We collected more than 700 respondents, with more than 100 in each of the seven purchase occasions. The three information conditions were spread across the 700 with approximately equal numbers in each.

The results are presented in Table 1. We have converted the best-worst coefficients into a 1-100 scale. The numbers can be read as the probability that the item would be chosen as most important. The differences indicate how close or far apart the different items are in the importance to buying wine. The results were quite similar and reliable across the different situations—that consumers choose wines fairly the same no matter what the occasion. *In all situations brand was most important.* Price was next important followed by promotional priced wine (10% discount). Region of origin and medals and awards were the next most important, switching places in a few situations. A somewhat surprising outcome was that all but two of the different purchase situations did not differ in importance among the attributes chosen.

The analysis showed that price was less and region of origin, medals, and country of origin more important for a purchase of a bottle of wine as a gift to someone special. For a special occasion such as an anniversary or celebration, medals and awards on the label had the next highest importance besides brand, whereas price had a lower influence. Promotional pricing had a greater influence, when buying a bottle of wine in a café-style restaurant.

The other surprising outcome was how unimportant packaging seemed to be. All of the lowest rated attributes were packaging related. This does not seem in accordance with our own experience or the experience of our advisory group. Even the respondents who could click to see pictures of the packaging attributes did not rate them more highly. We were surprised to find that the availability of pictorial information was only accessed by about 20% of the respondents. We thought that more people would seek further information on the different terms we used.

How useful is all of this?

Certainly the results across the situations confirm how important branding is and of course price. Looking over results I have gotten over the past eight years, I would say that region has become more important, even for everyday drinking. This emphasises the requirement that wineries work together in regions to impact the probability of being chosen off a shelf or wine list. Bottle size and alcohol level are about one third as important as brand and price. As I have stated before, we have not been very creative in offering packaging choices to consumers, except in bottles and casks. I believe there is demand out there for smaller packaging sizes as long as the price premium is reasonable. Also, there has been a lot of talk about increasing alcohol levels in wines. This research shows that consumers do pay attention to this, though this is probably just starting to become more important.

Where to from here?

This was a preliminary study to help us learn what the most important attributes were, so we could incorporate them in a larger future study, where we will manipulate actual bottles and labels. The relative unimportance of packaging has caused us to conduct another online experiment testing packaging attributes in a graphical rather than a written mode.

We had to develop a means of changing label style, colour, bottle shape as well as written information (brand, region, price) live on the computer screen based on an underlying experimental design. Thanks to the graphical design people at UniSA, we invented a new method which allows us to put different wine bottles on web pages for future choice experiments (Figure 1). We have just finished the packaging pre-test and at this stage we can say that the label styles and colour did have an effect on the probability of purchase, along with brand, region and price. We feel more confident going forward to be able to simulate the choice decisions of consumers standing in front of a shelf of wines.

More reports will follow in future editions of *WBM* as we gain the information. For more information on the project and results of the most recent work see: www.winepreferences.com.

PROFESSOR LARRY LOCKSHIN and DR SIMONE MUELLER are with the Wine Marketing Group, University of South Australia; and PROFESSOR JORDAN LOUVIERE, DAVID HACKMAN and SCOTT GILLISPIE are with the Centre for the Study of Choice, University of Technology, Sydney.

Packaging *is* important

Larry Lockshin

A few months ago in *WBM* I reported on some research we are doing on how consumers choose wines. We used written statements describing various features that might impact wine choice, like brand name, prices, awards and medals, as well as words describing packaging features such as bottle shape, label style and label colour. The results showed that brand, price and region were very important and that the various packaging features were mainly unimportant. This did not make sense to us or to some of the readers of *WBM* (as I was told directly).

Our mandate with this large project funded by the GWRDC is to develop a method for predicting consumer choice of new wines, both in packaging and style. The low ranking of packaging features showed us that our method probably did not correctly measure the influence of packaging. Our next stage, then, was to develop a means to measure packaging influences and be able to compare them simultaneously to other features, like brand name and price.

We developed a series of graphics, which could be substituted in an experimental design thanks to the graphics design department at UniSA. An example of these is shown in Figure 1. Although this example has the same brand name across all six bottles, we actually substituted two different brand names in a specified design on top of the different bottles. One was made up (Jinks Creek) and one was a real brand name of one of Australia's top selling wines. We had four different label designs: traditional, the 'chateau', modern and 'grapes'. We then were able to overlay four different label colours on top of the different designs. Two bottle shapes, Bordeaux and Burgundy, were set under the other graphics. We had four different prices below the wines and two different regions, one very well known and the other a small lesser-known region.

The idea was not to run a definitive experiment with all possibilities, but to see if manipulating the packaging elements along with the most important information elements had an effect on wine choice. If our method worked, we could then expand it in the next phase.

Figure 1. Sample screen shot from the choice experiment.

Our experiment was conducted on the web using people recruited by a web-panel provider. We asked for people who had purchased at least one bottle of red wine in the last month. More than 250 consumers responded to our survey. Each consumer answered some basic demographic questions and then was presented with a series of screens similar to Figure 1, except there were different brand names overlaid. The bottle shapes, label styles, label colours, brand names, regions and prices were varied according to an experimental design so that each person received an array of different combinations, but overall each attribute appeared the same number of times. Respondents choose which bottles they most and least preferred.

Our initial analysis is presented in Figures 2 and 3. The first thing we found is that there are different segments of consumers, who use different decision rules in choosing wine. The percentages in each bar indicate the relative importance of each factor during the purchase decision. The people in Cluster 1 use brand name more than any other attribute, but label style is also important, followed by the label colour. Price is not that important to this group, which doesn't mean they don't use price, but only that they first use brand and label. Region plays a small but significant role. Cluster 2 people mainly focus on the label style. They like some labels and dislike others. Label colour and price are about as important as in Cluster 1, but brand name is not that important. Clusters 3 and 4 focus mainly on price. Cluster 3 are high price buyers, where price seemingly indicates quality and these buyers are prepared to pay for it. Brand name is second most important with less attention paid to label colour. Interestingly bottle shape has a small effect, but almost no effect in the other groups. It may be that high price buyers are aware of the differences between the two types of bottles, but the other segments are not. Cluster 4 focuses on low priced wines. Brand is a distant second followed by label

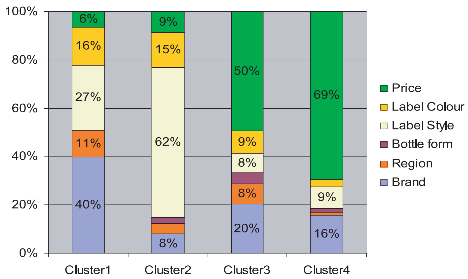


Figure 2. Importance of different attributes for four different segments.

style. Region was not that important compared to brand, label and price across the four clusters. However, we should be aware that this was a simplified choice task and may not represent all the factors adequately. Three of the clusters were of about similar size, with only Cluster 1, the brand name cluster much larger than the others.

The results of this experiment were much more realistic than the one we did first, where consumers compared written descriptions of different wine features for relative importance. These results indicated that consumers can't really 'say' that they are influenced by packaging, e.g., label style or colour, but faced with a choice among different wines, these packaging features do play an important role. It is also apparent that we cannot generalise to all wine buyers. There are definite segments, which each use different factors when buying wines. We are not reporting details here, but even within the label buyers, different styles were attractive to different buyers, as were different colours. This should give good comfort to both small wineries and to label and packaging providers. The results do point to the need to do some testing of different packaging concepts and see which appeal to the type of consumers you are targeting. Certain colours, such as orange, are not liked by very many buyers, but that seems apparent from the few orange labels appearing on store shelves.

This research was preliminary; it showed that we could manipulate packaging and that the simulated buying situation is realistic enough to get results. Our next phase will provide much more complex and realistic choices, where there are many more brands, regions, price discounts, and medals and trophies along with the packaging options. The overall idea is to be

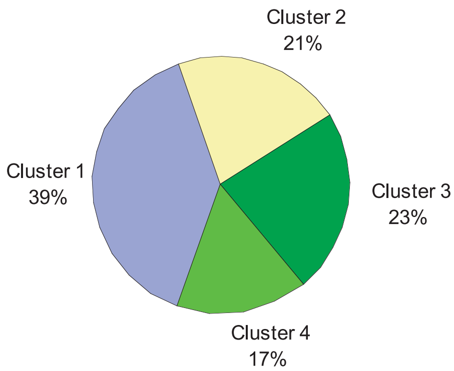


Figure 3. Size of each cluster in our sample.

able to predict what changing one or even a combination of features on a wine will do to the choices of different segments of consumers. The next sample will be much larger, which will also allow better segmentation, so that different wineries could choose different segments and see how changing some features affects the preferences of different segments.

Along with the labels, we are working on the wine style aspect of this project. By next year, we hope to be able to combine these packaging features with different wine styles as preferred by segments of consumers tasting actual wines, and then be able to predict the relative influence of all of these on consumer choice. We will then take the method into a key export market to help the Australian wine sector understand how to better package, price and style their wines to increase consumer preference.

We are very interested in your opinions and feedback on this work. For example, in the next phase, should we include the latest packaging, such as aluminium or plastic bottles? What manipulations to wine styles should we consider? I am happy to receive your comments via email. For more information on our project, see our website: www.winepreferences.com

PROFESSOR LARRY LOCKSHIN is director of the Wine Marketing Group, Ehrenberg Bass Institute for Marketing Science, University of South Australia.

Figure 1. Example of an on screen wine shelf where consumers choose one wine.

Figure 2. Example of a wine shelf using real wines.

How consumers choose wines

Larry Lockshin

I have led a team from my university (UniSA), the Australian Wine Research Institute, and the Centre for the Study of Choice (University of Technology Sydney) working on new methods to predict the sales of new wines into new markets. The research is funded by the Grape and Wine Research and Development Corporation.

We developed and trialled our method over the past year in Australia and are now starting the next phase in the US wine market—a place where Australia has potential to share in the growth of the world's largest wine market, but most recently has lost sales and, according to an article in *The Wall Street Journal*, even our $20 plus wines are not very distinctive.

Most market research methods ask consumers what features or attributes they like, or have them rate different wine packages. Typical sensory science research has consumers taste wines and asks them to rate how much they like each one. These methods have lots of problems, mainly because humans can't articulate what it is about a wine package they like or don't like. In wine tasting, most consumers are untrained and even after one wine, find it hard to distinguish among the next few they taste. The other major problem with both methods is what consumers say they like is not what they end up buying.

Our research asks consumers to choose a wine from a simulated shelf of wine online, which is more realistic and has been shown to predict real world sales much better than rating or liking. We developed the mechanism to manipulate the bottle labels, colours, styles, closures as well as the information on the labels (brand names, regions, countries, alcohol content) plus other information: prices and discounts, medals and trophies, and objective-based star ratings by wine writers and retailers. These features were changed according to a complex experimental design, so that all conditions appeared an equal number of times and therefore we could measure the number of times each level of each attribute was chosen. This method allows consumers to choose and then to calculate afterwards, which factors had the greatest influence on choice, without actually asking that question. A sample of one of our 256 different shelves is in Figure 1.

We also used a set of shelves using combinations of 21 real wines with their labels to check whether the method predicted actual sales. All the research was done using the NSW wine market, consumers from that area, and Shiraz wines. The wines were chosen to represent the widest range of Shiraz flavours available in the market. Four hundred consumers each tasted five of the 21 wines in a sensory facility in Sydney, so that each of the 21 wines was tasted by 100 consumers. Figure 2 shows an example of the real wine online choice screen. Here we also manipulated wine scores and the presence or absence of objective flavour descriptions of the wines.

Our results showed that objective ratings using 0-5 stars had the largest effect on choice, followed by brand and price, then medals and trophies. Price discounts were next and then alcohol level, and region followed by label style, label colour and then screwcap compared to cork. The country of origin showed Australian wines to be preferred over the Italian or French, but that Australian consumers were more price sensitive for domestic wines compared to imported wines.

Consumers' choices from the online shelves of real wines were compared to actual sales in the NSW wine market using ACNielsen sales data. Our online choices predicted actual sales with 75% accuracy. We then linked our first simulation of wine bottles to the real bottle attributes and could predict sales with about 60% accuracy.

The consumer sensory liking of the 21 wines had almost no correlation with actual sales. The preferences did reveal which flavours of the wines consumers liked, which can be used to determine wine style. However, we used some of the wine chemistry data provided by AWRI in our predictive model and that improved our ability to predict actual sales in the NSW wine market to more than 90% accuracy. Eventually this may allow us to provide some direction for wine styles aimed at specific markets or segments.

This phase of our research was mainly designed to develop the methods. We only used 21 real wines, which is a very small number of observations. Although our results looked promising, we can't be sure the accuracy did not occur by chance or by the way we chose the 21 wines. We plan to analyse the chemistry of many more wines in our next phase, but not use consumers to taste the wines.

We were very pleasantly surprised at how well this new method works. Being able to predict actual sales and then link totally simulated bottles to those sales would allow wine producers to 'test' new label and packaging designs before launching them in the market. Our method also will allow the testing of communication devices, such as point of sale material or even advertising, to measure the effect on sales.

This work is still very preliminary and has focused mainly on developing the methods rather than workable results for the Australian wine market. Our next phase is to broaden our research and test it in two US cities based on red wine sales in those areas. We are currently analysing the available red wines in these two cities in order to categorise the types of labels and wine styles. Our Advisory Group will help us choose the features to manipulate in our simulations once the initial analysis is complete. A subset of the wines will be chemically analysed and tasted to add to the features we can use in our predictive models.

Basic research in consumer behaviour can use scientific methods based on proven theories in economics and statistical design to understand and predict consumer choices in the market. Research such as this is vital to Australia moving from the 'lucky country' in winemaking and marketing to one that plans and takes advantage of its skills in developing wines consumers are willing to buy.

PROFESSOR LARRY LOCKSHIN is with the Wine Marketing Group, Ehrenberg Bass Institute of Marketing Science, University of South Australia.

Printed in Wine Business Monthly, October 2009

Don’t ask consumers, they can’t tell you

Professor Larry Lockshin
Wine Marketing Group, Ehrenberg Bass Institute of Marketing Science
University of South Australia

My last few columns have looked at the big picture facing the Australian wine sector, both internally and externally. This time, I want to turn my attention to a much narrower set of issues involved in marketing Australian wines. My research group, along with the AWRI and the Centre for the Study of Choice at the University of Technology Sydney, have been studying how consumers choose wines for almost three years. We have made a range of discoveries, many of which I have touched on in this column. The one I want to write about this time has to do with how to get information from consumers about what drives their purchasing.

There is no simple answer to this issue. The one thing we found over and over is that directly asking consumers what matters to them when choosing wine often results in seemingly logical responses, which are then contradicted by actual behaviour. So, this article is really aimed at all companies, which ask consumers directly about their preferences, whether they use internal or external market research providers or even do it at cellar door.

Why can’t we ask consumers what they like, or what motivates their purchase, either directly face to face as many companies do in focus groups or interviews, or through surveys? We seem to think that we contemplate and deliberate in making choices, and the more important the choice, the more we think about it. Although we often expend more conscious effort in making some decisions than others, there is much recent evidence that our actual choices are more affected by unconscious factors than conscious ones. We don’t know why we choose things!

Last year a landmark research project at Stamford University revealed that when people tasted wine while an MRI was scanning their brains, their pleasure centre was more highly activated when they were told the wines they tasted were high priced than when they were told they were low priced. It is not surprising that high priced wines elicited more pleasure. What was surprising is that the pleasure was not mediated by any cognitive interpretation of the taste sensations. The activity in the part of the brain receiving and interpreting taste did not change; only the activity in the pleasure centre did. The knowledge of the price of the wine directly affected their pleasure without any signals from the taste areas.

The same type of unconscious processing has been shown for people responding to visual signals of all types. Colours, shapes, and images can directly affect behaviour without the person being aware of it. Much recent evidence in psychology points to a huge amount of unconscious processing of signals, which directly affect behaviour without the person being aware at all of the effect. Our recent research in consumer response to wine labels confirmed this. We used a word-based survey asking people how important various factors were in wine choice, e.g., price, brand, region, label colour, label style, bottle shape. Our results showed that visual cues were all ranked as the least important, while verbal cues, like price and brand were ranked highly. We then repeated the research, but instead of asking directly, we showed people different wine bottles, where we manipulated the same cues in an experimental design. Participants choose their most liked bottles without having to state what were the important cues driving their choice. This time label colour and label style were ranked in the top five cues, and we could find segments where these cues were more important than brand or price, and segments where they were less important. When we conducted these experiments using real bottle photographs, we found the simulated choices to be very similar to the actual market share of the wines, which confirms the validity of this approach.

Another outcome of unconscious processing is the difference in scores given to the same wines by different ‘experts’. A recent article analysed 2400 wines receiving medals in a range of US wine competitions. They found no statistical correlation between the awarding of a gold medal in one competition and gaining a medal in another. WBM has been one of the Australian journals questioning the difference in scores for the same wines by James Halliday and Rob Geddes, both respected wine writers and judges. My response to these issues is that most wine writers, including Robert Parker and James Halliday, taste wines with full knowledge of what they are tasting. It is impossible to believe that they are not influenced by that knowledge regardless of claims to the contrary. The fact that some wines do receive medals in multiple competitions in Australia is most likely due to the blind tasting conditions and the long term training most judges go through, where they learn to identify specific elements in wine and to use these in making their scores. I believe that any score given a wine where the judge knows what is being tasted cannot be free of (unconscious) bias.

A more interesting question is whether or not the differences in scores affect consumer decisions. In one of our experiments we varied the average score given to a wine (on the shelf below the wine) and also varied the difference between three raters. Wines with high scores and low variance (all the raters agreed) recorded the largest positive impact on sales. However, when wines had one high score and some low scores, they were still given preference in choice. Consumers do notice the low scores but tend to discount them if there is one high score.

So, how do we conduct market research when asking consumers directly does not predict their actual behaviour? The method we use, choice experiments, does provide predictive results when properly conducted, but it takes expertise to create proper designs in order to rule out any spurious effects. I believe that using a survey and asking consumers or interviewing them directly is subject to a lot of bias and what we call ‘demand effects’- consumers provide what they expect the researcher to want, or what they believe is most rational. If you can’t afford the expertise to design and conduct experiments to test new labels and other marketing communications, then at least you can ask consumers which they like, or which they would choose given two different bottles. We know price has a huge effect, both conscious (when relating to specific situations) and unconscious, so don’t include price when doing these tests unless you also provide the same consumption occasion. Even at cellar door, you can ask visitors to tell you which of two label designs they like better, or would be more likely to buy, or to give as a gift. But don’t ask ‘why?, because whatever consumers tell you is unlikely to be the real reason. Certainly don’t base your label designs or marketing strategies on these conscious stated preferences.

Development of a new method to measure how consumers choose wine

Larry Lockshin[1], Simone Mueller[1], Jordan Louviere[2], Leigh Francis[3], Patricia Osidacz[3]

Marketing research has not been the strong point for the Australian wine industry's past success. Technical research and adoption of innovation in the vineyard and winery contributed most to the rise of the Australian wine sector from 1990 to the present. Like any innovation, competitors have copied and now Australia finds itself competing with countries and wineries well equipped to make wines of similar style at the same and often lower price points. One of the responses to this has been the Grape and Wine Research and Development Corporation's (GWRDC) investment into researching new methods to understand consumer wine buying.

The major goal of consumer research is to understand what aspects of a product and its promotion consumers use to make their purchase decision. If this is known, then wineries and distributors can highlight or even change the important aspects to better suit consumer needs. Traditional marketing research asks consumers what they find important when shopping for wine. Typical questions might ask shoppers to rate the importance of various label items on a seven-point scale, or ask them to rate their intention to purchase a wine with a certain price or brand.

These techniques, while easy to use, are not very predictive of what consumers actually do. Much of human decision-making is not well thought out and not available to our conscious mind. The other problem is that a bottle of wine (and most other items) consist of many features or attributes in complex combinations. Understanding each facet (e.g. brand, price, region, label colour) in isolation as rated separately does not help us understand how consumers actually compare and then choose these complex combinations. So, much of prior marketing research, while highlighting important aspects, does not help us predict what combinations motivate consumer purchasing, or even more importantly, what changes to existing packaging and wine styles would increase the probability of that wine being purchased and repurchased.

[1] Wine Marketing Group, Ehrenberg-Bass Institute for Marketing Science, University of South Australia. Email: larry.lockshin@unisa.edu.au

[2] Centre for the Study of Choice (CenSoC), University of Technology, Sydney

[3] The Australian Wine Research Institute, Adelaide

We report here the first stage of a GWRDC-funded project to develop and test new methods for understanding how consumers choose wines. The project team combines experts in the field of consumer choice, sensory research and wine marketing. The first stage of the project was conducted in Australia to develop and test the reliability and validity of these methods. The second stage, which is under way now, focuses on the US wine market and tests how we can estimate the effect of combinations of label and packaging changes on getting consumers to switch to Australian wines from other wines in the market. For more information on the project, visit www.winepreferences.com

CHOICE ANALYSIS

Discrete Choice Analysis has been used for about 20 years to understand and predict choices (Louviere *et al.* 2000). It was developed originally in transportation research to estimate use of different transport choices as their costs and convenience changed. More recently, it has been used in new product development to test the likely response to new products. We adapted this method for our project. The major feature of the method is that it simulates real choices and, therefore, is more predictive of what actually happens in the marketplace (Mueller and Lockshin 2008). The key to this is to ask consumers to choose the bottle of wine they would buy for a specific occasion.

We asked consumers to look at a simulated shelf of wine online (Figure 1) and to choose the wine they would buy to have at home with friends or family tonight, which is one of the most common wine drinking occasions in Australia (Oppenheim *et al.* 2001). We can then analyse the choices and work backwards to understand how the choices changed when the levels and combinations of the attributes changed. We don't have to ask consumers how they rate importances or their purchase intentions. By asking them to do the same thing they do in a shop – choose a bottle of wine to drink at home – we can measure the relative importance of the attributes and the levels. The method is able to reveal how the consumer is 'trading off' different levels of different attributes in their mind, e.g., "Will I pay a bit more to get that Barossa Shiraz with a medal, or would I prefer to pay less and get the south-eastern Australian Shiraz with the colourful label?"

TESTING THE VALIDITY OF THE METHOD

One of the most important questions we had to answer is how well the online choice method can predict consumers' real purchase behaviour. The idea was to see how valid the online choices were compared with the actual sales of real wines in the market. For the first choice experiment, we selected 21 Shiraz wines from the New South Wales AC Nielsen Top 100 sales data with a wide range of sensory properties and to cover both more and less well-known brands. Photographs of these wines were included in a shelf simulation showing five bottles at a time and their real market price (see a screen shot in Figure 1). In total, 1233 regular red wine consumers from New South Wales were asked to choose wine for a dinner at home with friends or family.

It was found that the wines that respondents chose in the experiment were strongly related to their actual market shares according to AC Nielsen data. A strong and significant correlation of 0.75 showed that an online choice experiment is a very good approximation of what consumers purchase in reality. This allows us to be confident that the simulated bottle experiment could predict sales changes in the market. At this stage, it was not our aim to explain what causes or influences sales (how well known a wine is or how it is packaged), but rather to test if the choice method is able to give valid predictions. We also recruited consumers to taste the wines, which will be reported separately. The online sample was highly representative of red wine drinkers in Australia, even though it was drawn from New South Wales wine consumers.

Figure 1: Example of a screen from the online choice experiment with real bottles to test the validity of the method.

SIMULATED RETAIL SHELVES: INVESTIGATING INFLUENCES ON WINE CHOICE

Once the discrete choice method has proven its validity, it can be used to systematically vary extrinsic wine attributes with simulated wine bottles to measure the impact on consumers' choices. Basically, we assume any product, here a bottle of wine, is made of separate attributes, such as a price, a region, a grape variety, a brand, etc., with each attribute consisting of different levels (such as several price points, different regions). These attributes should be selected to be important to consumers' wine choice and to represent features that can be controlled and varied by a winery to be able to optimise its products according the outcomes of the experiment. It has to be considered that not all wineries have control of the same attributes. While a large company with a portfolio of different products can vary the brand and the region of origin of its wines, these variables are often fixed for a smaller winery. Once the method is developed it can be tailor-made to specific needs for subsequent market research.

For a first proof of concept we included six intrinsic wine attributes (brand, country of origin, region of origin, price, price discount and alcohol level) and four extrinsic attributes (label style, label colour, closure and medals) into a simulated bottle choice experiment. Each of these attributes was varied between two and eight levels. For instance, closure had two levels - cork and screwcap - while there were four different prices. For a

Figure 2: Example of a screen from the online choice experiment with simulated wine bottles.

complete overview see Table 1. For realism's sake we also included other countries (France and Italy) for which all attributes showed smaller effects than for Australian wines. Here we only discuss the Australian results.

A comprehensive statistical design controls the combination of attribute levels into simulated wine bottles; in our case it contained more than 1000 graphical combinations. This design ensures that each attribute level co-appears with each other the same number of times which allows us to separate the effect of each individual attribute level on wine choice. Some combinations of attributes are not found on the wine shelf, but this is the important part of making and testing enough combinations to understand their individual effects. The same 1233 regular red wine consumers from New South Wales that participated in the validity experiment completed an online choice experiment with simulated shelves of five bottles in May 2008, with each consumer assessing multiple simulated shelves during the experiment (see Figure 2 for an example of a screen a consumer would see).

INTERPRETING OUTCOMES OF CHOICE EXPERIMENTS

While complex statistical analyses are required to evaluate fully the outcomes of choice experiments, they can be easily understood by calculating how often an attribute level was chosen when it appeared on the simulated wine shelves. This frequency of choice gives a measure of the preference for each attribute level; those that are chosen more often are more preferred than rarely chosen levels.

Considering the effect of the four price levels investigated, Figure 3 shows that a wine was chosen three out of 10 times (29.9%) when its price was $12.99. So, this price level was more preferred than $22.99 which was only chosen two out of 10 times (19.2%). The preference for price levels of $7.99 and $17.99 were in between these most and least preferred prices. Interestingly, these outcomes indicate that lower prices for Australian wine do not automatically sell more but that consumers actually chose wines around $13 most often. Therefore, we could not confirm a linear price-sales relationship as is often assumed. Remember, the purchase situation was with family and friends, which may have affected the different choices.

To compare the relative effects of different attributes, like price and label design, one has to look at the maximum impact on choice of a change of attribute levels. For price, this maximum impact is achieved by switching between the least chosen price of $22.99 (19.2%) and the most often chosen price level $12.99 (29.9%), which represents a relative difference (increase) in choice of 10.7%. To compare the relative importance of attributes for consumer choice this effect can now be compared with the maximum impact of other attributes. From all attributes analysed, price had the second strongest influence after brand (see Table 1).

Comparing the impact of changes in attribute levels allows wineries to make their own trade-offs in packaging and labelling, and is the biggest advantage of choice experiments. So, a manager of a brand portfolio can calculate if a price discount is necessary to keep the same market share if he or she sources grapes from a less well-known region, and if the region is clearly stated on the label.

It has to be noted that the measured impact depends on the attribute levels chosen by the experimenters; ideally, they should cover the maximum range of the relevant market under study. A too narrow range (e.g. only looking at $10-$15 wines) will result in a smaller impact of the attribute while a very wide range (e.g. $8-$35) will increase it.

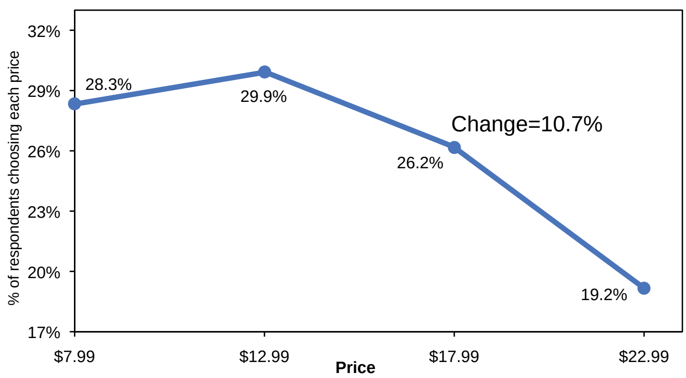


Figure 3: Impact of different price levels on relative choice.

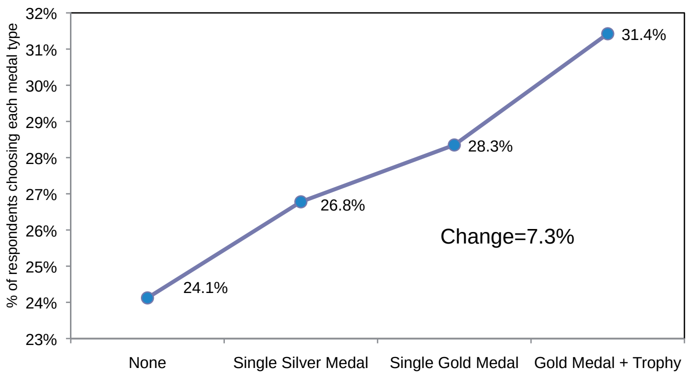


Figure 4: Impact of medal types on relative choice.

DRIVERS OF WINE CHOICE

Brand was revealed to be the most important for consumers' wine choice, and was just a bit higher than price (see Table 1). We used eight different Australian brands, which represented four different tiers of brand reputation from very well-known brands (Tier 1, such as Wolf Blass and Hardys) to unknown (made-up) brands (Tier 4, such as Basalt Ridge and Duck Hollow). The total effect of 10.8% of difference in choice between these brands is mainly caused by one brand with a very high reputation, while we found only small differences between medium-known and unknown brands. This shows the strong impact of a very well-known and advertised wine brand.

After price, medals were the third most influential attribute on consumer choice. Not surprisingly, a gold medal with a trophy was most often chosen, followed by a single gold medal and a single silver medal (see Figure 4). Compared with having no medal, a gold medal plus a trophy increased the chance of a wine being chosen by 7.3%.

A price discount proved to have a high impact on consumer choice. A special price of 20% off the listed price increased choice by 6.4%. Comparing this increase in market share with winning a gold medal plus a trophy, we find that the medal plus trophy outweigh the effect of a price discount.

There has been some recent discussion about Australian wines having too high alcohol levels and consumers potentially preferring lower alcohol wines. We could not confirm this for our sample of regular red wine consumers from New South Wales. For the four alcohol levels tested, we found higher alcohol levels to be preferred. Increasing the alcohol level from 11.5% to 16% increased choice by 4.3%. This might be related to consumers preferring the higher perceived body and viscosity of wines with higher alcohol levels (Gawel *et al.* 2007). The biggest change happens when raising the alcohol level from 13.0% to 14.5%; after this, choice does not increase much further for the highest level.

An emphasis on regionality is seen as an important aspect for exports for the Australian industry, but it did not show a very strong effect on wine choice in our experiment with New South Wales consumers. Changing the region of origin of a wine from less-known regions like Padthaway or Hilltops to well-known regions like Yarra Valley or Barossa only increased choice by 3.8%. For New South Wales wine consumers, Yarra Valley and Barossa resulted in the same relative choice overall, indicating that they are perceived to be of similar value for Shiraz wine.

For a first proof of concept we also included four different label styles and label colours into the experiment. Over all respondents, both effects were not very strong, with 3.6% difference in choice between a minimalistic and a traditional type label and 1.2% between yellow and grey/black colours. On the individual level, we found packaging to be more important for some consumer segments. In the next project phase, validating this method on two US wine markets, more realistic packaging concepts will be used that combine colour and label type. This will allow us to measure different consumer segments' response to packaging changes.

Table 1: Summary of relative impact of wine attributes on consumer choice.

Attribute	Levels		Maximum difference in % choice
Brand	8	Tier 1 (very well-known brand) to Tier 4 (unknown brand)	10.8%
Price	4	$7.99 - $22.99	10.7%
Medals	4	no medal - gold + trophy	7.3%
Price discount	2	none vs. 20% discount	6.4%
Alcohol level	4	11.5% - 16%	4.3%
Region	4	Padthaway, Hilltops, Yarra Valley, Barossa	3.8%
Label style	4	chateau, traditional, minimalistic, graphical	3.6%
Label colour	4	cream, yellow, red, black	1.2%
Closure	2	screwcap vs. cork	0.6%

Our results for the effect of closure type provide some confirmation that screwcap has gained wide acceptance in Australia. While cork was chosen slightly more often, the difference of 0.6% is extremely small. While this may be partly due to limitations of consumers noticing the closure type on a simulated shelf (see Figure 2), this mimics the situation in a retail outlet.

CONSUMER SEGMENTS

While the results previously discussed refer to the 'typical' New South Wales red wine consumer, we found three different consumer segments driven by different wine attributes who prefer different characteristics (see Table 2). The first segment, representing almost half of New South Wales regular red wine consumers, is mainly brand and medal-driven in their wine choice. These consumers prefer lower and medium-high price points and most often chose chateau-style and grey/black labels. While alcohol level had no influence on their choice, they slightly preferred Yarra Valley over Barossa.

The wine choice of the second segment, containing 40% of respondents, was most influenced by price discounts and wine ratings, which will be discussed in more detail in the May/June 2009 issue of the *Wine Industry Journal*. These consumers seem to be motivated by value for money, most often choosing medium price level wines with a strong preference for a price discount, signalling that they want to get more than they pay for. Regarding packaging, they preferred traditional and cream-coloured labels and most valued the Barossa region and medium alcohol levels.

A smaller segment of about a fifth of all consumers is very price sensitive. Their wine choice is mainly determined by the lowest prices and price discounts. While packaging does not seem to influence their choice at all, they prefer the highest alcohol levels. Well-known regions have a relatively small influence on their wine choice.

The segmentation helps us understand that not all consumers will react the same way to changes in wine packaging and pricing. The overall sample indicated that brand and price were about equal in importance and that the most chosen price was $12.99. When we look at segments, we see one segment is more brand-driven and one mostly price-driven. Not all consumers will respond the same to discounts and lower prices, and these should be used only when aiming at one specific segment.

INDUSTRY IMPLICATIONS

The first stage of this project has resulted in the development of a method to model consumers' wine choice and to quantify the impact of changes in attribute levels. These simulated wine choices were shown to relate to sales, which qualifies them to predict real market changes.

Online choice experiments with simulated wine bottles proved to be a practical, efficient and valid way to test consumer responses to packaging and pricing. Their ability to forecast and anticipate market response to a wide range of possible variations of wine factors allows their application in new wine product development. As a result of our research, we showed that the choice method overcomes the problem of measuring and predicting consumer responses to purchase drivers, such as packaging, that they cannot introspect, or that may affect them subliminally. The method can be adapted to different sized producers and to individual Australian wine regions to test the impact of changes to wine characteristics on consumers' wine choices. In the next issue of the *Wine Industry Journal*, we will detail findings on how the developed method can be used to test the impact of information provided to consumers, such as wine ratings or sensory descriptions on shelf talkers.

ACKNOWLEDGEMENTS

This project was supported by Australia's grapegrowers and winemakers through their investment body the Grape and Wine Research and Development Corporation with matching funding from the Australian Government. The members of our industry advisory group and the wineries providing us with photographs are sincerely thanked.

REFERENCES

Gawel, R.; Van Sluyter, S. and Waters, E. (2007) The effects of ethanol and glycerol on the body and other sensory characteristics of Riesling wines, Australian Journal of Grape and Wine Research,. 13:38-45.

Louviere, J.; Hensher, D. and Swait, J. (2000) Stated Choice Methods: Analysis and Application, Cambridge University Press, Cambridge.

Mueller, S. and Lockshin, L. (2008) How important is wine packaging for consumers? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods, 4th International Conference of the Academy of Wine Business Research, Siena, Italy.

Oppenheim, P.; Hall, J. and Lockshin, L. (2001) Deriving Wine Marketing Strategies by Combining Means-End Chains with an Occasion-Based CHAID Segmentation Analysis, Proceedings of the European ACR, June.

Table 2: Differences between consumer segments and the red wine attributes most often chosen.

	Segment 1	Segment 2	Segment 3
	Brand driven	*Value for money*	*Price sensitive*
Segment size	42%	40%	18%
Most important choice cues	brand and medal	star rating and discount	low price and price discount
Preferred price level	low/medium	medium	low
Preferred label style	chateau	traditional	unimportant
Preferred colour	grey/black	cream	unimportant
Most preferred region	Yarra Valley	Barossa	Barossa and Yarra Valley
Preferred alcohol level	unimportant	medium	highest
Brand influence	high	medium	low
Medal-influence	high	medium	low
Socio-demographics	more female		more male

How does shelf information influence consumers' wine choices?

Simone Mueller[1], Larry Lockshin[1], Jordan Louviere[2], Leigh Francis[3], Patricia Osidacz[3]

INTRODUCTION

In the last issue of the *Wine Industry Journal*, we reported on the development of a new method to measure how consumers choose wine, a project funded by the Grape and Wine Research and Development Corporation (Lockshin *et al.* 2009). We discussed why observing consumers' choices is more predictive of their real purchases compared with asking consumers how important different attributes are for their purchase decision. A validity test of our online choice experiment resulted in a very high correlation between simulated choices by regular wine consumers from New South Wales and actual brand market shares as reported by AC Nielsen sales data. We also presented the size of the impact we found for different wine labelling and packaging characteristics, such as brand, price, region, alcohol level, closure, label style and label colour, on the choice of a Shiraz wine for a typical dinner with family or friends.

While the last article focused on the influence on consumer choice of intrinsic and extrinsic characteristics of the wine itself, this article reports the effect of display information from a simulated retail shelf. While multimedia experiments aimed at forecasting consumer responses to product information have been used for other categories, such as cars or cameras (Urban 1997), we had to develop and test a prototype of shelf information in a simulated wine retail environment. For this first application to wine choice we used a selection of wine display information that might induce consumers to trade up to higher price points. We investigated the response of consumers to shelf display information using sensory descriptions; medals; ratings by wine critics.

HOW CONSUMERS ASSESS WINE

Before presenting details of the study, it is worthwhile reflecting why consumers' choices might be affected by shelf information displays. Except for highly involved wine drinkers who enjoy the search process, many wine consumers are overwhelmed by the number of wines available to them in a retail store. At the same time, most wine buyers want to make a quick decision. Past research (EBI 2007) observing wine shoppers in Australia found that the average time spent in front of a shelf in a retail outlet was less than a minute, and the total time browsing in the store was about four minutes. Involved shoppers spent up to 15 minutes buying wine, but these were the minority of wine buyers. Many consumers use an implicit logical sequence of assessing information available to them to simplify the difficult decision to make a choice from the large number of wines that differ in many attributes. These heuristic cues are used to reduce perceived purchase risk by indicating what consumers can expect to get when they purchase a wine.

To understand the role of information on consumers' risk perception it is helpful to think about how wine is actually perceived by consumers. Depending on if and when consumers are able to evaluate a wine characteristic, one can distinguish 'search', 'experience' and 'credence' attributes (Mueller 2004). 'Search' characteristics are those that can be assessed before the purchase in front of the shelf. The producer, brand, region, grape variety and packaging are examples of search characteristics. 'Experience' characteristics, such as the taste of a wine and whether it is enjoyable, can only be evaluated upon consumption. These are often the main benefits a consumer seeks from purchasing a wine. Other characteristics, such as health effects, environmental benefits, ingredients or production methods used for a wine, which cannot be assessed during consumption, are called 'credence attributes'.

Many consumers use an implicit logical sequence of assessing information available to them to simplify the difficult decision to make a choice from the large number of wines that differ in many attributes. These heuristic cues are used to reduce perceived purchase risk by indicating what consumers can expect to get when they purchase a wine.

When purchasing wine a consumer uses any available 'search' information to infer the hidden 'experience' and 'credence' aspects. While highly involved wine drinkers have a detailed understanding of how wine regions, producers and grape varieties interact and influence how the wine will taste, most consumers have difficulties in understanding these interactions (Lockshin *et al.* 2006). For instance, they find it very hard to infer wine styles related to regional differences. Less involved wine consumers have been found to remember fewer wine regions or producers overall, with less well-known regions and producers not recalled (Dodd 2005). Hence, those 'search' attributes commonly available to a consumer on the shelf are of limited help for most typical wine purchasers in order to reduce their perceived purchase risk.

[1] Wine Marketing Group, Ehrenberg-Bass Institute for Marketing Science, University of South Australia (Simone.Mueller@unisa.edu.au)
[2] Centre for the Study of Choice (CenSoC), University of Technology, Sydney
[3] The Australian Wine Research Institute, Adelaide

HOW TO REDUCE PERCEIVED PURCHASE RISK

George A. Akerlof won the Nobel Prize for Economics in 2001 for his breakthrough findings on information asymmetry and its impact on market performance. He found that consumers would pay only a relatively low price when they perceive a purchase to be risky, and that whole markets can fail when the perceived risk is too high, resulting in no transactions. He called these 'markets for lemons'. We have recently experienced such a market failure in the corporate lending market where to unblock the market, the Government had to reduce banks' perceived risk by issuing guarantees and by decreasing interest rates. According to Akerlof, this price discount, or 'risk premium', can be reduced if market participants provide their trade partners with credible information, which reduces the perceived risk.

What information would be able to make a wine purchase decision for consumers less risky if information on the label was of limited help? A sensory description that provides information on the taste the consumer can expect from the wine could be expected to reduce his/her uncertainty and increase the likelihood of a wine being chosen. One only has to make sure that this taste description is understandable, credible and relevant to the consumer, and reflects his or her likely perception of the wine.

While consumers can say if they subjectively like a wine, most do not feel very confident to assess its quality from a more objective perspective. So, even when experiencing the wine, its quality, in the sense of degree of excellence, can remain a credence characteristic. While it does not matter when the wine is drunk privately, there are a large number of social occasions, or when buying wine for a gift, where the buyer wants to make sure that the wine is, indeed, of high quality and is likely to be positively perceived as such by others. For these occasions, a wine consumer could look for expert advice on the objective quality in the form of wine ratings from the store, wine critics' scores, or medals from wine shows indicating the wine was evaluated favourably by experts compared with other wines.

In addition to reducing consumers' perceived risk, these accolades can also satisfy aspirational needs of exclusiveness or the social acceptance some consumers seek to fulfil with wine (Hall and Lockshin 2000). It is, of course, desirable that these awarded wines are indeed of a higher objective quality for the quality signal to be credible. If these accolades have established social acceptance then they can themselves have a strong influence on how we experience the quality and taste of a wine. Several research studies (Deliza *et al.* 1996, Deliza and McFie 1996, Guinard *et al.* 2001, Lange *et al.* 2002) have demonstrated that consumers can be strongly influenced in their taste evaluation by extrinsic attributes when tasting beverages such as wine or beer in an informed condition. Therefore, wine ratings, show medals and wine critics' scores can have a combined utility to wine buyers by signalling higher objective quality and also by positively influencing how the wine will taste. A quality signalling mechanism can, of course, lose its reputation over time if it becomes inconsistent or is contrary to expectations. It must be credible and reliable.

While we would expect sensory descriptions, wine ratings, show medals and wine critics' scores to have a positive influence on consumers' purchase decisions, little is known about their actual impact and relative importance on wine choice. We, therefore, decided to investigate the effect of these types of information.

SHELF DISPLAY INFORMATION

As discussed in our last article, we ran two experiments to measure the impact of display information on simulated retail shelves with online choice experiments. One experiment used 21 Shiraz wines, selected from the New South Wales AC Nielsen top 100 sales data, in the price range of \$9-\$26 with a wide range of sensory properties and which covered both more and less well-known brands. Photographs of these wines were included in a shelf simulation showing five bottles at a time and their real market price.

For a subset of six of the 21 wines we also included a short sensory description or a wine critics' ratings on a simulated shelf talker (see Figure 1). The appearance of both was controlled by a statistical design that allowed us to independently measure the impact of the existence of the sensory description and the effect of wine critics' scores. In total, 365 regular red wine consumers from New South Wales were asked to choose wine for a dinner at home with friends or family using these simulated shelves.

The second experiment used graphically simulated wine bottles that varied in six intrinsic wine attributes (brand, country of origin, region of origin, price, price discount and alcohol level) and four extrinsic attributes (label style, label colour, closure and medals). For a more detailed description of this experiment see Lockshin *et al.* (2009). For the information display we included a quality rating below some of the wines, which had between zero and five stars (see Figure 2). We asked 1233 regular red wine consumers from New South Wales to choose wine from the simulated shelves for a dinner at home with friends and family using these simulated shelves.

SENSORY DESCRIPTIONS

Members of the AWRI expert sensory panel characterised the wines, and based on this assessment a short sensory description was formulated for each wine in language understandable to consumers, such as complex Shiraz with leafy and vanilla characters; or dark berries and nuances of chocolate with a smoky aroma. As each description was always combined with the wine it belonged to, we can only measure the effect of the presence or absence of a sensory description, but not which description was more preferred.

A sensory description that provides information on the taste the consumer can expect from the wine could be expected to reduce his/her uncertainty and increase the likelihood of a wine being chosen. One only has to make sure that this taste description is understandable, credible and relevant to the consumer, and reflects his or her likely perception of the wine. While consumers can say if they subjectively like a wine, most do not feel very confident to assess its quality from a more objective perspective. So, even when experiencing the wine, its quality, in the sense of degree of excellence, can remain a credence characteristic.

Figure 1. Example of a screen as part of the study assessing the effect of wine critics' scores and sensory description in the online choice experiment.

The impact of the presence of a sensory description was analysed as described previously (Lockshin *et al.* 2009) by calculating how often a wine was chosen when it had a sensory description compared with when it had none. If a sensory description has a positive influence on choice then wines should be consistently chosen more often with a taste description than with no description. On average over all six wines, the presence of a taste description increased choice by 7.4%. As might be expected, the increase in choice was not the same for all six wines but was found to be always positive and varied between 3.9% and 15.1%.

Figure 2. Example of quality star ratings in the online choice experiment with simulated wine bottles.

Further research is necessary to better understand what caused this differential impact on choice. At this stage, we cannot say what the relative contribution of each of the possible aspects of a description is. It might be related to the content and wording of the sensory description; the wine with its unique combination of brand, region and packaging; or the price of the wine. All these variables will have to be combined independently in a new choice experiment to disentangle their individual influences from each other.

There are indications that the wording of sensory descriptions used in the marketplace can be improved to be more understandable by consumers. In a recent study, more than a quarter of Australian wine consumers stated that they find it hard to identify flavours indicated on wine back labels when they tasted the wine (Mueller *et al.* 2009). Non-expert consumers have previously been found to be best able to match wines to short instead of long sensory descriptions (Hughson and Boakes 2002). Non-experts are also better able to match wines to concrete flavour descriptions made by experts than to their own abstract descriptions (Lawless 1984). But, despite the fact consumers might find simpler taste descriptions easier to understand, it seems to be the case that they find elaborate taste descriptions more appealing when choosing a wine. In the study by Mueller *et al.* (2009) an elaborate taste description on the back label had, on average, a more positive influence on choice than a simple taste description. More research is required into the optimal translation between the inherent sensory characteristics of a wine and consumer understanding and appeal.

WINE CRITICS' SCORES

Wine quality ratings are not widely used in the Australian wine retail market to assist consumer purchase, and there is not such a clear single critic's influence on the Australian scene compared with markets such as the US, where Robert Parker or the *Wine Spectator* are very influential. As there are a number of different sources of opinions in Australia, we were not only interested in the effect of lower or higher critics' scores but also in the effect of the degree of agreement among several critics.

On the 'shelf talker' of the choice experiment, we displayed three

	Increase in choice (%)	
	Low average rating	High average rating
High agreement	1.9%	9.8%
	(85, 83, 87)	(90, 88, 92)
Low agreement	5.9%	7.2%
	(85, 75, 95)	(90, 85, 95)

Table 1. Relative impact of wine critic's point ratings with high and low average and different degrees of agreement between the critics (ratings are shown in brackets).

hypothetical ratings: one indicated to be from Kemenys, one from Vintage Cellars and one from *Winestate* magazine, with a maximum of 100 points each (see Figure 1). The ratings varied in both their average score (the low average was 85 points and the high one 90 points) and in the degree of agreement between the three scores (low and high agreement), resulting in four conditions in total.

Table 1 summarises the average impact of the four rating conditions on relative wine choice. For a low wine rating, where all three sources highly agreed with each other, the impact was, as expected, low (1.9%). Not surprisingly, the condition in which all three rating sources agreed on a high rating had the highest impact, with an average increase in relative choice of 9.8%.

One could expect that disagreement between the three scores would signal to the consumers a higher risk. We would then expect ratings with a high variation to have a lower impact on choice than those with lower variance at the same average level. We found that the effect of disagreement differs for the low and high average rating conditions. As expected, the strongly deviating rating scores on the high average had a somewhat lower impact on choice (7.2%) than those agreeing on the same high average (9.8%). Interestingly, if wine raters disagreed on the quality rating of the wines at the lower average level, then consumers seem to be more influenced by the single high score of 95 and hardly consider the very low score.

At this stage, we can conclude that high expert wine ratings indeed have a positive impact on consumer choice. For the highest influence on consumer choice, retailers should consider picking the highest score available from different expert ratings and only show several ratings when they agree on a high value (e.g. above 90 points).

STAR RATINGS

With thousands of wines available in Australia, only a relatively small group are rated by external wine experts. However, a retailer could develop its own quality rating system. To investigate the effect of such a retailer-specific system, we integrated a five-star quality rating into the shelf choice experiment with simulated wine bottles (see Figure 3). Before the experiment, respondents were informed about the definition of the quality ratings, from no star to a maximum of five stars for an outstanding wine. Half of all wines in the experiment had no star rating (blank) while 12.5% showed either one, two, four or five stars as a quality rating.

As shown in Figure 4, while a wine without any star was chosen 21% of the time, a wine that had a five star rating was chosen 38.6% of the times it appeared. Keeping all other attributes constant, the relative impact on choice from having no rating to a five-star rating was therefore 17.6%. This equates to about a 3.5% increase in relative choice per incremental star.

As discussed in more detail in our previous article, choice models allow wine marketers to assess how consumers trade off attributes against each other. An attribute beneficial to consumers, such as a quality rating, could be compensated by an attribute that is less preferred, such as a higher price. While adding a beneficial attribute at a constant price would increase the likelihood of the wine being chosen (i.e. more volume sold) a producer could also consider raising the price by a certain amount. One might also assume that a wine that aims to achieve a five-star rating is more expensive in its production than an average commercial wine. Taking into account the relative choice impact of price, where a decrease of choice by

Rating	Definition
blank	unrated
*	an average commercial wine
**	a commercial wine with above average flavour
***	a well-made fine wine, acceptable for many occasions
****	an excellent wine showing good flavour, structure and balance
*****	an outstanding wine, exceeding most others of its type

Figure 3. Definition of star ratings as used in the experiment.

10.7% was found for an increase from $7.99 to $22.99 as shown in Lockshin *et al.* (2009), a producer could potentially raise a wine's price by about $6 if the star rating is increased from four to five stars. Similarly, an additional star from three to four might justify a price increase by about $4.

INDUSTRY IMPLICATIONS

We found a positive influence on wine choice for all information display types included in the retail shelf simulations. The effects found for the real bottle and the graphical simulated bottle experiments are not exactly comparable, but the overall effect of star ratings was the strongest with a 17.6% increase in choice between no star and five stars, an average of 3.5% per star. Quality ratings in the form of a star seem to be especially suitable as aids to decision-making, presumably as they may be more intuitive and do not require extensive cognitive processing. The presence of sensory descriptions had an average effect of 7.4%, which had a similar impact as found for wine show medals (no medal to Gold and Trophy) with 7.6% (Lockshin *et al.* 2009, Figure 4) and wine critics' scores (7-10%).

In these experiments, respondents were asked to choose a wine for a dinner with friends or family where there is some degree of social risk present. Results for other purchase occasions are likely to be different. For very special occasions, like a formal dinner or giving wine as a gift, we would expect medals and expert ratings on objective quality to be even more important than measured here. On the other hand, they are likely to be less important for everyday consumption or for drinking wine by oneself.

Our results also present a snapshot in time; the effects of medals, stars and scores will be reduced if they are overused or wrongly used and lose their credibility. For quality signals to keep their value they must be used sparingly and consistently to signal high perceived quality. We expect that meaningful and understandable sensory descriptions do reduce purchase risk and, if used wisely, can induce consumers to trade up and try new unknown wines, therefore helping unknown brands to gain market share. More research is necessary to verify this effect.

SHOULD THE RETAILER PROVIDE CONSUMERS WITH MORE INFORMATION?

From what we found in our experiments, specific information to consumers at the retail outlet has a substantial effect on whether a wine will be selected for purchase. There are some industry voices who suggest that shelf talkers are a lazy form of retailing and that retailers should instead give consumers personal advice. While we clearly advocate a personal retailer consultation that can be tailored to a specific client's needs, we recommend complementing it with suitable shelf information. While some specialty stores might have a larger number of highly-educated staff, we doubt that the consumer-to-staff ratio and the quick turnover of most staff in liquor outlets would allow an extensive personal conversation with every customer. Nobody would recommend a car seller to not display the engine power, petrol consumption and extra equipment of a car on the information display just because a potential client could also personally ask the salesperson. Moreover, many consumers hesitate to ask for advice as they are afraid to reveal a lack of wine knowledge, and our previous research shows that most consumers want to make a quick decision in a minute or two at the most. Appropriate shelf information would help these consumers to make quicker and less risky (to them) choices.

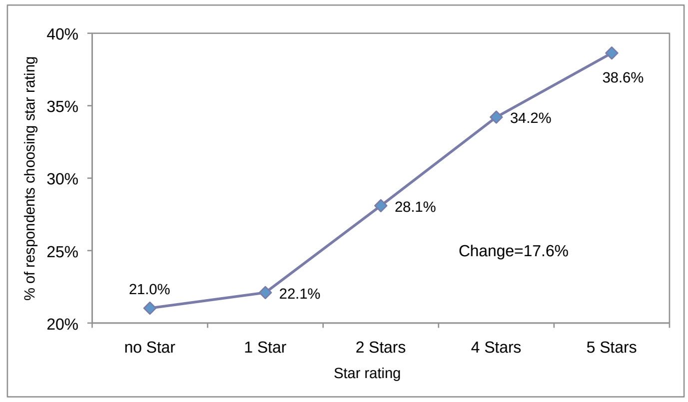


Figure 4. Impact of star ratings on relative choice.

We are not advocating putting control in the hands of a few wine critics. Instead, we suggest that wineries provide retailers with as much suitable information as possible to be used for marketing their wines by the retailers. These could be pre-produced taste descriptions and information on medals, wine critics' judgements, and show awards won by the wine. The star ratings were one example that showed that retailers could develop their own in-house rating and wine description system. These currently exist and are used by some retailers. In the long run, the consumer will honour the system that is the most useful to him or her with greater patronage.

The wine industry often declares that consumers need to be better educated without specifying the suitable means to do so. There is hardly any more frequented location for consumer information than the retail shelf. Retailers in other product categories, like Amazon, have set examples on how referencing systems - 'if you like this, then try that' - can be highly successful in inducing consumers to try new suitable products, trading up and reducing consumers' perceived risk at the same time. Once we better understand the preference drivers of different consumer segments then wineries and retailers can cross-reference their products for similarity and recommendations. This is just one potential form of consumer information.

We as an Australian industry should not miss the chance to meet the strong consumer need for lower perceived risk when buying wines in a crowded and confusing market, because we fear that information from particular sources might create a herd mentality. If we do not wish to provide consumers with what they want, then in the long term we create a window for those importers that are able and willing to do so, or even for other products to satisfy the same consumer needs.

FUTURE USE OF INFORMATION DISPLAY IN CHOICE SIMULATIONS

In this first proof of concept test of integrating information displays into the retail shelf choice method developed by our team, we focused only on a small subset of potential information sources and communication strategies that could be included in choice simulations. The relative impact of different promotional materials - neck hangers, environmental messages and even advertising movies (like in YouTube) - can be tested with retail shelf simulations. The method can be adapted to single wine producers, wine regions or the Australian wine industry. It can test consumers in Australia or in overseas markets.

In the next phase of our GWRDC-funded project we will apply and refine the method in two US markets. As part of this study, we will test the impact of hypothetical press articles to test the efficiency of different communication devices to influence consumer choice. As in the Australian experiment, we will test the impact of various types of shelf information on US consumers. The results of these experiments will be found on www.winepreferences.com at the end of this year.

ACKNOWLEDGEMENTS

This project was supported by Australia's grapegrowers and winemakers through their investment body the Grape and Wine Research and Development Corporation with matching funding from the Australian Government. We would also like to thank the members of the AWRI expert sensory panel. The members of our industry advisory group and the wineries providing us with photographs are sincerely thanked.

REFERENCES

Deliza, R. and MacFie H.J.H. (1996) The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: A review. Journal of Sensory Studies 11:103-128.

Deliza, R.; MacFie, H.J.H. and Hedderley D. (1996) Information affects consumer assessment of sweet and bitter solutions. Journal of Food Science 61:1080-1084.

Dodd, T.H.; Laverie, D.A.; Wilcox, J.f. and Duhan, D.F. (2005) Differential effects of experience, subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing. Journal of Hospitality and Tourism Research 29:3-19.

EBI Ehrenberg-Bass Institute for Marketing Science (2007) Understanding wine shoppers' purchase decision process and behaviour in store, unpublished research report.

Guinard, J.-X.; Uotani B. and Schlich P. (2001) Internal and external mapping of preferences for commercial lager beers: comparison of hedonic ratings by consumers blind versus with knowledge of brand and price. Food Quality and Preference 12:243-255.

Hall, J. and Lockshin, L. (2000) Using means-end chains for analysing occasions – not buyers. Australasian Marketing Journal 8(1):45-54.

Hughson, A.L. and Boakes, R.A. (2002) The knowing nose: the role of knowledge in wine expertise. Food Quality and Preference 13(7-8), 463-472.

Lange, C.; Martin, C.; Chabanet, C.; Combris, P. and Issanchou S. (2002) Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. Food Quality and Preference 13:597-608.

Lawless, H.T. (1984) Flavor description of white wine by 'expert' and nonexpert wine consumers. Journal of Food Science 40:120-123.

Lockshin, L.; Mueller, S.; Louviere, J.; Francis, L. and Osidacz, P. (2009) Development of a new method to measure how consumers choose wine. The Australian and New Zealand Wine Industry Journal 24 (2):35-40.

Lockshin, L.; Jarvis, W.; d'Hauteville, F. and Perrouty, J.-P. (2006) Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. Food Quality and Preference 17(3-4):166-178.

Mueller, S. (2004) The German wine law from an information economics perspective. International Journal of Wine Marketing 16:72-86.

Mueller, S.; Lockshin, L., Saltman, Y. and Blanford, J. (2009) Message on a bottle: the relative importance of wine back label information on choice, working paper University of South Australia.

Urban, G.L; Hauser, J.R.; Qualls, W.J.; Weinberg, B.D.; Bohlmann, J.D. and Chicos, R.A. (1997) Information acceleration: validation and lessons from the field. Journal of Marketing Research 34:143-153.

Can bottle weight be taken lightly for premium wines?

Simone Mueller[1], Haan Kweh[1], Larry Lockshin[1]

INTRODUCTION

Last year saw an intensive media discussion on the environmental benefits of lightweight bottles, but focussed mainly on the production side. We have seen no objective research on consumer evaluation of lightweight bottles, especially in the premium wine segment. Our study addresses the question of whether there are actual differences in bottles by price tier by analysing the height and weight of wine bottles in different price segments in the US market. This analysis provides wineries with insights about which bottle alternatives to consider for their premium wines targeted for the US wine market.

ENVIRONMENTAL ADVANTAGES OF LIGHTWEIGHT BOTTLES

There has been a trend of using heavier and larger bottles to differentiate product offerings and to create a perception of quality since the mid-1990s in the global wine industry (Corsey 2006). This development has been met by a range of concerns by wine critics, such as Jancis Robinson, and the WRAP initative in the UK, a program funded by the UK Government to help businesses and individuals cut waste and use resources more efficiently. For wine, where a glass bottle can weigh as much as its content, the potential to reduce packaging is particularly strong. Alternative packaging and lightweight bottles can significantly cut both the amount of raw materials used to produce wine packaging and the amount of glass that enters the waste stream, as well as associated carbon emissions from manufacturing and transportation.

While much attention has been given to the production and introduction of lightweight packaging for wine, little is known about how consumers react to it. Do consumers appreciate environmental benefits more than the reduced ability of heavy wine packaging to signal quality and value? Do companies have to make a decision between the environment and the consumer when determining the packaging of their wine? And, even more directly, what are the existing differences in packaging between wines at different price/quality points in the market? Is there a relationship between price and bottle size and weight?

[1]Ehrenberg-Bass Institute for Marketing Science, University of South Australia, PO Box 2471, Adelaide SA 5000, Australia. Email: Simone.Mueller@unisa.edu.au

THE PSYCHOLOGY OF LIGHTWEIGHT PACKAGING

Environmental benefits and claims are supposed to provide consumers with the cognitive benefit of caring for the environment when purchasing a wine. However, for this cognitive benefit to be perceived, it has to be consciously processed during purchase and consumption. This competes with the unconscious effects of visual packaging cues, which are very easily processed intuitively and about which consumers are usually unaware. Because wine is an experience good, the quality of which cannot be evaluated before consumption, consumers utilise label and packaging cues to infer quality and value at purchase. Psychological research has shown that product choices are strongly affected by subtle cues and that behaviour unfolds unconsciously as a result of the mere perception of cues such as product packaging (Dijksterhuis 2005). As these effects mostly occur outside of conscious awareness and are unrecognised by the decision maker, consumers cannot be asked about their effects directly.

Recent research by the University of South Australia's wine marketing group has shown wine consumers state that wine packaging is the least important cue for their wine choice when asked directly. However, if consumers choose from a simulated shelf of bottles that differ in their attributes, then packaging cues, such as label style and colour, turn out to be as important as price and less important than brand (Mueller *et al.* 2010). This means that studies that ask consumers directly about their acceptance of alternative packaging styles (such as mentioned in Goode 2008) should be interpreted cautiously as they can only reflect the influence of cues of which consumers are aware.

Our research and others show that consumers make choices based mainly on the unconscious processing of cues and direct questioning provides erroneous results.

Many wine marketers are conscious of the ability of premium packaging to communicate or justify to consumers why a wine is special and deserves a higher price. Accordingly, alternative packaging has to keep up to the standard set by traditional packaging. As one example, Uno Packaging designed its PET wine bottles narrower and taller to prevent the impression that it has less content than traditional glass bottles. An earlier article printed in the *Wine Industry Journal* long before the introduction of lightweight glass bottles highlighted the importance of bottle weight for consumers' wine quality perception (Corsey 2006).

It should be kept in mind that all luxury goods producers focus on extrinsic packaging attributes to communicate quality in an unconscious but obvious way. For years, subtle cues in cars have been optimised to reflect value and power, such as the roaring sound of the exhaust, the heavy weight of the car keys or the solid sound when shutting the doors. The cost perfume makers spend on the exclusive style and weight of flacons (specialised bottles) to create the perception of value and luxury is often higher than the content itself. It, therefore, can be suggested that the role of subtle wine packaging cues is more important for special occasions and the premium segment where perceived quality plays an important role. As far as we know, this has not been analysed.

METHOD AND ANALYSIS

As consumers cannot weigh up the importance of packaging cues they process unconsciously, an indirect method has to be used to understand the role of bottle weight and bottle height for purchase behaviour. One indirect way is to analyse past market transactions that reflect what consumers actually chose from the shelf. This kind of data has very high external validity as consumers paid for these purchases and were not influenced by any kind of social bias common in direct personal market research, such as surveys or interviews.

Most of the environmental debate over lightweight bottles originated in the UK, an important Australian export market that is currently in slight decline. The US is our second most important export market, which is still growing overall and has the potential to become the largest wine import market globally. Environmental awareness is growing in the US but its absolute level differs between the states. The US is one of the most conservative markets when it comes to wine packaging, for example, there is still a low penetration of screwcaps.

We selected 210 red wines based on AC Nielsen scanner data from Chicago in the price range of $10-$80 per bottle for a large GWRDC project (see www.winepreferences.com for other outcomes of this project). The AC Nielsen data contained the sales price (including price discounts) and units sold from August 2007 to July 2008 for each of the wines.

Table 1. Bottle weight and height for different price tiers of red wines in the US (n=208).

Price range in US$	Average weight in grams		Average height in mm	
<15$	567	a	307	a
$15-$20	594	a	305	a
$20-$30	590	a	307	a
>$30	656	b	313	b
All prices	590		307	

Different superscripts indicate significant differences in each column at p=0.05 (ANOVA Tukey post-hoc test).

The selected wines represent grape varieties that have the highest market share in the US: Cabernet Sauvignon, Merlot and Shiraz, but not Pinot Noir since Australia does not export much into the market. The wines were selected to cover representative countries of origins of these three grape varieties and blends in the Chicago market, and originate from the US, Australia, France, Argentina, Chile, South Africa, Italy and Spain. One bottle of each of the wines was shipped from Chicago to Adelaide for chemical analysis for the GWRDC project. This ensured that the bottles were representative of what is sold in the US, as some producers use different packaging for different markets. Two-hundred-and-eight empty wine bottles were weighed and their height measured. The lightest bottle was 415 grams while the heaviest weighed 891g. The smallest bottle measured 285 millimetres high and the tallest was 337mm.

FINDINGS

We found a moderate but significant positive relationship when relating the price of a wine to the weight of its bottle and the bottle height. The correlation between price and bottle height is 0.36 ($p<0.001$) and between price and bottle weight 0.22 ($p=0.002$). While these positive correlations could suggest that height and weight increase proportionally with the price of a wine, a more detailed analysis by price tier reveals a more complex picture.

Table 1 shows the average bottle weight and height we measured for four different price tiers. While wines below $15 have the lowest bottle weight, they are not significantly different in weight from the two next most expensive price brackets. Red wine bottles between $15 and $30 weigh an average of about 590g and are significantly lighter than wine bottles above $30, which average about 65g heavier. The same picture appears when we look at the height of wine bottles across different price tiers. While wines below $30 are on average about 307mm tall, wines in the premium segment above $30 stand out significantly to be 5mm taller.

While we find wines in the premium segment to be, on average, taller and heavier, these taller and heavier bottles do not sell more units when compared with smaller bottles at the same price. This means that heavier and taller wine bottles can generate a price premium, but consumers do not purchase them more frequently than smaller and lighter bottles.

CONCLUSION

In the US we found red wines in the premium segment above $30 to have a distinct usage of glass bottles that differs significantly from wines sold in lower price tiers. Wines in the price segment above $30 were in glass bottles that are on

Future research will determine if there is a relationship between price and bottle size and weight. Photo: Los Angeles International Wine & Spirits 2009 Competition

average taller and heavier. These results reflect that the market still uses weight and bottle height to differentiate the premium price segment of wine from lower price tiers. These findings confirm previous suggestions by WRAP (2007) that expensive food items, in this case premium wines, gain a premium image through heavier bottles. These expensive items are likely to be resistant to efforts to create lighter-weight versions.

When comparing the development of the bottle weight over time by looking at the bottle weight of different vintages we found no trend for a reduction in the bottle weight of red wine in the Chicago market; the bottle weight stayed almost constant since 2004. Instead, we even find a very small (insignificant) upward trend in bottle weight between 2004 and 2008. This indicates that lightweight bottles have not gained a strong penetration in the US market so far. At this stage, alternative wine packaging (BiB, pouches and PET) are gaining a foothold in the US market at lower and medium price levels that are used for everyday consumption and where extrinsic quality perception is likely to be less important than for special occasions.

While we do not suggest wineries increase bottle weights, our results suggest that at this stage wineries should be careful about changing their packaging to lightweight bottles in the US premium segment above $30. While lowering weights and heights might not be a problem for well-established wine brands, it is more risky for unknown brands just starting to build brand salience at these higher price points, where consumers depend more strongly on unconscious packaging cues. We also know through research by our wine marketing group and others, that environmental attributes are not very important in choosing wines. Lighter-weight and more environmentally-friendly packaging are important to retailers and to governments, but have low salience to the average wine consumer.

This recommendation should also be seen against a background of strongly increased competition in the US premium segment, which lost market share because consumers have traded down in the current economic situation (Brager 2009). Our research is limited by the fact that our sample comprised only 208 bottles that were sourced from one US market and only covered the three major grape varieties. Future research should analyse larger samples and also examine other export markets, such as the UK, to see if there is a higher acceptance of alternative wine packaging. This is the first objective research study we know of and sets a benchmark for comparison with later and more complete studies.

REFERENCES

Brager, D. (2009) Current US wine sales trends. Wine Business Monthly, 7 December, http://www.winebusiness.com/news/?go=getArticle&dataid=69632.

Corsey, L. (2006) Larger bottles increase perception of quality. Wine Industry Journal 21(1): 58-59.

Dijksterhuis, A.; Smith, P.K.; Van Baaren, R.B. and Wigboldus, D.H.J. (2005) The unconscious consumer: effects of environment on consumer behavior. Journal of Consumer Psychology 15: 193-202.

Goode, J. (2008) Alternative packaging. Meininger's Wine Business International 3(1): 28-35.

Mueller, S.; Lockshin, L. and Louviere, L. (2010) What you see may not be what you get: asking consumers what matters may not reflect what they choose. Marketing Letters, accepted for publication.

WRAP (2007) Lightweight glass containers: understanding consumer perceptions, case study, Waste and Resources Action Programme, www.wrap.org.uk/retail.

Message on a bottle: the relative influence of wine back label information on wine choice

Simone Mueller[1] and Larry Lockshin[1]

INTRODUCTION

The wine market presents the consumer with a vast array of products and product attributes to consider when making a purchase decision; there are thousands of brand names, dozens of grape varieties, regions, labels, wine styles and a large range of prices from which to choose. Thus, purchasing wine for various occasions is associated with a perception of risk, which often leads consumers to approach the purchase with a degree of fear, insecurity, scepticism and caution. This insecurity is increased if the wine is being bought for a special occasion (e.g., for a gift or a festive social dinner).

In order to choose a wine, consumers examine the product's attributes as part of a risk reduction strategy. Some of a wine's attributes, such as quality or sensory characteristics (taste), can only be assessed during consumption. Other attributes, such as brand name, awards, production procedures and cellaring advice, are found on the wine's front or back label and may assist consumers in evaluating the wine prior to purchase. Front labels convey (with some exceptions) the most essential and legally required information about the product: the winery's name, grape variety, grape origin, vintage year and alcohol content. The back label often describes the sensory characteristics of the wine, winemaker's notes and compatible meals for the specific style of wine. A wine's front and back label are the most cost-effective form of marketing promotion and an information source available for wine producers to communicate directly to their customers at the point of sale. It is, therefore, surprising that so little research has been conducted on what statements on the back label have the most influence on consumer purchasing.

The few studies conducted have shown that more than 50% of consumers say they read back labels and find them important in their decision-making (Charters *et al.* 1999) The research on wine back labels is limited mainly to small studies of narrow sets of attributes. Ten years ago, the *Wine Industry Journal* published a study that showed different back label statements created different perceptions of the wine's quality (Shaw and Hall 1999). Beyond these, the other studies only investigated one or two attributes, usually in the context of front and back labels. None of these studies were able to quantify the importance of different types of back label statements or test them against a consumer's actual wine choice, especially with different prices.

METHOD

We developed an experiment to test 10 different back label statements in a balanced design along with four different prices. A sample of 331 wine consumers was recruited in May 2008 for a wine tasting research project in North Sydney, and were given the back label experiment as a part of this project. The sociodemographics of the sample were similar to the general Australian wine consumer population, when compared with the Roy Morgan single source data of more than 50,000 Australian consumers.

The respondents were given a range of sociodemographic and wine consumption questions along with the experiment. They were asked to consider purchasing a wine for a special occasion, which represents approximately 25% of the purchase occasions in Australia (Hall and Lockshin 2000) and given a printed page with four different back labels and a price for a Shiraz wine. We used 10 different back label statements and four prices (Table 1, see page 33) in an

[1]Ehrenberg-Bass Institute for Marketing Science, University of South Australia, PO Box 2471, Adelaide SA 5000, Australia. Email: Simone.Mueller@unisa.edu.au

incomplete block experimental design. The 10 different statements were taken from previous research and from common back label statements. We added the one on ingredients, since this is under consideration in both Australia and the US. Each back label had between two and 10 of the statements. Respondents chose the wine they would be most likely to buy from 16 different sets of four labels, which allowed us to compute the effect of each of the statements and price on the probability of choice. Respondents were asked, "would you really purchase their choice?" to test the realism of the experiment. Eighty-seven percent said they would buy their choice.

Table 1. The statements and prices tested.

	Attribute	Actual statement or price used on the label
1	History	Family-owned for 75 years using our time-honoured methods to ensure unparalleled quality.
2	Grape source	All grapes sourced locally.
3	Production	Matured in French oak barrels for 12 months prior to bottling.
4	Simple taste	A full-bodied, red wine.
5	Elaborate taste	Displaying elements of dark chocolate, ripe plums, and fine chalky tannins.
6	Food pairing	Match with red meat, poultry dishes, and good Indian curries.
7	Consumption advice	Drink now, or with careful cellaring, enjoy in 5 to 6 years.
8	Environmental	This environmentally-conscious wine was produced using biodynamic techniques.
9	Website	For more information please visit www.barossawines.com.au
10	Ingredients	INGREDIENTS: grapes, sulphur dioxide, yeast, diammonium phosphate, bentonite, pectinolytic enzymes
11	Price	\$13.99, \$19.99, \$25.99, \$31.99

RESULTS

We used a latent class choice model to simultaneously create clusters and the utilities for each statement in each cluster. The best solution had the 331 respondents grouped into five different clusters, with strong differences in the importance of each of the statements and price across the clusters (Table 2).

Table 2. Importance of the attributes for each of the five segments and overall (importance in percent).

	C1	C2	C3	C4	C5	Total Sample
Segment size	31%	18%	20%	18%	13%	N=331
Price	88.1	31.3	80.1	69.4	33.2	65.9
Ingredients	-.6	-1.9	-.2	-4.3	-59.0	-9.0
History	.1	18.1	1.8	6.4	.0	4.8
Elaborate taste	2.4	7.9	.0	8.9	.3	3.8
Food pairing	6.1	1.6	4.7	.8	2.8	3.7
Production	.3	10.8	3.9	1.7	.0	3.1
Grape source	1.1	6.7	2.2	2.0	1.4	2.5
Environmental	.5	9.0	.6	1.5	1.8	2.4
Simple taste	.2	6.0	5.3	.2	.1	2.3
Consumption advice	.5	6.6	1.0	3.3	.1	2.1
Website	.0	.1	.1	1.5	1.2	.5

The final column in Table 2 shows the average value for the sample. Overall price accounts for 66% of the importance with the back label attributes accounting for the remaining 34%. Listing the 'ingredients' had the highest value, though with a negative influence on predicted choice, followed by history, food pairing, and the elaborate (or longer version) taste of the wine.

The segments differ substantially in the importance of price and the back label statements. The clusters are ordered from 1-5, with the lower numbers preferring lower prices and the higher numbers medium and higher prices. We can also see two clusters where price is dominant (C1 - low price; C3 - medium price) and the others where the back label statements have a larger affect. Perhaps the most interesting is C5, where ingredient labelling has a very large negative affect on the probability of purchase. The advent of ingredient labelling would certainly effect people in this segment. The lowest price segment (C1), which is about 31% of the sample, value food pairing and not much else. The next segment (C2) prefers wines at either $13.99 or $19.99 and strongly values information on the history of the winery, production methods, both the simple and elaborate taste descriptions. C3 prefers prices around $19.99 and is influenced a bit by simple taste descriptions and food pairing. Consumers in C4 choose prices around $25.99 for a gift or special occasion and value elaborate taste descriptions and history, but are negatively influenced by ingredient labelling.

Overall, those classes for which price is the predominant and almost only choice driver represent about half of the population (C1 and C3). About a third of frequent Australian wine consumers (C2 and C4) can be positively influenced by back label information, especially valuing history and elaborate taste descriptions. About a third of frequent Australian wine consumers are adversely affected by stating ingredients on the back label, with a small share of about 13% of consumers (C5) refusing to choose labels with them.

We compared each of the segments on a range of demographic (age, gender, income) and wine consumption behaviours and attitudes, but did not find any major differences between the groups. This is an interesting and quite important result. Typical marketing and wine marketing professionals use demographics and other easy-to-measure variables to segment the potential consumers for their products. We have now been using choice experiments for more than six years, and continue to find that demographics and attitudes do not predict how consumers choose wine. Consumers definitely use different strategies to make their wine choices, and our experimental results have strong correlations with actual sales in the market, so we believe wine marketers need to reconsider how they segment consumers.

As a result of this finding, producers cannot specifically target the five consumer segments by supplying different products to different sales channels. However, this study outlines certain combinations of wine attributes that are valued by certain groups of consumers. For instance, lower-priced wines should display information on food pairing and elaborate taste descriptions, which are of high utility for about a third of consumers (C1). A smaller share of about a fifth of consumers who value environmental back label attributes likes to read history and production method information as well as elaborate taste descriptions (C2). Wines sold at medium and higher price points are recommended to display food pairing, elaborate taste descriptions and winery history information on their back labels (C3 and C4). All of these additions had positive impacts on choice probabilities, and none would decrease the probability of choice.

The low importance of an environmental message is in congruence with findings by Remaud *et al.* (2008) who found only 15% of Australian wine consumers consider environmental claims when making a purchase decision for wine. Also here, it only has a notable impact for one consumer segment (C2). While almost all back label information had a positive impact on consumer choice, ingredient information had a strong negative effect for about one third of frequent Australian wine consumers. For a small segment of 13%, the negative impact on choice of 59% implies that a very positive attribute, such as a very low price, would have to compensate the substantive disutility from ingredient information. This strong aversion to the list of ingredients was surprising and its reasons cannot be explained completely by this study. It is possible that the mention of complex and unfamiliar ingredients creates a stronger feeling of risk or perhaps is incongruent with the overall image of wine as being natural and healthy.

These findings have important implications for a Government considering compulsory labelling of wine ingredients as recently supported by Australia's leading consumer organisation 'Choice' (Port 2008). The Government has to ensure that consumers are educated and informed about the meaning, risk and potential health impact of those ingredients and needs to find terms and language understandable to buyers. Otherwise, these information measures are likely to have an adverse impact by creating risk perceptions instead of reducing consumer uncertainty.

This study is preliminary and used only back labels and price. We know about half of consumers mainly use front labels in their wine choice decision, so these findings must be combined with a good understanding of front labels as well to be effective. We did find that except for ingredient labelling, these back label statements had either a positive or no effect, so using these results to fine-tune a back label is recommended. We were unable to measure the interactions of different statements over the total consumer sample, but our latent class choice modelling approach allowed us to find back label statement combinations on the segment level that are better than others. Back label statements are an inexpensive and efficient means for small and medium sized wineries to interact with their consumers and more attention should be paid to what is actually said on them.

REFERENCES

Charters, S.; Lockshin, L. and Unwin, T. (1999) Consumer responses to wine bottle back labels. Journal of Wine Research 10(3): 183-195.

Hall, J. and Lockshin, L. (2000) Using means-end chains for analysing occasions – not buyers. Australasian Marketing Journal 8(1): 45-54.

Port, J. (2008) Adding value: are we drinking Frankenstein wines? The Age, 11 November 2008.

Remaud, H.; Mueller, S.; Chvyl, P. and Lockshin, L. (2008) Do Australian wine consumers value organic wine. Proceedings of 4th International Conference of the Academy of Wine Business Research, Siena.

Shaw, M.; Keeghan, P. and Hall, J. (1999) Consumers judge wine by its label, study shows. Australian and New Zealand Wine Industry Journal 14(1): 84-87.

Part 3: Academic publications

1) Mueller, Lockshin, Louviere, Hackman (2007), Do respondents use extra information provided in online Best-Worst choice experiments?, Australian and New Zealand Marketing Academy Conference (ANZMAC), 3-5 December 2007, Dunedin, New Zealand

2) Mueller, Francis, Lockshin (2008), The relationship between wine liking, subjective and objective wine knowledge: Does it matter who is in your 'consumer' sample?, Proceedings of 4th International Conference of the Academy of Wine Business Research, Siena, 17-19 July, 2008.

3) Mueller, Lockshin, Louviere (2008), How important is wine packaging for consumes? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods, Proceedings of 4th International Conference of the Academy of Wine Business Research, Siena, 17-19 July, 2008.

4) Mueller, Francis, Lockshin (2008), Modelling consumer sensory preference heterogeneity – A case study on how the choice of clustering method impacts implications for optimal product design, 2nd Annual Meeting of the American Association of Wine Economics, Portland (OR), 15-16 August, 2008.

5) Mueller, S., Francis, L., Lockshin, L. (2009), Comparison of Best-Worst and Hedonic Scaling for the Measurement of Consumer Wine Preferences, Australian Journal of Grape and Wine Research, Vol. 15 (3), 205-215.

6) Mueller, S., Lockshin, L., Louviere, L. (2010): What you see may not be what you get: Asking consumers what matters may not reflect what they choose. Marketing Letters, published Online First.

7) Mueller, S., Lockshin, L., Saltman, Y., Blanford, J. (2010), Message on a bottle: The relative influence of wine back label information on wine choice, Food Quality and Preference, Vol. 21(1), 22-32.

8) Lockshin, L., Mueller, S., Louviere, J. (2010), The influence of shelf information on consumers' wine choice, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).

9) Mueller, S., Osidacz, P., Francis I.L., Lockshin, L. (2010), Combining discrete choice and informed sensory testing to measure extrinsic and intrinsic wine attributes, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).

10) Mueller, S., Szolnoki, G. (2010), Wine packaging and labelling - do they impact market price? A hedonic price analysis of US scanner data, 5th International Academy of Wine Business Research Conference 8-10 February 2010, Auckland (NZ).

Do Respondents use Extra Information Provided in Online Best-Worst Choice Experiments?

Simone Mueller, Larry Lockshin, University of South Australia, Adelaide
Jordan Louviere, David Hackman, University of Technology, Sydney

Abstract

An issue of interest to researchers is the amount of explanatory information one needs to give respondents making decisions in choice tasks. One way to resolve this issue is to let people select only relevant information from interactive information sources. This resolution poses unanswered questions: e.g., will respondents use the extra information, and potential systematic differences in information users and non-users. To shed some light on this issue, we let respondents access optional descriptive information about attributes in the form of partial (verbal) and full (verbal plus visual) glossaries associated with a Best-Worst (BW) web survey. Only a small minority with higher subjective product knowledge accessed the glossary information. We found no significant difference between verbal and visual information in attractiveness of use or impact on choice.

Keywords: choice, Best-Worst, information usage, verbal vs. visual information

Introduction

Web surveys provide researchers with a way to offer respondents optional information according to their needs and thereby giving them a higher degree of information control (Ariely 2000). Hoffman and Novak (1996) showed that decision makers' information needs are better satisfied when respondents have control over what information they want to choose according to their personal preferences. Providing respondents optional information also has the advantage that more knowledgeable respondents will not be overburdened with mandatory information with which they are already familiar (Malhotra 1982), and they can integrate it into their decisions (Payne 1982).

Bettman and Zins (1979) suggest that respondents are influenced by choice task format to which they adopt by adjusting the timing and accuracy of their responses. In turn, this suggests that optimal respondent accuracy is achieved by using optimal choice task formats, which is another way of saying that respondents become more variable (inconsistent) in their responses as one moves away from optimal format (Louviere and Eagle 2006). By providing optional descriptions of all product attributes, respondents theoretically can make fully informed decisions if they access the information provided. Yet, little is known about whether respondents actually will use optional information if it is offered in Best-Worst tasks. Best-Worst Scaling (BWS) has been found to be a useful way to measure consumer preferences without scale bias (Finn and Louviere, 1992; Cohen, 2003; Cohen and Neira, 2002), and it can produce ratio level scales for attribute importance or other latent dimensions (Marley and Louviere, 2005). BWS tasks require respondents to choose the most and least important attributes from several designed sets of three or more attributes. BWS is a relatively new measurement theory and methodology, hence a number of unresolved issue remain, such as whether and how much explanatory information should be provided to respondents, whether

such information should be mandatory or optional, and the impacts of such information of decisions on BWS choice outcomes.
Thus, a major unresolved research question is whether BWS respondents will use additional information and which type(s) of respondents will access it. Researchers can choose to provide respondents with verbal or graphical information, the latter being easier to process cognitively (Lurie and Mason, 2007). Thus, our research seeks to determine whether verbal and graphical information have different effects on respondent's choices in BWS tasks. Using data from a BWS web survey of 740 Australian wine consumers, we examine the effects of optional verbal and graphical information on information usage on choices in BWS tasks.

Propositions

Jarvenpaa (1989) showed there were lower cognitive costs and higher benefits for graphical relative to verbal information. Lohse (1997) showed that visual representations can enhance problem-solving capabilities without overloading decision makers; and Kosslyn (1994) discussed how humans have developed visual and spatial skills and better retrieve information with visual cues. Lurie and Mason (2007) compared the context of visual versus verbal information, which showed vividness, evaluability and framing increased with visual information; that is, "a picture is worth a thousands words".

Proposition 1: Respondents should favour graphical over verbal information as they can quickly process and comprehend graphical compared with verbal information. Louviere et al. (1987) showed that differences in information format preferences were largely due to what we now would call scaling or error variance differences (Swait and Louviere 1993). So, we would expect to see more use of graphical compared with verbal information sources, all else equal.

Proposition 2: Information users should be less knowledgeable about the product category than non-information users. Moore and Lehman (1980) showed that more experienced consumers require less pre-purchase information. Selnes and Howell (1999) observed that experts used less written extrinsic product information but relied more on sensory intrinsic product information for radio choice. Wu and Lin (2006) tracked frequency of information usage for choices in a computer based survey and found that product novices chose more information than product experts. Specifically for wine, Lockshin et al. (2006) showed that high involvement wine consumers chose wines differently than low involvement consumers, using more intrinsic attributes like region of origin instead of extrinsic ones like brand.
We are unaware of work investigating whether those who use more information have different attribute importances than those who do not. Proposition 2 leads us to expect that more involved and/or more knowledgeable respondents should access less information, and also should exhibit different attribute importances than non-users of information.

Proposition 3: Consumers, who access information, will have different importances for product characteristics than those, who do not access extra information.

Method

We used a web survey to collect data to test our propositions with a BWS task to measure the importance of 16 wine attributes. A complete list of attributes can be found in Figure 2. Attributes were chosen based on Lockshin et al. (2006) and Goodman et al. (2006). A

balanced incomplete block design (Raghavarao, 1988) was used to create 24 sets of six wine attributes, and in each set respondents chose their most and least important attributes for choosing wines. A webpanel provider recruited 740 people, randomly assigning them to three conditions: 1) no additional information (245); 2) partial glossary that verbally described each attribute (243); and 3) full glossary with verbal descriptions and a photograph (see Figure 1 for characteristic bottle shape) for nine of the 16 attributes (252).
Seven of 16 attributes (eg, alcohol level, region of origin) could not be visually described, so were had only verbal descriptions in the full glossary condition. At the beginning of the survey respondents were shown how to access glossary information via a hyperlink associated with each attribute. We tracked each person's glossary information use for each attribute.

Figure 1 Survey with opened full information glossary for bottle shape

Results

We first evaluated how often respondents accessed information in the partial and full glossary conditions. The results in Table 1 show that a very large majority (79% in the partial and 77% in the full) did not use any optional information to respond to the BWS task. Of the 21% and 23% who used extra information, only 14.9% and 19.5% accessed more than one attribute description in the partial and full glossary conditions, respectively.

Table 1 Information usage of Partial and Full Glossary

	Partial glossary		Full glossary	
	n=243		n=252	
No information access	187	79%	198	77%
Information access	56	21%	54	23%
Number of info accessed				
1	16	6.6%	9	3.6%
2	22	9.0%	18	7.1%
3	3	1.2%	10	4.0%
4	7	2.9%	7	2.8%
5	3	1.2%	5	2.0%
6	0	0.0%	2	0.8%
7	1	0.4%	1	0.4%
8	1	0.4%	0	0.0%
9	2	0.8%	0	0.0%
10	1	0.4%	2	0.8%

Despite a seemingly higher multiple access percentage for the full glossary, a χ^2 test of the difference between the information usage distributions shows no significant difference (df=10, χ^2=15.15, p=0.13) in the two conditions.
Figure 2 shows information use, but differentiates between attributes shown as photographs or only verbally. Capsule and closure material were the most accessed attributes, accessed by almost 20% of respondents. This may be because the remaining attributes were known to the respondents, so they needed no further explanation. Again, a χ^2-test showed no significant difference between verbal and visual glossary conditions (DF=8, χ^2=7.10, p=0.53).
To test information access, we treated whether or not any glossary information was accessed as a dependent variable in a binary logistic regression with glossary condition (partial or full information), attribute B-W scores, respondent wine behaviour related and sociodemographic measures as independent variables.

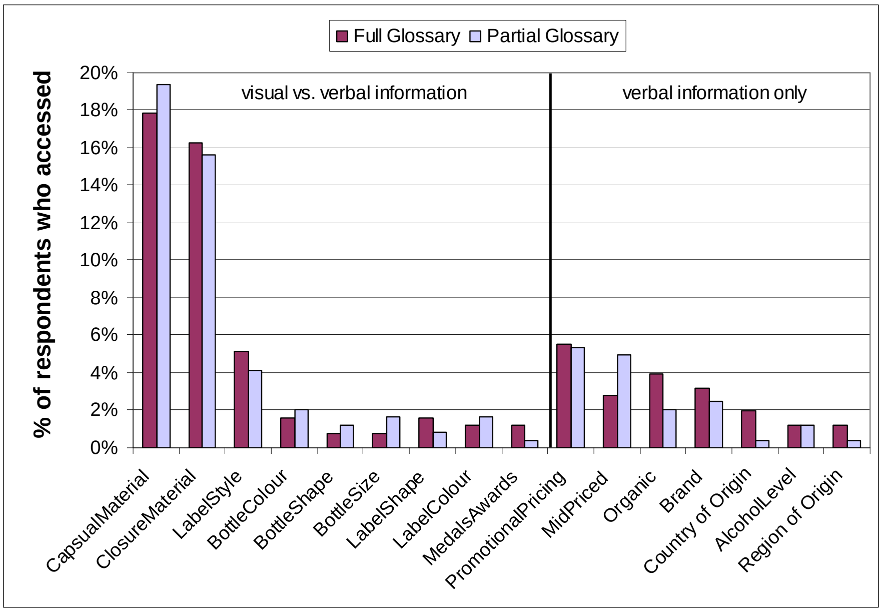


Figure 2 Information Access by Wine Attribute for Partial and Full Glossary

Estimates of the significant variables in the binary logistic regression are shown in Table 2. The glossary condition was not significant, implying that respondents' information choices were not influenced by presentation mode. This result accords with the previous two χ^2-tests, which taken together do not support Proposition 1, namely that respondents should favour graphical over verbal information in the BW task.

Table 2 Statistical Results of the Binary Logistic Regression

	B	S.E.	Wald	Sig.
Subjective wine knowledge	0.23	0.09	7.31	0.01
Wine usage special occasion	0.39	0.21	3.53	0.06
Wine usage fine dining	-0.54	0.20	7.45	0.01
Read back label technical info	0.30	0.14	4.48	0.03
Capsule	-0.29	0.06	23.72	0.00
Alcohol level	-0.09	0.04	4.18	0.04
Brand	0.10	0.05	3.82	0.05
Constant	-4.52	0.89	25.76	0.00

(χ^2=64.20, -2LL=394.88, Nagelke R Square 0.21)

We now test whether respondents who accessed any glossary information differ from those who did not. Only four of the 16 wine choice attributes exhibited a significant difference between information users and non-users. Specifically, respondents with more subjective wine knowledge were more likely to access optional glossary information as did those who reported more frequent reading of technical information on back labels. These differences suggest that glossary information users have higher product knowledge and show interest in other specific wine information. This departs from Proposition 2 that suggested that low knowledge consumers would use optional information.

We found two opposing effects for wine consumption situations: a) those who reported higher levels of drinking wine on special occasions were more likely to access glossary information, but b) those who reported higher levels of wine consumption in fine dining restaurants were less likely to use optional information. Contrary to our expectations in Proposition 2, we could not find significant differences in wine involvement in the use of information in our BWS tasks. Sociodemographic variables also were not significantly related to information choices, which is consistent with Lockshin et al. (2006).

Referring to Proposition 3, the results in Table 2 show significant differences for only three of 16 attributes. That is, information users had lower BW scores for capsule and alcohol level and higher scores for brand, contrary to our expectations. The respondents self-selected into information users and non-users, so these preference differences cannot be attributed to information usage. As far as we know, capsule importance has not been studied before, but as respondents accessed it most often (Figure 2), and it likely is less well-known to them as a wine attribute, the measured importance difference probably was at least partly impacted by the glossary information.

Conclusion and Implications

Previous consumer behaviour research suggests that consumers use heuristics to make decisions, and are cognitive misers who tend not to access extra information that might improve their decisions. A key result in our research is that this seems also be true for online wine survey respondents, who could easily access additional information. Most interestingly, we found that those with higher self-assessed wine knowledge were more likely to access information. One implication of this is that if researchers want information to impact people's decisions, it probably should be mandatory for all respondents; otherwise, the probability that respondents will access is low. We found no difference in the impacts of verbal and graphical information on BWS choices, which implies that researchers may not need to create visual images for well-know choice alternatives, although we believe this conclusion is premature.

Future Research and Limitations

There is need for future research on the impact of information in both online and offline surveys. A major limitation of our research is the implication of self-selection, which does not allow us to separate the impact effects of information and the differences of underlying preferences of information users and non-users.

References

Ariely, D., 2000. Controlling the Information Flow: Effects on Consumer's Decision Making and Preferences, Journal of Consumer Research, 27, 233-248.

Bettman, J., Zins, M., 1979. Information Format and Choice Task Effects in Decision Making, Journal of Consumer Research, 6, 141-153.

Cohen, S. H., 2003. Maximum Difference Scaling: Improved Measures of Importance and Preference for Segmentation, Sawtooth Software Conference Proceedings, Sequim, WA.

Cohen, S. H., Neira, L., 2003. Measuring Preference for Product Benefits across Countries: Overcoming Scale Usage Bias with Maximum Difference Scaling, ESOMAR 2003 Latin America Conference Proceedings. Amsterdam: The Netherlands.

Finn, A., Louviere, J.J., 1992. "Determining the Appropriate Response to Evidence of Public Concerns: the Case of Food Safety", Journal of Public Policy and Marketing, 11(1), 12-25.

Goodman, S., Lockshin, L., Cohen, E., 2006. "Using the Best-Worst Method to Examine Market Segments and Identify Different Influences of Consumer Choice", 3rd International Wine Marketing Research Conference, ed. F. d'Hauteville, Montpellier, France. CD-ROM.

Hoffman, D., Novak, T. P., 1996. Marketing in Hypermedia Computer-mediated Environments: Conceptual Foundations, Journal of Marketing, 60, 50-68.

Jarvenpaa, S., 1989. The Effect of Task Demands and Graphical Format on Information Procession Strategies, Management Science, 35(3), 285-303.

Kosslyn, S. M., 1994. Elements of Graph Design, New York, W.H. Freeman.

Lockshin, L., Jarvis, W., D'Hauteville, F., Perrouty, J., 2006. Using Simulations from Discrete Choice Experiments to Measure Consumer Sensitivity to Brand, Region, Price, and Awards in Wine Choice', Food Quality and Preference, 17, 166-178.

Louviere, J.J., Anderson, D.A., Woodworth, G.G., Louviere, C. H., 1987. Do the Parameters of Choice Models Depend on Differences in Stimulus Presentation: Verbal vs. Visual Presentation?, Advances in Consumer Research, 14, 79-82.

Louviere, J.J., Eagle, T., 2006. "Confound It! That Pesky Little Scale Constant Messes Up Our Convenient Assumptions," Proceedings, 2006 Sawtooth Software Conference, 211-228, Sawtooth Software, Sequem, Washington, USA.

Lohse, G. L., 1997. The Role of Working Memory on Graphical Information Processing, Behaviour and Information Technology, 16(6), 297-308.

Lurie, N., Mason, C. H., 2007. Visual Representation: Implication for Decision Making, Journal of Marketing, 71, 160-177.

Malhotra, N. K., 1982. Information Load and Consumer Decision Making, Journal of Consumer Research, 8, 419-430.

Marley, A. A. J., Louviere, J. J., 2005. Some Probabilistic Models of Best, Worst, and Best-Worst Choices, Journal of Mathematical Psychology 49, 464-480.

Moore, W. L., Lehmann, D. R., 1980. Individual Differences in Search Behavior for a Nondurable, Journal of Consumer Research, 7, 296-307.

Payne, J. W., 1982. Contingent Decision Behavior, Psychological Bulletin, 92(2), 382-402.

Raghavarao, D., 1988. Constructions and Combinatorial Problems in Design of Experiments, New York: Dover.

Selnes, F., Howell, R., 1999. The Effect of Product Expertise on Decision Making and Search for Written and Sensory Information, Advances in Consumer Research, 26(1), 80-89.

Swait, J., Louviere, J. J., 1993. The Role of the Scale Parameter in the Estimation and Comparison of Multinominal Logit Models, Journal of Marketing Research, 30, 305-14.

Wu, L.-L., Lin, J.-Y., 2006. The Quality of Consumers' Decision-Making in the Environment of E-commerce, Psychology & Marketing, 23(4), 297-311.

The relationship between wine liking, subjective and objective wine knowledge:

Does it matter who is in your 'consumer' sample?

Dr Simone Mueller
Research Fellow Wine Marketing
Ehrenberg-Bass Institute for Marketing Science, University of South Australia
GPO Box 2471 Adelaide, South Australia 5001
Telephone: (61 8) 8302 0906
Facsimile: (61 8) 8302 0442
Email: simone.mueller@unisa.edu.au

Dr Leigh Francis
Research Manager - Sensory
The Australian Wine Research Institute
PO Box 197 Glen Osmond, South Australia 5064
Telephone: (61 8) 8303 6631
Facsimile: (61 8) 8303 6601
Email: leigh.francis@awri.com.au

Prof Larry Lockshin
Professor of Wine Marketing
Ehrenberg-Bass Institute for Marketing Science, University of South Australia
GPO Box 2471 Adelaide, South Australia 5001
Telephone: (61 8) 8302 0261
Facsimile: (61 8) 8302 0442
Email: larry.lockshin@unisa.edu.au

The relationship between wine liking, subjective and objective wine knowledge:

Does it matter who is in your 'consumer' sample?

Abstract

It is relatively common in empirical academic research to use samples of students, or nearby institute or campus-related respondents. Results obtained in this way are often assumed to be generally valid and to represent the behaviour of normal consumers. Researchers very rarely examine if and to what extent conclusions drawn from these convenience samples deviate from a representative random sample. We analyse to what extent the relationship between wine expertise and sensory wine preferences is influenced by the sampling method. Our sample consisted of respondents from a consumer panel, who can be assumed to be closely representative for Australian frequent red wine consumers, and respondents from the agricultural research institutions of the Adelaide Waite Campus. Our results indicate that both sub-samples not only deviate in their sociodemographic characteristics, but much more importantly in their wine consumption behaviour. Campus related respondents have a significantly higher objective but lower subjective wine knowledge than normal consumers. More importantly the two samples also differ in their sensory preferences for red wine. Our findings are relevant for researchers who aim to analyse the behaviour of normal wine consumers. It must strongly be questioned that valid conclusions regarding structural relationships such as segmentation for wine consumers in general can be drawn from samples, which include a significant share of non-representative consumers, such as research staff and higher education related respondents.

Keywords: wine, subjective knowledge, objective knowledge, hedonic evaluation, sensory preference, segmentation, sampling, representativeness

Introduction

Wine experts are different from wine consumers with less wine knowledge. An increasing body of research has shown that wine experts not only like different wines than wine novices (Ballester, Patris, Symoneaux, & Valentin, 2008) but also use different selection criteria when making a purchase decision (Dodd, Laverie, Wilcox, & Duhan, 2005; Johnson & Bastian, 2007; Lockshin, Jarvis, d'Hauteville, & Perrouty, 2006). More insights into which sensory profiles wine consumers with different knowledge level prefer and how wine has to be communicated to them would help the wine industry to better target specific consumer segments with tailor made products.

But which type of expertise is more relevant to discriminate different consumer segments, a consumer's perceived degree of expertise or his true level of knowledge? Initial studies revealed that a consumer's perceived expertise (subjective knowledge) does not necessarily agree with the knowledge a consumer really has (objective knowledge) (Veale & Quester, 2007). By now, there is only limited insight into which of both wine knowledge constructs better relates to wine preference differences. Should market researchers use both objective and subjective knowledge in their survey instruments or is one sufficient to find relevant consumer segments?

One caveat of prior studies analysing the effect of wine knowledge on wine behaviour is their predominant use of convenience samples, including at least significant shares of students or employees in wine research institutions. From these samples conclusions were drawn for general wine consumers without testing their validity. Can previous findings on the differences between wine experts and wine novices safely be generalised to normal wine consumers or are their results biased by their sample selection? Specifically, we will analyse if the relationship between subjective and objective is influenced by which respondents are selected as experiment participants. Furthermore we will examine if sensory wine preferences of students and research employees, typically used in convenience samples, deviate from those of normal consumers.

To answer our research questions we conducted a red wine tasting with a sample consisting of two sub-samples: representative red wine consumers recruited from a consumer panel and students and employees from wine institutions of the Adelaide Waite Campus. Besides the sensory wine evaluation we also surveyed their objective and subjective knowledge as well as wine behaviour characteristics.

In the following section we will review previous findings on the importance of product knowledge in general and on observed differences of wine behaviour between wine experts and less knowledgeable wine consumers. We also review the composition of samples used in previous studies. After deriving our research propositions we describe our research method applied to measure respondents liking for eight designed red wines and to measure their wine knowledge. Afterwards we analysed for which sociodemographic and wine behaviour characteristics both subsamples deviate from each other. Further on we examine how those differences affect the relationship between subjective and objective wine knowledge as well as the sensory liking of wine. We conclude with a discussion and research implications of our findings.

Literature review

Importance of product knowledge in general

It has long been recognised that consumer product knowledge plays an important role in consumer decision making, influencing information search, product evaluation, and processing (Bettman & Park, 1980; Brucks, 1985; Rao & Monroe, 1988; Sujan, 1985). The concept of consumer knowledge is defined as the extent of experience and familiarity that one has with a product (Alba & Hutchinson, 1987; Alba, 2000). Objective knowledge and subjective knowledge are interrelated, yet distinct components of consumer knowledge (Raju, Lonial & Mangold, 1995).

Objective knowledge is the actual content and organisation of knowledge held in memory. This can include terminology, product attributes, attribute evaluations, brand facts, purchasing, and decision procedures (Brucks, 1986). On the other hand, subjective knowledge is the consumer's perceived level of expertise and self-confidence in his/her decision making ability, also called 'self-assessed' level of knowledge. Subjective knowledge has been found to be an important part of the knowledge construct because it influences the decision-maker's perception of their ability to process information and which information they search and process (Moorman, Diehl, Brinberg, & Kidwell, 2004). Empirical evidence established that most consumers do not possess the level of objective knowledge they believe they do (Alba, 2000; Heimbach, Johansson, & MacLachlan, 1989). Objective and subjective knowledge have been found to be closely related to product interest or involvement (Park & Lessig, 1981).

The nature of wine knowledge

There is strong agreement that wine experts are better than novices at discriminating between, recognising, and describing wines (Lawless, 1984). But there is no consent yet, if this ability of experts is caused by superior sensory ability or by more effective perceptual encoding (see Hughson and Boakes, 2002 for a review). Some studies like Parr, Heatherbell, & White (2002) and Parr, White, & Heatherbell (2004) state that superior perceptual skills rather than enhanced semantic and odour recognition memory structures are responsible for experts' superior performance. Others, like Ballester, Patris, Symoneaux, & Valentin, (2008) and Hughson & Boakes (2002) conclude that wine expertise is a cognitive rather than a perceptual superior skill. According to Hughson & Boakes (2002) experts and novices perform differently in describing wines because novices lack the vocabulary and the knowledge of varietal types that experts employ in such tasks. Similarly, Ballester et al. (2008) found wine experts to have developed separate cognitive sensory concepts through product experience in successive wine tastings, which influences their hedonic evaluation of wines.

Importance of wine knowledge for purchase behaviour

Several studies have shown that wine purchase behaviour is influenced by wine expertise (Dodd, Laverie, Wilcox, & Duhan, 2005; Frøst & Noble, 2002; Johnson & Bastian, 2007). According to Dodd *et al.* (2005) the level of subjective and objective wine knowledge influences which information sources wine consumers consider before making a wine purchase. For example, consumers with high objective wine knowledge use more impersonal information such as wine guides and wine reviews, while consumers with higher subjective wine knowledge rely more on their own preferences formed in previous experiences. Based on consumers' objective wine knowledge Johnson & Bastian (2007) derived three distinct consumer clusters which were found to differ in the degree of their risk aversion and risk reductions strategies they applied when purchasing wine. While Ballester et al. (2008) shows that wine experts and novices like different wine styles, Frøst & Noble (2002) could not clearly confirm a clear relationship between liking for wine and wine expertise.

Sample usage

These prior research studies analysing the importance of wine knowledge for consumer differences in purchase behaviour and sensory wine preferences mostly relied on convenience samples from their local university or institute populations. Nevertheless, none of those studies tested whether their findings are also valid for wine consumers in general. Convenience samples are suitable to analyse if any difference between consumers with high and low wine knowledge exists at all. But they do not give valid information about the effect size of this difference for consumers in general. Most importantly, structural relationships between different variables as analysed by segmentation analysis of convenience samples can not be assumed to be valid in general, if the sample composition deviates strongly from the population of all wine consumers.

Hughson & Boakes (2001, 2002) mainly used undergraduate psychology students and some wine experts to analyse psychological differences between wine novices and experts. Subscribers of wine accessories magazines utilised by Dodd *et al.* (2005) can safely be assumed to be more wine involved and knowledgeable than normal wine consumers. In Frøst & Noble (2002) close to a third of the sample either were students of oenology or had a wine related profession. Almost half the participants used by Johnson & Bastian (2007) (27 out of

61), to find consumer clusters 'typical' for Australia, were students and employees from the Adelaide Waite Campus, where mainly agriculture and wine research institutes are located. The validity of those clusters has to be questioned if strong differences between representative wine consumers and campus respondents can be found.

Research Propositions

These previous studies each claim to find some useful measures of 'wine consumers', but did not take into account the source of their participants. Drawing from the discussion of prior findings we will analyse the following research propositions:

1) Samples which include students of wine-related university programs or wine/agricultural research institute employees are not representative of average wine consumers.

2) Consumers with high and low wine knowledge differ in their sensory wine preferences.

3) Subjective and objective wine knowledge are interdependent, but the strength of their relationship is affected by the recruitment of the sample.

Research Method

Subjects

One hundred and twelve consumers participated in a larger sensory study comparing two sensory methods to measure wine liking, where they also completed a self-administered survey including questions regarding their wine behaviour and sociodemographics. Participants were required to consume red wine at least once a month and to have purchased a bottle of red wine within the last month. With these qualification criteria we targeted regular red wine drinkers, who based on their regular experience, can be assumed to have developed distinct sensory preferences for red wine. Furthermore we excluded those Australian wine consumers who exclusively drink cask wine.

The majority of respondents (62%) were recruited via a national commercial consumer panel provider, PureProfile, which has more than 420,000 Australian members. The panel is actively managed to be representative for Australian consumers in general. Despite sampling aimed to be representative for the Adelaide metropolitan area regular red wine consumers not exclusively drinking cask wine, the willingness to participate in a tasting at a certain location is nevertheless biased by self-selection. Usually consumers with higher wine involvement living or working close to the tasting location are more likely to agree to participate and thus are overrepresented in the sample.

The remaining forty-three participants (38% of the sample) were recruited from the Adelaide Waite Agricultural Campus after fulfilling the same qualification criteria. Furthermore, campus respondents were selected to be easily available during the afternoon tasting and should not have been involved in wine tasting studies previously in order to resemble sensory preferences of 'normal' consumers as closely as possible. None of the campus subsample was formally trained in sensory methods or a member of a sensory panel. The 'campus' respondents were either employees of agricultural research related institutions such as

CSIRO, SARDI, and the Australian Wine Research Institute or students in viticulture and oenology at the University of Adelaide.

Measuring subjective and objective wine knowledge

We measured subjective wine knowledge (Perrouty, d'Hauteville & Lockshin 2006) with two items on a 5-point scale, which had a satisfactory reliability indicated by a Cronbach's alpha of 0.78 (see Table 1). Contrary to other studies on objective wine knowledge, we only measured the cognitive dimension but not respondent's sensory perception and verbalisation ability (Frøst & Noble, 2002; Johnson & Bastian, 2007).

Grape variety and wine region have been shown to be of the highest relevance for Australian wine consumers' purchase decisions next to brand and wine packaging (Goodman, Lockshin & Cohen, 2007; Mueller & Lockshin, 2008). Thus, we used an unaided elicitation of grape varieties and Australian wine regions to measure respondents' objective wine knowledge. We deviated from multiple choice questionnaire instruments used by Frøst & Noble (2002), Johnson & Bastian (2007) and Veale & Quester (2007), which asked respondents mainly viticultural and oenological knowledge and overseas' (e.g. French) wine growing regions and grape varieties. Because the majority of Australian wine consumers still mainly purchases domestic wines, objective knowledge of overseas wine regions is assumed to be only partially relevant for their purchase decision. A Cronbach's alpha of 0.82 signals a high reliability of the objective knowledge measures.

For the measurement of wine involvement we used a three item scale applied in several empirical studies before (Lockshin, Spawton & Macintosh, 1997) which has proven to be repeatedly reliable.

Table 1: Reliability of wine knowledge and wine involvement scales

Scale Items	Cronbach's alpha
subjective wine knowledge (5-point scale) I know more about wine than many other people I would describe myself as being very knowledgeable about wine	0.78
objective wine knowledge Number of correctly named grape varieties Number of correctly named Australian wine regions	0.82
wine involvement (5-point scale) I have a strong interest in wine Wine is important to me in my lifestyle Drinking wine gives me pleasure	0.80

Measuring hedonic liking of wine

For the hedonic measurement of wine liking we concentrated on three sensory components, which have been shown to be of high importance for consumers. Brettanomyces has been found to be disliked by most consumers by (Bramley *et al.* 2007) and the Australian wine industry has undertaken major efforts to control and reduce wine infections by

Brettanomyces. Nevertheless, it is still unclear how consumer liking is affected when Brettanomyces interacts with other sensory components, such as oak flavour, which by itself is liked by many red wine consumers (Lattey, *et al.* 2007, Frøst & Noble, 2002). The alcohol content of wine has recently gained focus in the climate change and health debates. Australian red wines are internationally known for their higher alcohol content which is seen as potential threat to their acceptance in major export markets, such as the UK.

We designed eight wines, which were developed from a 2006 Cabernet Sauvignon base wine. Each wine was varied in a full factorial design across all three sensory attributes: oak flavour, alcohol, and Brettanomyces flavour with either high or low levels (chemical details can be found in Mueller, Francis and Lockshin, 2008). The major reason for using designed instead of commercial wines was to have closer control over the wines' flavours and to allow investigation of these important attributes on consumer acceptance (Hersleth, Mevik, Naes & Guinard 2003). The full factorial design allows the estimation of all two and three way interactions. A sensory descriptive analysis of the eight wines by judges of the Australian Wine Research Institute's trained wine panel revealed that most of the wines differed sufficiently in their sensory characteristics to be appropriate to be assessed in the consumer preference studies. Only two of the eight wines (Brett+oak and Brett+oak+alc) were relatively similar in their characteristics. The complete descriptive analysis and a discussion of the sensory properties of all eight wines can be found in Mueller, Francis and Lockshin (2007) and Bramley et al. (2007).

Wines were assessed in May and June 2007 in sensory booths at the Australian Wine Research Institute under controlled conditions (ISO 8589: 1988). Respondents evaluated sensory liking of the eight wines with a hedonic rating of the wines were monadically presented with five minutes rest in between each wine. Respondents indicated their liking on a structured nine point hedonic scale. The tasting design over all respondents was completely randomised to control for position and interaction effects; every wine appeared in each position the same number of times and each adjacent combination was equally distributed (Macfie, Bratchell, Greenhoff & Vallis, 1989). Water and crackers for mouth cleansing were available for respondents to reduce carry-over effects.

Analysis and Results

Differences between the subsamples

Roy Morgan single source data provide characteristics of the overall population of Australian red wine drinkers (first column in Table 2). Due to our qualification criteria excluding casual red wine drinkers and consumers only purchasing red cask wine, we can expect our sample to deviate slightly in their sociodemographic characteristics from red wine drinkers in the Roy Morgan sample. From previous research we know that regular Australian wine consumers not exclusively purchasing cask wine are younger, have a higher income and a higher education compared to the overall population (Wilson, Lockshin, & Rungie, 2005; Spawton & Lockshin, 2001).

Table 2 compares the sociodemographic characteristics of the Australian total red wine consumers, our total sample and both recruitment sub-samples. The last column indicates those attributes where the samples recruited via panel and from the campus significantly deviate from each other.

Table 2: Sociodemographic description of Australian red wine consumers, the total sample and differences between the sub-samples

		Roy Morgan (red wine consumers)	Total sample	Panel recruitment	Campus recruitment	
Gender	Female	45.9%	47.3%	45.0%	51.0%	
	Male	54.1%	52.7%	55.0%	49.0%	
Age	18-24	6.4%	13.4%	4.3%	27.9%	**
	25-34	16.3%	29.5%	31.9%	27.9%	
	35-49	32.3%	32.1%	31.9%	31.4%	
	>50	45.0%	25.0%	31.9%	12.8%	**
Marital status	single	29.1%	50.9%	38.0%	69.0%	**
	married/ de facto	70.9%	49.1%	62.0%	31.0%	**
Children in household	yes	31.3%	24.1%	26.1%	21.4%	
	No	68.7%	75.0%	73.9%	78.6%	
Number of children	1	12.7%	10.7%	11.6%	9.3%	
	2	12.9%	9.8%	8.7%	11.6%	
	3+	5.7%	5.4%	5.7%	4.7%	
People living in household	1-2 People in HH	46.0%	54.0%	54.4%	53.5%	
	3-4 People in HH	41.3%	35.1%	35.3%	34.9%	
	5+ People in HH	12.7%	10.8%	10.3%	11.6%	
Personal income (AUD)	Under $10,000	5.3%	4.9%	6.0%	5.0%	
	$10,000 to $19,999	11.5%	4.9%	6.0%	5.0%	
	$20,000 to $29,999	11.7%	8.9%	11.0%	6.0%	*
	$30,000 to $49,999	24.8%	21.4%	23.5%	18.0%	
	$50,000 to $69,999	19.8%	25.9%	26.0%	26.5%	
	$70,000 or More	26.9%	30.4%	27.5%	38.5%	*
Education	Below High School	28.4%	7.1%	9.0%	0.0%	*
	Finished Tech./ Matric/HSC/Year 12	17.3%	21.4%	27.0%	14.0%	**
	Diploma or Degree	54.3%	71.4%	64.0%	86.0%	**
Employment	full time work	50.6%	66.0%	61.0%	77.0%	
	part time work	18.8%	11.0%	13.0%	13.0%	
	not employed	30.5%	23.0%	26.0%	10.0%	*

Binary logistic regression recruitment against sociodemographic variables:
** significant (p<0.05)
* significant (p<0.10)

Roy Morgan single source data : JAN 2006 - DEC 2006, representative for Australian red wine consumers

Younger age groups are fairly overrepresented in our sample compared to Australian red wine drinkers, whereas respondents above 50 years are underrepresented. While the age distribution of the consumer panel sample is relatively close to Australian red wine consumers the campus sample is strongly skewed towards very young and middle aged respondents, thereby causing a stronger deviation of our total sample from the red wine consumer population.

Respondents recruited from the consumer panel are closer in their martial status to the Roy Morgan population reference, whereas campus respondents are very strongly skewed towards being single. Despite both sub samples not being significantly different in the number of children living in the household, the consumer panel is more similar to the population of red wine drinkers.

Both sub samples show a weak significant difference in the lower and the highest income groups in which the campus sample is slightly under represented in low income and over represented in the higher income. Again, the sample drawn from the consumer panel is very similar to the overall population of red wine consumers.

As previously expected, respondents with higher education are overrepresented in the sample drawn from the consumer panel, which can to a large amount be explained by the age skew and the selection criteria of being a regular red wine consumer not exclusively drinking cask wine. Our total sample deviates even more because respondents from the campus are underrepresented in lower education categories and strongly overrepresented in the highest education levels, almost exclusively having a university or postgraduate degree.

Our total sample slightly deviates in respect to the employment status from the Roy Morgan reference in having a higher share of full time working and a lower share of not working respondents. This skew is mainly caused by respondents recruited from the campus who are fairly underrepresented in not working consumers.

Differences between both recruitment sub-samples can be summarised by the following. Respondents recruited from the consumer panel and from the Waite Campus are different in their sociodemographic characteristics and their wine behaviour. A binary logistic regression with recruitment method as the dependent variable and sociodemographic and wine behaviour related characteristics as independent variables shows a number of significant differences (see Tables 2 and 3). Campus respondents are younger, more often single, more often full time employed, have a slightly higher personal income, and a significantly higher education than respondents recruited from the consumer panel.

More important than their sociodemographic characteristics, both sub-samples also show significant differences in their wine behaviour. Table 3 summarises all variables for which a binary logistic regression showed significant differences between both samples for at least one variable category.

Respondents recruited from the Waite Campus deviate in a number of important wine purchase related characteristics from representative consumers: they purchase wine less often and more often purchase at price points above $15. The lower purchase frequency can partly be explained by their professional exposure to wine combined with some free wine supply by the wine institutions campus respondents are working in. Wines up to $15 represent the most important volume share of the Australian wine market. In these price brackets campus respondents are underrepresented compared to respondents from the consumer panel.

Table 3: Wine behaviour related variables with at least one statistically significant difference in the category between sub-samples ($p<0.05$)

	Panel recruitment n=69	**Campus recruitment** n=43
purchase frequency	more often	less often
drinking wine for how many years	longer wine experience	shorter wine experience
purchase for price less $8	more often	less often
purchase for price $9-$15	more often	less often
importance to taste wine in store	more important	less important
importance of story on back label	more important	less important
purchase wine in wine club	more often	less often
drink wine with friends	more often	less often
drink wine at home	more often	less often
drink wine at café	more often	less often
drink wine at restaurant	more often	less often

Caused by their lower average age, campus respondents have a shorter wine consumption experience measured in years already drinking wine. For them, tasting the wine before purchase is less important than for normal wine consumers as well as reading the winery's story on the back label. This can again be partially explained by their professional relationship to wine through which they gained a higher wine knowledge to guide them objectively during the wine purchase process. On the other hand, respondents from the consumer panel purchase wine more often in wine clubs and drink wine more frequently with friends, at home, in cafés and in restaurants.

From these considerable differences in sociodemographic and wine consumption related characteristics between both sub samples, it follows that a sample containing a significant portion of campus respondents will not allow conclusions to be valid for average consumer wine behaviour in either its effect size or the structural relationship between variables.

Relationship between subjective and objective wine knowledge

Over the total sample, subjective and objective wine knowledge showed a rather low correlation of 0.35, which increases to a moderate level if both sub-samples are analysed separately (see Table 4). According to Cohen & Cohen (1983) correlations below 0.35 are considered rather low, while those above 0.45 are considered moderate to high. The higher correlations when considering recruitment implies underlying differences between the sub-samples. Compared to previous studies this correspondence between the two knowledge constructs is relatively low (Johnson & Bastian, 2007), implying that both constructs measure different underlying dimensions. While no significant relationship between objective wine knowledge and wine involvement can be found for the total sample, a low but significant correlation exists in the consumer sub-segment.

These differences between normal consumers and campus respondents are further substantiated if absolute levels of subjective and objective knowledge are analysed for both sub-samples (see Table 5). While consumer panellists have a higher subjective knowledge, they have a considerably lower objective wine knowledge than respondents from the campus. Whereas an average consumer can name eleven grape varieties and wine regions, respondents from the campus on average correctly specify 18, varying between four and 38 (see Figure 2).

Thus, while consumer panellists rate their subjective knowledge higher than campus respondents, the latter exceed them by far in their objective knowledge. A logistic regression reveals strong differences between perceived subjective and objective wine knowledge, but no difference in wine involvement (Table 5). The relatively lower variability in subjective wine knowledge for campus participants is illustrated in Figure 1. Average wine consumers also show a much broader range of responses.

Table 4: Correlation between wine involvement, subjective and objective wine knowledge

			Total sample n=112		**Panel recruitment** n=69		**Campus recruitment** n=43	
subjective knowledge	~	objective knowl.	0.35	**	0.43	**	0.47	**
subjective knowledge	~	wine involvement	0.34	**	0.31	**	0.35	**
objective knowl.	~	wine involvement	0.12		0.33	**	0.11	

** significant (p<0.01)

Table 5: Wine knowledge and wine involvement for total sample and sub-samples

	Total sample n=112		**Panel recruitment** n=69		**Campus recruitment** n=43		**Logistic Regression** Difference between sub-samples	
	Mean	Stdev	Mean	Stdev	Mean	Stdev	B	p
subjective wine knowledge	3.38	1.74	3.54	1.65	3.12	1.87	-0.44	**0.01**
objective wine knowledge	13.82	8.20	11.06	5.94	18.26	9.38	0.19	**0.00**
wine involvement	8.40	2.84	8.72	2.46	7.88	3.34	-0.15	0.12

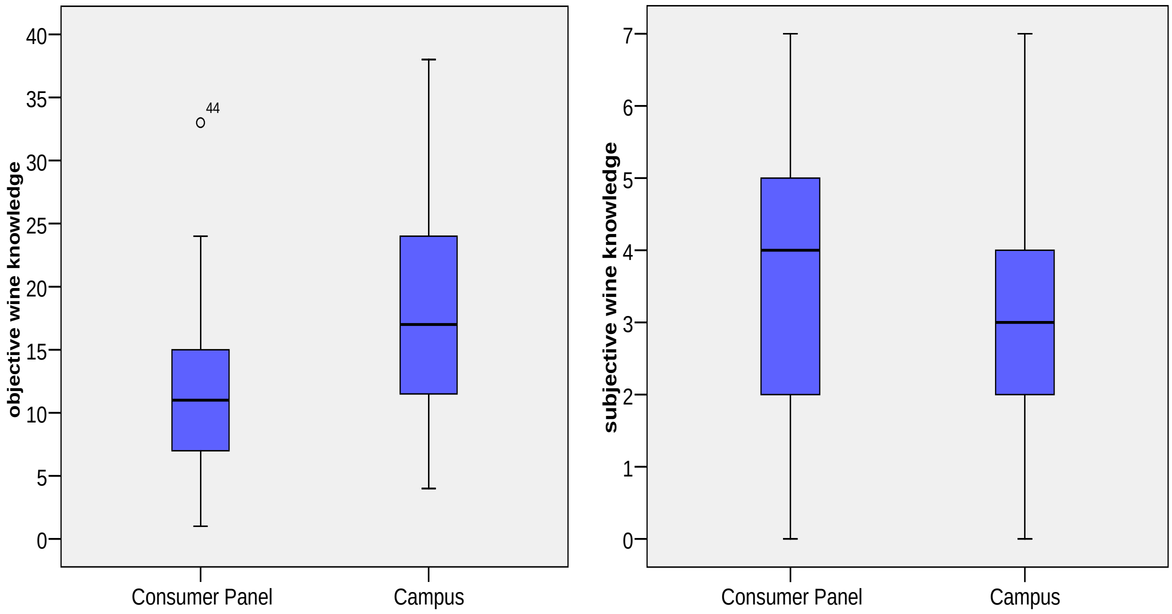


Figure 1: Box-Plots of objective and subjective wine knowledge for sub-samples

This opposing effect of subjective and objective knowledge between the sub-samples can be explained by two factors. The first is the relative nature of the subjective wine knowledge construct, which is perceived relative to its reference or peer group. While consumers compare themselves to other normal consumers, respondents from the campus likely relate their wine knowledge to their senior working colleagues and fellow students resulting in lower ratings. Self-selection is the second factor underlying our findings. From previous research we know that consumers with higher wine involvement and subjective wine knowledge are generally more willing to participate in wine tastings than the average wine consumer. On the other hand, for respondents working or studying on the campus, it is more likely to be the other way around. Those with more available time or less experienced than specialised experts are more likely to be recruited for wine experiments.

These findings substantiate that studies measuring the correlation between objective and subjective knowledge, which include a major part of wine institute related respondents, are very likely not to reflect relationships which are valid for typical consumers.

Consumer segments of different hedonic liking

An analysis of hedonic liking for the eight wines revealed a strong heterogeneity, which could be best modelled with a 2-(4,2) Latent Class Discrete Factor Model (Magidson & Vermunt 2001; Vermunt & Magidson 2005). A rating level factor with four levels corresponds to different scale usage by respondents with different average response levels. The relative differences in liking are captured by the second preference factor with two levels which represent two preference clusters (see Figure 2). Seven of the eight wines are significant differently liked by both preference clusters and cluster wise regression of hedonic rating against sensory components found opposing sensory drivers for both clusters (a complete analysis can be found in Mueller, Francis and Lockshin, 2007).

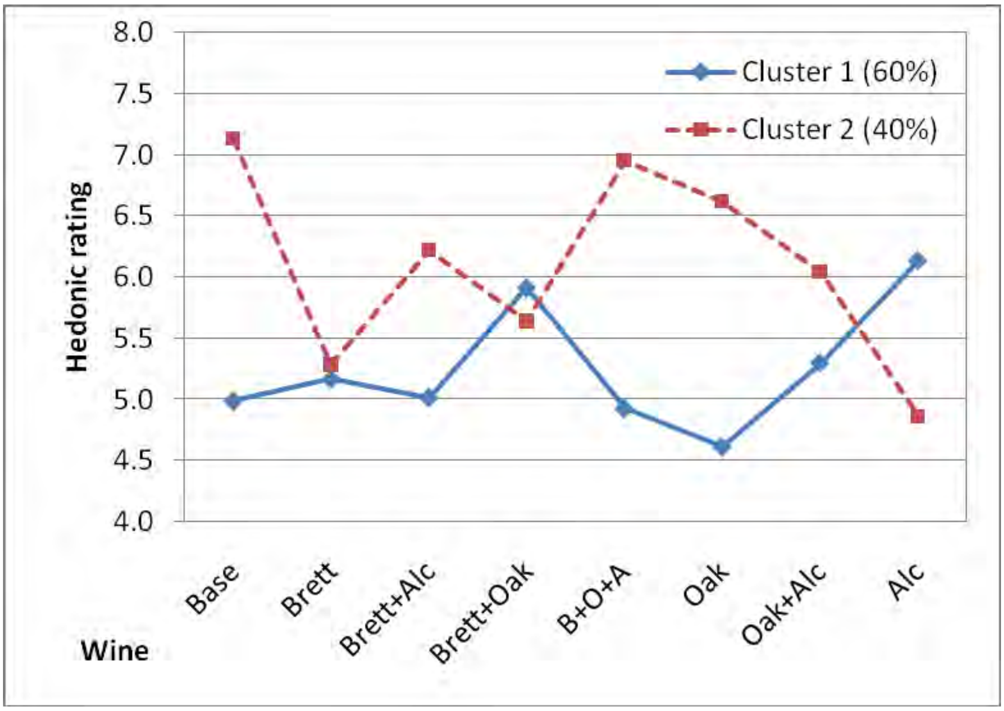


Figure 2: Hedonic liking for the eight wines for both preference clusters

As Figure 2 shows, the first cluster significantly prefers the wine with higher alcohol and the Brett+oak wine over all others. The second cluster has the highest preference for the base wine, followed by wines with complex sensory components, such as Brett+oak+alc, oak, and Brett+alc. Despite the fact that the Brett only wine is not well liked by either cluster, our research shows that the influence of Brettanomyces on consumer liking can be mitigated by combining it with oak and/or higher alcohol levels.

Wine knowledge and sensory liking

To analyse if both sensory clusters differ in their subjective and objective wine knowledge, we conducted a binary logistic regression with the cluster as the dependent variable and wine involvement, subjective and objective knowledge as independent variables. The results imply that consumers with different sensory preferences differ in wine knowledge and involvement (Table 7). The first sensory segment has significantly higher subjective and objective wine knowledge, but lower wine involvement than the second segment (Table 6). When both recruitment groups are analysed separately, the model fit for the consumer sub-sample improves, implying underlying differences between the consumer panel and campus respondents. For the consumer panel only subjective knowledge and wine involvement are significantly different between the sensory preference clusters. On the other hand, for campus respondents, subjective knowledge and wine involvement do not discriminate between clusters. Objective knowledge shows a substantive difference for the whole sample (Table 7), but is just marginally not significant for the campus sample (p=0.11). This may be due to the small sample size.

A second difference is the relative cluster share between consumers and campus respondents. While consumer panellists are almost equally distributed over both sensory clusters, almost two thirds of campus respondents belong to the first cluster with higher objective and subjective knowledge. A chi-square test of cluster membership between both sub-samples is significant at the p=0.09 level (chi-square = 2.873, df=1), indicating significantly different wine taste preferences between campus respondents and panel respondents which can be assumed to closer resemble the behaviour of representative consumers.

Table 6: Descriptive analysis of knowledge and involvement for sensory clusters

	Sensory Cluster	**Total Sample** n=112			**Panel recruitment** n=69			**Campus recruitment** n=43		
		N	Mean	Stdev	N	Mean	Stdev	N	Mean	Stdev
subjective wine knowledge	1	67	3.67	1.59	37	3.92	1.52	30	3.37	1.65
	2	45	2.93	1.88	32	3.09	1.71	13	2.54	2.26
objective wine knowledge	1	67	15.58	8.95	37	11.89	6.28	30	20.13	9.72
	2	45	11.20	6.16	32	10.09	5.45	13	13.92	7.14
wine involvement	1	67	8.10	2.98	37	8.24	2.62	30	7.93	3.41
	2	45	8.84	2.59	32	9.28	2.16	13	7.77	3.30

Our results are also robust for other segmentation methods. We found similar results when applying Ward Clustering to mean centred hedonic ratings. Furthermore, an analysis of scale usage revealed that campus respondents used significantly lower average ratings for evaluating the wines (B=-.52, Wald=7.69, p=0.006). In absolute ratings especially the Brett (B=-.184, Wald=3.21, p=0.07) and the oak+alc (B=-.20, Wald=3.65, p=0.056) wines were rated significantly lower by campus respondents than by panel respondents.

Table 7: Differences between first and second sensory cluster for total sample, panel and campus recruitment: logistic regression of sensory cluster membership against subjective, objective knowledge and involvement

	Total sample (differences between sensory clusters 1 and 2) n=112				**Panel recruitment** (differences between sensory clusters 1 and 2) n=69				**Campus recruitment** (differences between sensory clusters 1 and 2) n=43			
	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.	B	S.E.	Wald	Sig.
subjective wine knowledge	-0.30	0.14	4.49	**0.03**	-0.46	0.20	5.26	**0.02**	-0.15	0.24	0.39	0.53
objective wine knowledge	-0.07	0.03	5.42	**0.02**	-0.06	0.05	1.19	0.28	-0.08	0.05	2.50	0.11
wine involvement	0.22	0.09	5.57	**0.02**	0.37	0.14	6.88	**0.01**	0.04	0.12	0.10	0.75
Constant	-0.30	0.78	0.15	0.70	-1.17	1.13	1.07	0.30	0.56	1.13	0.25	0.62
	-2LL: 133.99; Nagelke R^2: 0.19				-2LL: 82.05; Nagelke R^2: 0.23				-2LL: 47.82; Nagelke R^2: 0.15			

Overall, the sensory preference differences between panel and campus recruited respondents imply that the relative cluster size is skewed towards the first cluster with an overrepresentation of campus respondents. Otherwise, we would draw invalid conclusions for the relative liking of different wines on the Australian wine market if we had not considered sample bias caused by campus recruitment. Furthermore, we would predict an invalid distribution of subjective and objective wine knowledge for Australian wine consumers within both clusters if we had not considered the higher objective but lower subjective wine knowledge of respondents recruited from the Waite campus. Subjective knowledge seems to discriminate both sensory clusters for panel respondents, whereas objective wine knowledge is more likely to discriminate between both sensory clusters for campus respondents. A comparable bias in effect size and structural relations between variables will likely exist for similar segmentation studies using convenience samples from agricultural related institutes.

Conclusion

Our research revealed strong differences in sociodemographic characteristics and wine behaviour between respondents usually used in convenience samples, such as students and employees of research institutes, and consumers randomly recruited from a consumer panel. These findings cast doubt on the validity of results regarding the behaviour of real consumers inferred from non-representative samples. Especially the validity of studies applying segmentation procedures have to be questioned when the underlying structures of convenience samples strongly deviate from typical wine consumers.

We found that objective and subjective knowledge measures better agree when sampling influences are taken into consideration, which has not been the case in previous research literature. Nevertheless, their relationship remains still far from perfect. This suggests that both constructs should be measured separately in consumer research.

For the sensory wine differences we found that for consumers with high or low wine knowledge, both constructs equally related to the same preference segments. For the consumer panel sub sample subjective knowledge was a significant discriminator between both sensory clusters, whereas objective knowledge was not. For campus recruited respondents objective wine knowledge tended to be the stronger discriminator. Those wine consumers in the first cluster, preferring wines with higher alcohol and simultaneous additions of oak and Brettanomyces flavour, had a higher subjective and objective wine knowledge. Surprisingly, consumers with higher wine involvement were significantly more represented in the second cluster which showed the highest preference for the fruity base wine.

Overall, this result should provide a strong cautionary note to all researchers recruiting locally, when their intent is to make some conclusions towards a wider population.

Managerial implications

Our research reinforces the importance of correct sampling for drawing valid conclusions on consumers' wine behaviour and sensory wine preferences. We showed that the structure of respondents in convenience samples can deviate substantially in their sociodemographic characteristics, but more importantly in their wine behaviour and sensory wine preferences. Segmentation and conclusions about the structural composition of the wine consumer population have to be interpreted with caution if they were drawn from convenience samples, such as including a major portion of campus related respondents. Wine research related respondents were shown to possess significantly higher objective product knowledge and revealed different sensory product liking than respondents drawn from a consumer panel.

If managers aim for market relevant conclusions which predict true consumer behaviour they should assure that the composition of the sample is representative or at least similar to the total wine drinker population. We confirmed for an Australian example that drawing a sample from an actively managed consumer online panel is a very good approximation for the wine consumer population.

Further research

This study provides the first attempt we know of investigating the generalisability of convenience samples of wine preferences to a typical wine consuming population. We realise our two sub-samples were rather small; however, the differences we found were quite large. Our findings need to be validated for larger samples comprising of representative consumers and convenience sampled respondents.

Because we could not find a very strong relationship between both knowledge constructs, further research is necessary into how subjective and objective wine knowledge relate to consumers' wine behaviour and if both constructs have to be measured separately in consumer studies. There exists a variety of different objective product knowledge measures, most of them are very comprehensive and potentially take too much time to integrate into consumer studies with a different focus. More research into practicable but highly predictive instruments would be desirable.

For our study we have used ‘doctored’ wines to better be able to control the influence of sensory components and their interactions on sensory preferences. It would be desirable to analyse the influence of sampling and product knowledge also for commercial wines.

Acknowledgements

The authors wish to thank Brooke Travis and Belinda Bramley from the Australian Wine Research Institute (AWRI) sensory team, the AWRI sensory panel and the AWRI ‘Brett’ research team, especially Matt Holdstock and Chris Curtin. This work was financially supported by Australia's grapegrowers and winemakers through their investment body the Grape and Wine Research and Development Corporation (GWRDC), with matching funds from the Australian Government.

References

Alba, J. W. (2000). Dimensions of consumer expertise ... or lack thereof. *Advances in Consumer Research, Vol 27, 27*, 1-9.

Alba, J. W., & Hutchinson, J. W. (1987). Dimensions of Consumer Expertise. *Journal of Consumer Research, 13*(4), 411-454.

Ballester, J., Patris, B., Symoneaux, R., & Valentin, D. (2008). Conceptual vs. perceptual wine spaces: Does expertise matter. *Food Quality and Preference, 19*(3), 267-276.

Bettman, J. R., & Park, C. W. (1980). Effects of Prior Knowledge and Experience and Phase of the Choice Process on Consumer Decision Processes: A Protocol Analysis. *Journal of Consumer Research, 7*(3), 234-248.

Brucks, M. (1985). The Effects of Product Class Knowledge on Information Search Behavior. *The Journal of Consumer Research*, *12*(1), 1-16.

Brucks, M. (1986). A Typology of Consumer Knowledge Content. *Advances in Consumer Research, 13*(1), 58-63.

Bramley, B.; Curtin, Chris; Cowey, G.; Holdenstock, M.; Coulter, A.; Kennedy, E.; Travis, B.; Mueller, S.; Lockshin, L.; Godden, P. & Francis, L. (2007): Wine style alters the sensory impact of 'Brett' flavour compounds in red wines; Poster presented at the 13th Australian Wine Industry Technical Conference (AWITC) from 28 July - 2 August in Adelaide.

Cohen, J., Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale: Lawrence Erlbaum Associates, Inc.

Dodd, T. H., Laverie, D. A., Wilcox, J. f., & Duhan, D. F. (2005). Differential effects of experience, subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing. *Journal of Hospitality and Tourism Research, 29,* 3-19.

Frøst, M. B., & Noble, A. C. (2002). Preliminary study of the effect of knowledge and sensory expertise on liking for red wines. *American Journal of Enology and Viticulture*, *53*(4), 275-284.

Goodman, S., Lockshin, L., & Cohen, E. (2007). influencers of consumer choice in a retail setting - more international comparisons. *Wine Industry Journal, 22*(6), 42-48.

Heimbach, A. E., Johansson, J. K., & MacLachlan, D. L. (1989). Product Familiarity, Information Processing, and Country-of-Origin Cues. *Advances in Consumer Research*, *16*(1), 460-467.

Hersleth, M., B.-H. Mevik, T. Naes & J.-X. Guinard (2003) Effect of contextual factors on liking for wine--use of robust design methodology. *Food Quality and Preference*, 14**,** 615-622.

Hughson, A. L., & Boakes, R. A. (2001). Perceptual and cognitive aspects of wine expertise [Australian Wine Knowledge Test.]. *Australian Journal of Psychology, 53*(2), 103-108.

Hughson, A. L., & Boakes, R. A. (2002). The knowing nose: the role of knowledge in wine expertise. *Food Quality and Preference, 13*(7-8), 463-472.

Johnson, T. E., & Bastian, S. E. P. (2007). A preliminary study of the relationship between Australian wine consumers' wine expertise and their wine purchasing and consumption behaviour. *Australian Journal of Grape and Wine Research, 13*, 86-197.

Lattey, K., B. Bramley, L. Francis, M., Herderich & S. Pretorious (2007) Wine quality and consumer preferences: understanding consumer needs. *Wine Industry Journal*, 225**,** 31-39.

Lawless, H. T. (1984). Flavor description of white wine by 'expert' and nonexpert wine consumers. *Journal of Food Science, 40,* 120-123.

Lockshin, L., Jarvis, W., d'Hauteville, F., & Perrouty, J.-P. (2006). Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. *Food Quality and Preference, 17*(3-4), 166-178.

Lockshin, L., Spawton, A., Macintosh, G.. (1997), “Using Product, Brand, and Purchasing Involvement for Retail Segmentation,” *Journal of Retailing and Consumer Services*, Vol. 4 (3), 171-183.

Macfie, H. J., N. Bratchell, K. Greenhoff & L. V. Vallis (1989) Designs to balance the effects of order of presentation and first-order carry-over effects in hall tests. *Journal of Sensory Studies*, 4**,** 129-148.

Magidson, J. & J. K. Vermunt (2001) Latent class factor and cluster models, bi-plots, and related graphical displays. *Sociological Methodology 2001, Vol 31,* 31**,** 223-264.

Moorman, C., Diehl, K., Brinberg, D., & Kidwell, B. (2004). Subjective knowledge, search locations, and consumer choice. *Journal of Consumer Research, 31*(3), 673-680.

Mueller, S., & Lockshin, L., (2008). How important is wine packaging for consumers? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods. Refereed paper, 4th *International Conference of the Academy of Wine Business Research*, Siena, 17-19th July, 2008.

Mueller, S., Francis, L., & Lockshin, L. (2007). Comparison of Best-Worst and Hedonic Scaling for the Measurement of Consumer Wine Preferences. Working Paper, Ehrenberg-Bass Institute for Marketing Science, University of South Australia.

Park, C. W., & Lessig, V. P. (1981). Familiarity and Its Impact on Consumer Decision Biases and Heuristics. *Journal of Consumer Research, 8*(2), 223.

Parr, W. V., Heatherbell, D., & White, K. G. (2002). Demystifying wine expertise: olfactory threshold, perceptual skill and semantic memory in expert and novice wine judges. *Chemical Senses, 27,* 742-755.

Parr, W. V., White, K. G., & Heatherbell, D. A. (2004). Exploring the nature of wine expertise: what underlies wine experts' olfactory recognition memory advantage?. *Food Quality and Preference, 15*(5), 411-420.

Perrouty, J.P., F. d’Hauteville, and L. Lockshin, (2006), “The Influence of Wine Attributes on Region of Origin Equity: An Analysis of the Moderating Effect of Consumer’s Perceived Expertise”, *Agribusiness: An International Journal*, 22 (3) 323-41.

Raju, P. S., Lonial, S. C., & Mangold, W. G. (1995). Differential Effects of Subjective Knowledge, Objective Knowledge, and Usage Experience on Decision Making: An Exploratory Investigation. *Journal of Consumer Psychology, 4*(2), 153.

Rao, A. R., & Monroe, K. B. (1988). The Moderating Effect of Prior Knowledge on Cue Utilization in Product Evaluations. *Journal of Consumer Research, 15*(2), 253-264.

Spawton, T., & Lockshin, L. (2001), Consumer response to societal controls designed to modify alcohol usage and abuse. Marketing policy implications, AMA Marketing Association Conference, Washington (D.C).

Sujan, M. (1985). Consumer Knowledge: Effects on Evaluation Strategies Mediating Consumer Judgments. *Journal of Consumer Research, 12*(1), 31-46.

Veale, R., & Quester, P. (2007). *Consumer Expertise: Measuring Consumer Objective Knowledge.* Paper presented at the Australian and New Zealand Marketing Academy Conference, Dunedin, NZ.

Vermunt, J. K., & Magidson, J. (2005). Factor analysis with categorial indicators: a comparison between traditional and latent class approaches. In A. Van der Ark, M. A. Croon & K. Sijtsma (Eds.), *New Developments in Categorial Data Analysis for the Social and Behavioral Sciences* (pp. 41-62). Mahwah: Erlbaum.

Wilson, D., Lockshin, L. & Rungie, C. 2005, The Value of Identifying Cohorts through Retrospective Panel Data: Preliminary Findings from Australia [CD-ROM] presented to *Second Annual International Wine Marketing Symposium,* Sonoma State University, California, 8-9 July.

How important is wine packaging for consumers?

On the reliability of measuring attribute importance with direct verbal versus indirect visual methods

Dr Simone Mueller
Research Fellow Wine Marketing
Ehrenberg-Bass Institute for Marketing Science, University of South Australia
GPO Box 2471 Adelaide, South Australia 5001
Telephone: (61 8) 8302 0906
Facsimile: (61 8) 8302 0042
Email: simone.mueller@unisa.edu.au

Prof Larry Lockshin
Professor of Wine Marketing
Ehrenberg-Bass Institute for Marketing Science, University of South Australia
GPO Box 2471 Adelaide, South Australia 5001
Telephone: (61 8) 8302 0261
Facsimile: (61 8) 8302 0042
Email: larry.lockshin@unisa.edu.au

How important is wine packaging for consumers?

On the reliability of measuring attribute importance with direct verbal versus indirect visual methods

Abstract

Wine packaging design has received a growing research interest in the last few years. Nevertheless different approaches to measure the relative importance of packaging compared to other extrinsic cues like brand name, origin and price yield deviating results. Verbal methods directly asking consumers about wine packaging relevance usually result in low packaging importance ratings contradictory to what we know from the market place. We review previous research in the measurement of packaging attribute importance and discuss psychological differences found between direct verbal and indirect visual methods. We compare the results of two methods to measure wine attribute importance: a direct verbal Best Worst Scaling (BWS) experiment versus an indirect visual discrete choice experiment (DCE). With BWS all visual extrinsic cues are not only measured as less important than verbal cues but also show a smaller variance between respondents, signalling a strong respondent agreement on their non-importance. Contrary, the DCE combining label and packaging attributes in wine bottle graphics in a shelf-like setting reveals a higher average importance and strong consumer preference heterogeneity of wine packaging design attributes and levels.

Our results imply that stimuli which are visually perceived by consumers cannot be reliably measured with verbal methods. This results in strongly biased results. Choice experiments with packaging graphics, which simulate consumers' real purchase behaviour in front of the shelf are a powerful tool for marketing practitioners. It allows them to efficiently measure the relative importance of design attributes for different consumer segments and to cost-efficiently test consumer acceptance of newly developed wine packaging in the market place.

Keywords: Wine packaging, verbal versus visual representation, research methodology, discrete choice analysis, Best Worst Scaling

Introduction

Wine packaging has received increasing research attention in the last few years (Barber, Almanza, & Donovan, 2006; Boudreaux & Palmer, 2007; Orth & Malkewitz, 2006 and 2008; Rocchi& Stefani, 2005; Szolnoki, 2007). Appearance and packaging of food products and wine play an important role in influencing consumer perception and subsequent acceptance (Imram, 1999).The first taste is almost always with the eye. Extrinsic packaging attributes provide consumers with social and aesthetic utility and strongly influence expectations of sensory perception (Deliza & MacFie, 1996; Gianluca, Donato, & Cavicchi, 2006; Sara R. Jaeger, 2006; Lange, Martin, Chabanet, Combris, & Issanchou, 2002). Those expectations have been shown to be very robust against later disconfirmation when consumers actually taste the product (Cardello & Sawyer, 1992). Despite what we know about the underlying psychological influence packaging exerts on product evaluation, contradictory findings were found on the relative importance of wine packaging compared to other extrinsic product cues as brand name, origin and price.

Several studies directly measuring the importance of attributes conclude that wine packaging design is rather unimportant (Goodman, Lockshin, & Cohen, 2005, 2006, 2007; Mueller, Lockshin, Louviere, & Hackman, 2007). Other studies find that strong consumer impressions are evoked by wine packaging design elements (Boudreaux & Palmer, 2007; Orth & Malkewitz, 2006) and that during in depth focus groups consumers reveal they consider packaging design features when making purchase decisions (Rocchi & Stefani, 2005; Szolnoki, 2007). A first indicative study including a relatively small subset of packaging attributes without considering product price by Szolnoki (2007) reveals that the importance of wine packaging designs differ when measured directly and indirectly.

It further can be expected that the importance of wine packaging design and preferred attribute levels differ for different wine consumers as empirically confirmed for other food products (Deliza, MacFie, & Hedderley, 2003; Silayoi & Speece, 2007). Nevertheless, the majority of previous wine packaging studies did not consider consumer preference heterogeneity, which is managerially important to target different consumer segments.

Thus, a major unresolved research question is how wine packaging preference and importance can be reliably and validly measured. To answer this question we will first discuss prior findings on different psychological processes initiated by visual and verbal information and review previous empirical studies comparing direct verbal and indirect visual attribute importance measurement. To test our two research propositions we compare wine packaging design importance and importance variance in two experimental settings – a direct verbal Best Worst Scaling study with an indirect graphical discrete choice experiment. We will discuss the validity and reliability of both methods and conclude how graphical choice experiments can provide the wine industry with extremely valuable advice for product development and consumer targeting.

Literature review

Different psychological processes initiated by visual and verbal information

Different types of information processing induced by verbal and visual information are found to be responsible for conceptual differences between verbal and graphical product representation. Paivio (1971) proposed a dual-coding hypothesis, implying that pictures tend to be processed simultaneously in an imagery system, whereas verbal representations are processed sequentially in an independent system. Findings by Allan Paivio & Csapo(1973) confirm that imagery can be substantially better recalled than verbal information and that image and verbal memory are independent and additive in their effect on recall, confirming the dual encoding hypothesis. Similar explanations, although from different perspectives, have also been brought forward by Das, Kirby, & Jarman (1975), Mandler & Johnson(1976) and Pick & Saltzman(1978). These findings assert that verbal descriptions are very likely to generate different connotations than the corresponding pictorial representations of the same product.

Other research focused on humans' processing ability and preference for verbal and visual information (Childers, Houston, & Heckler, 1985; Sojka & Giese, 2001). MacInnis & Price (1987) and Jarvenpaa (1989) showed that there are lower cognitive elaboration costs and higher benefits for graphical relative to verbal information. Furthermore, visual representations can enhance problem-solving capabilities without overloading decision makers (Lohse, 1997). Kosslyn (1994) discussed how humans have developed visual and spatial skills and better retrieve information with visual cues. Lurie & Mason(2007) compared the context of visual versus verbal information, which showed vividness, evaluability and framing increased with visual information; that is, “a picture is worth a thousands words”.

Empirical differences between verbal, visual and real product presentation

A review of the early literature comparing effects of verbal and visual product presentation of the 1980 can be found in Vriens, Loosschilder, Rosbergen, &Wittink (1998). Ambiguous findings of those early studies are very likely partially caused by very simple and unrealistic graphical representation techniques like line drawings. Whereas Holbrook & Moore (1981) found stronger effects for visual than for verbal sweater descriptions a replication of this study by Domzal & Unger (1985) for watches did not result in significant differences. Similarly, Louviere, Schroeder, Louviere, & Woodworth(1987) comparing verbal descriptions and visual photographic representations of state parks in choice experiments found only a few differences in part-worth between representation modes. Smead, Wilcox, & Wilkes (1981) compared real coffee makers and their verbal presentation and found more eye movement and more significant preference determining attributes for real products.

Vriens *et al.*(1998) compared the relative importance of different design attributes of car stereo equipment with verbal and visual representations in a conjoint analysis. Pictorial representation produced slightly higher relative importance for two of three design attributes and a somewhat greater heterogeneity among respondents. Despite a higher degree of task realism for photographic representations, they concluded based on hold-out tasks that verbal representation facilitated judgement and had higher predictive accuracy.

Dahan & Srinivasan (2000) compared verbal, visual and physical product presentation of bicycle pumps for a conjoint analysis-based product concept test and found strong between differences verbal and visual, but only minor differences between visual web animated and physical product presentation. They concluded that that Internet visual presentation and costlier real prototype experiments produced a close match. But they only used full concepts and price, no design was used to measure and combine several attributes.

Silayoi & Speece (2007) used a rating based conjoint study for packaged ready-to-eat products in Thailand and found a strong overall importance of packaging shape, packaging colour and packaging graphics. They also confirmed strong consumer heterogeneity with distinct segments focused either on visual aesthetics or verbal product information on the label.

Jaeger, Hedderley, & MacFie (2001) compared photographs and real products in conjoint analysis and found that apple photographs conveyed information about apple varieties equally well compared to prototype apple packages. Because of equal validity and lower application costs, they recommended using designed graphics for conjoint analysis.

Sethuraman, Kerin, & Cron (2005) findings supported the use of internet technology for conjoint analysis data collection. Online data collection was judged superior to a traditional offline (paper-and-pencil) method. The differences were explained by greater participation attention and involvement especially because of visual enhancement of the pictorial objects possible in web-based tasks.

Szolnoki (2007) is the only study known to the authors utilising wine. He compared the relative importance of wine packaging elicited with rating and rating-based conjoint analysis for German wine consumers. Using verbal direct measurement, packaging design was rated as second least important after wine flavour and origin, but surprisingly before brand. The rather weak discrimination between the items could have been caused by the usage of a five point rating scale (Cohen & Neira, 2003). For the rating based conjoint analysis he combined four attributes origin/grape variety, label layout, bottle form and bottle colour with either two or three levels in photographic bottle representations. Label style showed the overall largest effect with an importance of 40%, followed by origin/grape variety (30%), bottle colour (19%) and bottle form (12%). Neither brand nor prices were included in the conjoint design. Szoloniki (2007) found three heterogeneous consumer segments using hierarchical cluster analysis on conjoint attribute weights, thereby loosing statistical efficiency in a two-step procedure.

Differences direct versus indirect attribute importance measurement

Most recent research suggests that there are also fundamental differences between direct and indirect importance measurement methods, independent of whether they apply verbal or graphical stimuli. Van Ittersum, Pennings, Wansink, & van Trijp (2007) found in their meta analysis that methods measuring different dimensions of attribute importance usually have a lower correlation than methods analysing the same dimension. Direct methods as rating or BWS measure the underlying dimension of attribute relevance, determined by personal values and desires. On the other hand, indirect methods such as conjoint or discrete choice analysis measure the determinance of an attribute - its relevance in judgement and choice – which is seen as most important from a managerial perspective (Pennings & Smidts, 2003).

Louviere & Islam (2007) found context effects and the degree of definition of a reference frame were responsible for differences between directly and indirectly derived importance measures. They argued that the importance of price depends on the ranges of price values a respondent has previously experienced, expects to experience or as provided by the researcher. Directly asking for importance of price is only meaningful if all subjects use the same frame of reference (e.g. $7.99-$22.99 for a bottle of wine). How this reference can best be defined by a researcher (Huffman, 1997) and connects again to the difference of verbal and visual stimuli. While a attributes such as price, brand, and region can unambiguously be defined verbally this is not the case for visual stimuli. Imagine the number of different shades of red respondents could refer to if the reference is set verbally. This exemplifies how important graphical methods are to be able to define the same basis of reference for respondents.

Research Propositions

Drawing from prior findings on differences between direct and indirect attribute importance measurement, and verbal and visual product presentation we will analyse two research propositions:

1) The relative importance of wine packaging attributes will be lower under verbal representation in direct importance measures than under visual representation in indirect attribute importance analysis.

2) Respondent heterogeneity in inferred relative attribute importance for packaging attributes will be higher under visual than under verbal representation.

Research Method

1) Direct verbal attribute importance measurement

For direct verbal extrinsic wine attribute importance measurement we use Best-Worst Scaling developed by Finn & Louviere(1992) which has shown to be a powerful method for preference measurement in social sciences and marketing (Auger, Devinney, & Louviere, 2007; Cohen & Orme, 2004; Goodman *et al.*, 2006; J. Louviere & Islam, 2007; Marley & Louviere, 2005). BWS uses respondents' choices of the best (most important) and worst (least important) item in set to create a ratio-based scale and overcomes several biases resulting from scores or ratings. This results in better discrimination between attributes (Cohen & Neira, 2003; Marley & Louviere, 2005). Despite the fact that we use BWS here as a direct verbal method - as it also has mainly been used in the past - it has to be emphasised that BWS is not limited to verbal attributes but can equally be applied to graphical concepts, as will later be shown.

Based on previous studies (Orth & Malkewitz, 2006; Rocchi & Stefani, 2005) and in store analysis in Australian retail stores we selected a total number of 16 extrinsic wine attributes (see list in Table 3). We thereby limited the potential detail of the bottle and label attributes as analysed by Orth & Malkewitz (2006) to a few more aggregated attributes like label style, label form, bottle shape and bottle colour along with standard verbal attributes like brand and price. We assigned all 16 attributes to a Youden design with 24 choice sets and choice set size of 6.

740 regular wine consumers (purchasing and drinking wine at least twice a month) from around Australia, recruited in March 2007 via a panel provider, completed an online questionnaire. The sample is very similar to the population of Australian wine drinkers with a slightly larger share of younger consumers (see Table 1). Respondents were asked to state within each set of wine characteristics the ones that are most and least important for their purchase decision of a bottle of Shiraz wine in a retail store.

2) Indirect visual attribute importance measurement

Discrete choice analysis or choice-based-conjoint are now predominating the measurement of attribute importance according to trade announcements of the commercial market leader in conjoint software, Sawtooth Software. Discrete Choice Experiments (DCE), use experimental designs to combine attribute levels into bundles. Respondents are forced to make tradeoffs when choosing bundles or product concepts. This method has been shown to be more valid in predicting actual choice (Louviere, Hensher, & Swait, 2000).

For a first proof of concept we had to limit the number of extrinsic wine attributes in the DCE because of the exponential growth of design complexity with a linear increase in attributes and levels (Street, Burgess, & Louviere, 2005). From the total of 16 attributes used for the direct verbal BWS we selected three verbal (brand, price and region scored highest in BWS) and three visual attributes (label style, label colour and bottle shape, which widely vary in the Australian wine market). The limitation on six attributes with either two or four levels (listed in Table 2) allowed us to have every respondent complete a full choice design and subsequently analyse respondent heterogeneity. A complete comparison between the BWS and DCE importance weights will not be possible as the relative attribute importance in choice experiments depends on the presence and absence of other choice relevant attributes (Islam, Louviere, & Burke, 2007).

Table 1: Comparison of experiment samples to total population of Australian wine consumers (Roy Morgan Single Source Australia: Jan 2006 – Dec 2006)

		Roy Morgan (total wine consumers)	Best Worst Experiment (n=740)	Discrete Choice Experiment (n=244)
State	NSW	34.3%	30.9%	34.2%
	Victoria	25.7%	25.5%	22.3%
	Queensland	18.4%	17.4%	19.7%
	South Australia	7.7%	10.3%	7.8%
	Western Australia	10.8%	12.7%	7.8%
	Tasmania	2.3%	2.8%	5.2%
	Northern Territories	0.6%	0.4%	3.1%
Area	Capital Cities	65.3%	74.6%	64.2%
	Country Area	34.7%	25.4%	35.8%
Gender	female	52.2%	53.5%	51.2%
	male	47.8%	46.5%	48.8%
Age	18-24	8.2%	14.9%	13.4%
	25-34	16.1%	32.7%	20.5%
	35-49	31.4%	34.9%	32.0%
	>50	44.3%	17.5%	34.1%
Marital status	single	30.7%	37.3%	31.1%
	married/ de facto	69.3%	62.7%	69.9%
Children in household	yes	31.8%	43.1%	46.6%
	no	68.2%	56.9%	53.4%
Number of children	1	13.3%	18.0%	13.6%
	2	12.7%	14.1%	16.8%
	3+	5.7%	10.0%	9.9%
Personal monthly income (AUD)	under $20,000	18.1%	21.8%	25.9%
	$20,000 - $39,999	24.8%	28.8%	28.2%
	$40,000 - $69,000	32.6%	33.6%	26.8%
	$70,000 or more	24.7%	15.8%	19.1%
Education	Some Secondary/Tech.	14.6%	8.5%	10.1%
	Certificate	16.5%	19.5%	19.0%
	High School	17.7%	17.1%	16.4%
	Degree or Diploma	51.3%	54.9%	54.5%
Employment	full time work	47.7%	58.3%	49.2%
	part time work	20.3%	19.6%	20.4%
	not employed	32.0%	22.1%	30.4%
Home ownership	Own Home	76.0%	58.2%	67.0%
	Rent Home	24.0%	41.8%	33.0%

Table 2: Attribute and levels for visual Discrete Choice Experiment

	Attribute	Levels	1	2	3	4
1	Price	4	$7.99	$12.99	$17.99	$22.99
2	Label style	4	traditional	chateau	graphic	minimalistic
3	Label colour	4	whitish	yellowish	orange	dark grey
4	Brand	2	Jinks Creek	McWilliams		
5	Region	2	Henty	McLaren Vale		
6	Bottle shape	2	Bordeaux	Burgundy		

Price levels were chosen to cover the commercially most relevant price range for Australian wine. Based on a content analysis of several store checks four types of label styles – traditional, chateau, graphic, and minimalistic – were found to compose the vast majority of different wine labels. A quantitative analysis of wine label colours in several Adelaide retail outlets revealed the four colours off-white, yellowish, orange/red and grey/black to be most dominant. Brand and region levels were chosen to represent a well known and an unknown example of each. Bordeaux and Burgundy are the two most available bottle shape types in Australia.

Figure 1: Sample discrete choice experiment with graphical bottle representations

It is well known that the range of attribute variation and number of levels used in DCE designs influences the inferred attribute importance (Wittink, Krishnamurthi, & Reibstein, 1990). When comparing attribute importance between verbal BWS and visual DCE we therefore have to consider that the importance of attributes with only two levels (brand, region, and bottle shape) can be negatively biased compared to attributes with four levels.

Attributes and levels were assigned according a 2^3x4^3 orthogonal main-effect plan in 16 choice sets with choice set size 6, its statistical efficiency is about 91%. Graphical designers developed graphical bottle representations of all attribute levels with prices given below, typical for a retail environment. Respondents were asked to choose the wine from the 'shelf' they most and least prefer and stated if they realistically would purchase the most preferred wine (see Figure 1). While typical choice based conjoint experiments only ask respondents to choose the best option, asking them for the best and worst in each set provides significantly more choice information (see Louviere, Eagle, & Cohen (2005) and references given there).

244 regular wine consumers (purchasing and drinking wine at least twice a month) from around Australia, recruited via a panel provider, completed the online experiment. As for BWS, the sample is very similar to the total population of Australian wine consumers (see Table 1).

Analysis and Results

1) Direct verbal attribute importance measurement

For BWS we counted the number of times an attribute was chosen as most important (best) and least important (worst) on aggregated level. (Marley & Louviere, 2005) Calculating the square root of the ratio of best to worst frequency counts for each attribute results in a bias free measure of attribute importance on a ratio scale (Marley & Louviere, 2005). This ratio scale can be standardised to a maximum value of 100 to result in a probabilistic scale (Mueller, Francis, & Lockshin, 2007). The relative importance of each attribute can then easily be compared by its coefficient to the most important attribute. For example country of origin is about half as likely to be chosen most important as brand.

According to the standardised importance measure in Table 3 verbal attributes such as brand, price and region are most important for respondents' purchase decision of a bottle of wine. Other verbal extrinsic attributes like medals/awards, country of origin and alcohol level follow in the middle. By contrast, all visual wine characteristics are consistently found as least important. Verbal Best Worst Scaling results imply that characteristics like bottle shape and colour, and label shape and colour only are five percent as important as brand. If these results are valid wine marketers could stop spending money on label design and fancy bottle shapes but instead sell their wine in brown paper bags.

The differentiation between verbal and visual extrinsic wine cues becomes even more prominent if we consider consumer heterogeneity. The standard deviation of the average best minus worst counts per attribute indicates how much attribute importance deviates over the total sample (Mueller, Rungie, Goodman, Lockshin, & Cohen, 2008). The relationship between attribute importance and importance heterogeneity is depicted in Figure 2.

Table 3: Verbal Best Worst Scaling results (n=740)

	Best	Worst	Sqrt(B/W)	Sqrt stand.	B-W Mean	Stdev
Brand	3052	145	4.59	100.0	3.93	2.94
Midpriced wine	2392	203	3.43	74.8	2.96	3.07
Promotional pricing	2577	302	2.92	63.7	3.07	3.35
Region of origin	2433	317	2.77	60.4	2.86	3.18
Medals awards	2321	386	2.45	53.4	2.61	3.50
Country of origin	1911	324	2.43	52.9	2.14	2.91
Bottle size	564	631	0.95	20.6	-0.09	1.99
Alcohol level	718	905	0.89	19.4	-0.25	3.21
Closure material	369	960	0.62	13.5	-0.80	2.42
Organic	358	1348	0.52	11.2	-1.34	3.22
Capsule material	259	1288	0.45	9.8	-1.39	2.46
Label style	212	1839	0.34	7.4	-2.20	2.38
Bottle shape	166	1896	0.30	6.4	-2.34	2.23
Bottle colour	128	2075	0.25	5.4	-2.63	2.37
Label shape	166	2708	0.25	5.4	-3.44	2.78
Label colour	134	2433	0.23	5.1	-3.11	2.60

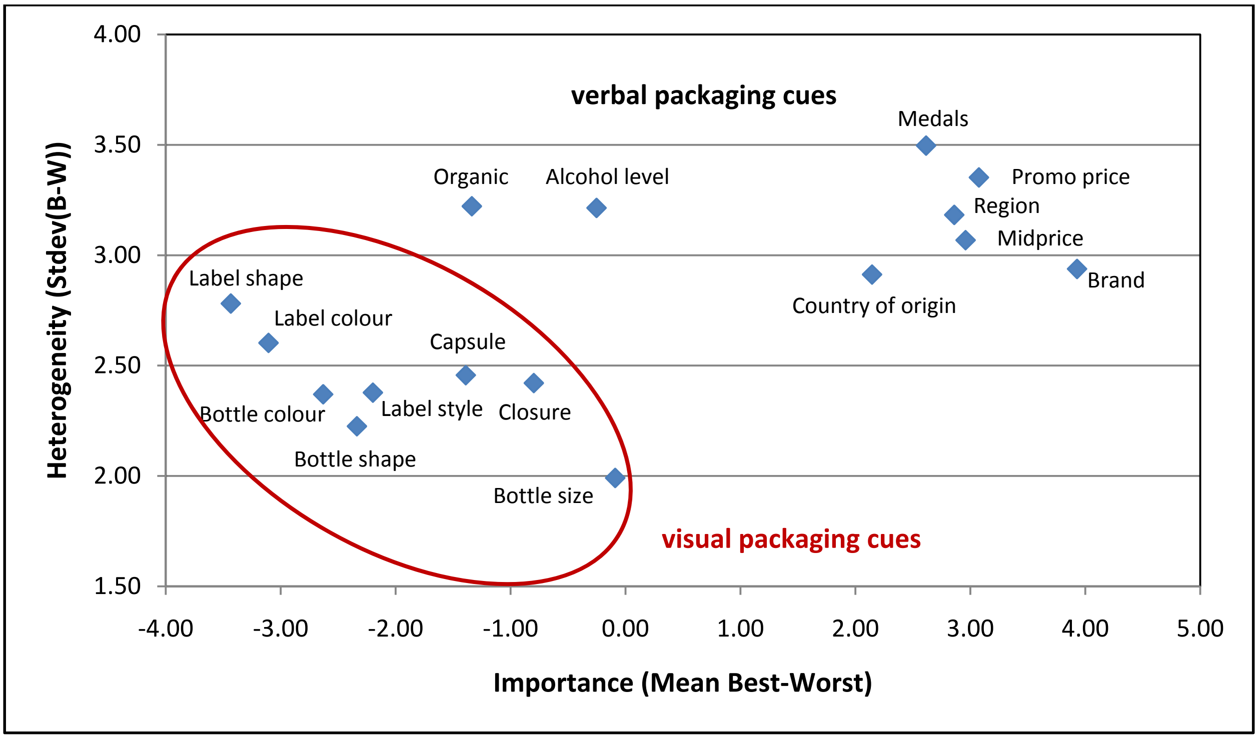


Figure 2: Relationship between attribute importance and heterogeneity

2) Indirect visual importance measurement

We used a scale extended latent class regression model to simultaneously estimate part worth utility parameters and class membership from our discrete choice experiment described above. Thereby individual-level Best-Worst scores for every attribute combination are regressed against the effects coded attribute levels. We specify a linear regression model from the generalised linear modelling (GLM) family in which parameters (part worth utilities) differ across latent classes (Vermunt & Magidson, 2005). Our latent class model is defined by three components, the assumed probability structure (general mixture model probability structure), the distributional characteristic of the response variable (continuous B-W scores) and the linear scale extended utility regression function (Magidson & Vermunt, 2007). We estimated the model with Latent GOLD Choice 4.5 syntax module (Beta version).

For our model the best fit (lowest BIC value) was achieved with a model of K=5 classes and S=2 scale classes (λ_1=1, λ_2=0.39 (Wald=50.4, p=0.00), n_{s1}=191, n_{s2}=53). Utility part worth estimates for attribute levels for all five classes are given in Table 4. Wald statistics are significant for all attributes except for bottle form and indicate that attribute part worth utilities are significantly different between the classes, with the exception of bottle form, which is equally unimportant for all consumers.

Attribute importance is derived by calculating the range of estimated parameter values for each attribute and then normalising by dividing each attribute's range by the sum of all the attribute ranges. Attribute importance weights derived in this way can be slightly biased by different utility scales. Because of strong non-linearity in estimated price part-worth utilities (see Table 5), a priori standardisation of estimates by a linear price vector β_{price} was not possible as it would rather increase any potential bias. In the recent available beta-version of Latent Gold Choice (Statistical Innovations, Belmont, MA, USA) a derivation of attribute importance by the contribution of every attribute to the Log-Likelihood of the overall model as used by Louviere & Islam (2007) is not yet possible.

Table 4: Attribute importance weights for classes

	Class1	**Class2**	**Class3**	**Class4**	**Class5**	**Mean**
Class size	30%	23%	27%	10%	10%	100%
Brand	22%	16%	6%	13%	8%	14%
Region	8%	2%	2%	4%	5%	4%
Bottle form	4%	0%	0%	1%	0%	1%
Label style	4%	10%	63%	51%	84%	34%
Label colour	16%	6%	18%	20%	2%	13%
Price	47%	66%	10%	12%	2%	33%

The last column of Table 4 shows that in average over the total sample label style was most important, very closely followed by price. Brand and label colour were almost equally important as third and fourth most important, whereas region and bottle form followed as least important. For the attribute levels, all classes prefer the better known brand McWilliams over the made-up brand name Jinks Creek. Similarly all classes reveal a higher probability of choosing the well known region McLaren Vale over the rather unknown region Henty. This lower than expected attribute importance weights of brand and region are likely caused by only considering two attribute levels compared to four levels for all other attributes (Wittink *et al.*, 1990). Future research with indirect visual importance measurement methods should include a similar number of attributes and levels of for all extrinsic attributes.

Table 5: Estimates of scale extended Latent Class choice model

		Class1	Class2	Class3	Class4	Class5	Mean	Std.Dev.	Wald	df	p
Class size		30%	23%	27%	10%	10%	100%				
		price + brand		**label style + colour**		**label style**					
		brand	price	flexible	chateau, graphic	minimalistic					
Predictors											
Brand	Jinks Creek	-0.835	-0.558	-0.195	-0.522	-0.250	-0.506	0.032	228.3	5	0.00
	McWilliams	0.835	0.558	0.195	0.522	0.250	0.506	0.032			
Region	Henty	-0.306	-0.072	-0.085	-0.173	-0.151	-0.163	0.022	33.1	5	0.00
	McLaren	0.306	0.072	0.085	0.173	0.151	0.163	0.022			
Bottle form	Bordeaux	0.145	-0.002	0.010	0.022	0.011	0.049	0.017	5.8	5	0.32
	Burgundy	-0.145	0.002	-0.010	-0.022	-0.011	-0.049	0.017			
Label style	traditional	0.101	0.029	0.910	-2.729	-2.118	-0.202	0.072	954.8	15	0.00
	chateau	0.168	-0.114	1.230	1.447	-0.497	0.461	0.073			
	graphic	-0.123	-0.303	1.129	1.443	-0.501	0.303	0.069			
	minimalistic	-0.145	0.388	-3.269	-0.161	3.116	-0.561	0.036			
Label colour	white	0.627	-0.073	0.223	0.648	0.010	0.297	0.066	172.5	15	0.00
	yellow	0.016	0.094	0.449	0.427	-0.050	0.188	0.065			
	orange	-0.016	0.183	0.161	-0.081	0.046	0.078	0.064			
	grey	-0.627	-0.204	-0.832	-0.994	-0.005	-0.563	0.029			
Price	$7.99	1.577	-2.612	-0.302	0.238	0.050	-0.188	0.073	883.7	15	0.00
	$12.99	-2.022	2.012	-0.367	-0.538	-0.028	-0.294	0.073			
	$17.99	-0.434	1.347	0.296	-0.149	-0.045	0.243	0.069			
	$22.99	0.879	-0.747	0.373	0.449	0.023	0.239	0.028			

R^2= 0.5325; LL =-8,048.99; BIC(LL) = 16,493.77, n = 244, #parameters = 72; Classification Error = 0.0857, 5 Classes and 2 Scale Classes

Nevertheless, the strength of visual extrinsic packaging cues, label style and label colour, stand in stark contrast to their importance measured by the direct verbal method above. The unimportance of bottle form for Australian wine consumers found in verbal only study indicates the reliability and power for discrimination of this indirect graphical measurement method – all three cues were almost equally unimportant when measured by the direct verbal method (Figure 2).

By jointly interpreting importance weights and attribute level utilities it becomes clear that the five classes can be grouped in two more general consumer types of almost equal size: consumers who consider price and brand as most important (class1 and class2 together form 53%), and respondents who mainly value label style and label colour (class3, class4 and class 5 amount to 47%).

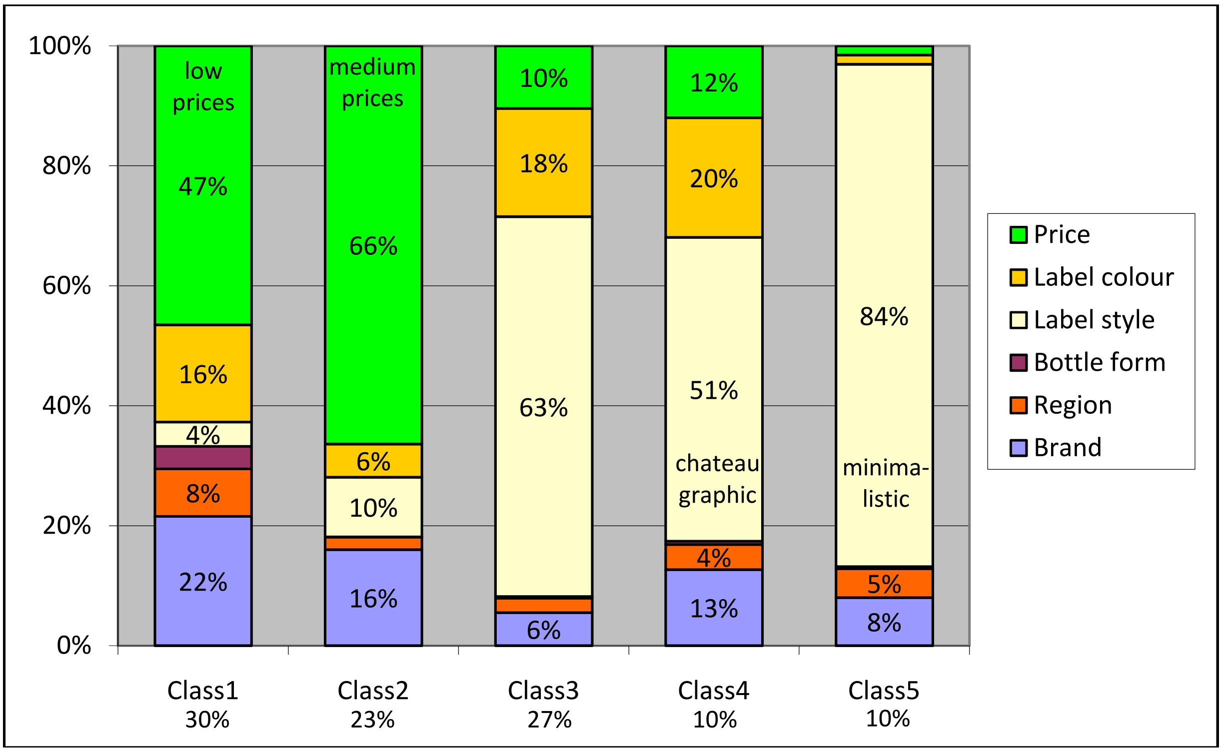


Figure 3: Importance weights for all classes

The first two classes base their wine choice mainly on price and brand, where class1 strongly prefers lower prices ($7.99), and class2 values medium prices ($12.99 and $17.99). Surprisingly consumers of class2 who favour medium prices and very likely perceive price as a quality indicator show a higher price importance than the low price choosing consumers of the first class. Label colour and label style of both price+brand classes are rather unimportant, but reveal different preferences. Whereas the low price class1 prefers traditional and chateau labels in white colour, the medium price class2 mostly likes minimalistic and traditional labels in yellow and orange. Given only two regions were considered in our experiment, class1 values region with the highest importance of all clusters.

Despite the fact that class3 and class4reveal relatively similar attribute importance weights, they differ in the attribute levels most preferred. Class3 has a wide tolerance for all label styles and colours as long as they are neither minimalistic nor grey; both levels are very much disliked by this class. Both other label style oriented classes 4 and 5 have much more specific label and colour preferences. While the fourth class also dislikes grey, it has a narrower colour preference for white and yellow labels. The traditional label style is very disliked by class4, whereas chateau and graphical label styles are equally well liked. Of all classes class5 seems to apply the simplest decision heuristic when choosing wine, only accepting the minimalistic label style. From all other attributes only brand and region are very marginally important. Future research should endeavour to investigate how valid this respondent choice behaviour is for real market transactions.

Table 6: Sociodemographic differences between clusters

	Class1		**Class2**		**Class3**		**Class4**		**Class5**		Total
	30%		23%		27%		10%		10%		100%
average age	42.3		48.6	b	37.1	a	45.2		45.0		42.9
female %	47.2		41.1		50.7		72.0		66.7		51.2
male %	52.8	b	58.9		49.3		28.0	a	33.3		48.8
number of children in hh	1.04		1.00		1.02		1.23	a	0.78	b	1.02
home owner %	55	a	74		69		68		78	b	67
education	average		average		highest		lower		lower		
part time working%	12		19		13	b	27	a	22		17

In the next step we characterised respondents in the five different clusters by differences in their sociodemographics and wine behaviour. Surprisingly we found no significant differences in the wine purchase or consumption frequency, wine involvement or subjective wine knowledge between the five classes. In contrast, consumer segments were most strongly discriminated by sociodemographic characteristics such as age and gender, which could be caused by the overrepresentation of graphical attribute levels in the choice design. Both classes with high price and brand importance have a higher than average share of male respondents, implicating a very cognitive decision process, whereas especially the classes 4 and 5 with very specific preferences for label style are significantly dominated by female wine consumers. This could be a confirmation of previous studies exploring gender differences in decision making (Venkatesh, Morris and Ackerman, 2000; Powell and Ansic, 1997) that females tend to be more affective than cognitive decision makers when it comes to wine choice. These two classes also show the lowest share of under- and postgraduate education degrees and the highest share of part-time working. The third class with a high importance of label style but rather broad acceptance of vivid colours and label styles has the lowest average age and shows the highest education level of all classes. Contrary the oldest consumer class2 shows a strong preference for medium and higher prices. The cluster with the highest preference for low prices also has the lowest rate of home ownership, which is very highly correlated with available income in Australia.

Discussion

Our first proposition that the indirect graphical method utilising DCE results in a higher importance for visual extrinsic wine attributes was confirmed. Label style and label colour were on average the most (34%) and the forth most important attribute (13%) in the DCE. This stands in contrast to the direct verbal BWS method where label colour and label style are by far the least important attributes. Bottle form was not found to be an important choice driver for Australian wine consumers in the choice experiment (1%) or the verbal Best Worst task. Contrary to the direct verbal method, the graphical indirect DCE was much better able to discriminate the relative importance of visual cues.

Visual cues had a comparable or higher variance than verbal cues of the same number of attribute levels, e.g. price, in the DCE and were found to be important drivers of consumer segmentation. This stands opposite to the verbal BWS where visual extrinsic cues had a distinct lower heterogeneity than verbal packaging cues (Figure 2). Thus, our second proposition was also empirically confirmed.

As previously discussed in the literature review, BWS and DCE are not expected to result in identical attribute and importance weights because they measure different underlying dimensions (Van Ittersum *et al.*, 2007) and rely on different referent frames (Louviere & Islam, 2007). Our extremely contrary attribute importance findings for visual cues by both methods can hardly be explained with different underlying dimensions of attribute relevance and determinance. Though, graphical stimuli define an unambiguous reference frame in the DCE we would have expected a higher and not a lower variance of attribute importance in the direct BWS if different mental reference frames were the main reason for our observed differences between both methods.

Besides these explanations, at least two further reasons are responsible for explaining the observed differences between visual and verbal methods. The first are social demand characteristics, responsible for answers respondents believe are socially accepted and right (Cooley, 1983), which also operate unconsciously. It is surely socially more accepted to purchase a wine for its taste, quality, brand and regional reputation than for its packaging design, which could result in a lower directly measured importance. Secondly, visual cues are known to have subliminal effects which we are not aware of (Bornstein, Leone, & Galley, 1987; Monahan, Murphy, & Zajonc, 2000). If respondents do not consciously realise the impact of visual cues like colour and label design, they will not be able to report those effects in direct importance measures. Subliminal effects can then only be deciphered and quantified if respondents replicate their choice behaviour with visual cues in close to real choice settings like choice experiments.

We found mainly gender and age to be discriminating variables between consumer segments between those with high importance of cognitive cues (brand and price) compared to visual cues (label style and label colour). Wine involvement and wine consumption or purchase frequency were not found to be significantly different between consumer segments. Because the focus of this research was to test the concept of the validity and importance of the measurement of visual wine packaging and labelling cues, future studies should include a broader range of attributes and levels to further refine the description of different consumer segments.

Conclusion

The importance of visual wine packaging cannot be measured with direct verbal instruments. Instead indirect visual methods like conjoint analysis and DCE employing graphics are necessary to reliably capture those attributes. This also implies that the validity of attribute importance of wine packaging variables measured with direct verbal elicitation (e.g. rating) has to be doubted.

Besides those insights for research methodology, our findings also have high managerial relevance. Wine marketers can not only use DCE with graphically combined attribute labels for concept testing in new product development to find which packaging attributes are most important for their target consumer segment. Instead, photographically real labels, prototypes and innovative wine packaging (e.g. cans, tetra packs) can be included and tested for their relative performance compared to competitor products (Srinivasan, Lovejoy, & Beach, 1997). Only tactile experiences cannot (yet) be simulated with computer based experiments. But today's available graphical computer methods, high internet band width and representative online panels give the wine industry the chance to relatively inexpensively test and develop their product packaging in close to real life shelf settings compared to very expensive real market introductions with their high failure likelihood.

The relative attribute importance of price, brand, region, label style, label colour and bottle form included in the DCE was too limited to cover a complete picture of what drives Australian wine drinkers as only a subset of extrinsic attributes were considered in order to limit the complexity of the choice design. Research by (Louviere & Islam, 2007) has confirmed that attribute importance depends on the number of attributes and levels considered in a choice task. Future research should therefore include more (all relevant) attribute and levels in graphical DCE experiments. This also requires practical solutions to apply very complex choice designs in visual choice analysis.

Acknowledgements

The authors wish to thank Stewart Gluth, Head of Graphic Design Studio at South Australian School of Art, UniSA. This work was financially supported by Australia's grapegrowers and winemakers through their investment body the Grape and Wine Research and Development Corporation (GWRDC), with matching funds from the Australian Government.

References

Auger, P., Devinney, T., & Louviere, J. (2007). Using Best–Worst Scaling Methodology to Investigate Consumer Ethical Beliefs Across Countries. *Journal of Business Ethics, 70*, 299-326.

Barber, N., Almanza, B. A., & Donovan, J. (2006). Motivational factors of gender, income and age on selecting a bottle of wine. *International Journal of Wine Business Research, 18*(3), 218-232.

Bornstein, R. F., Leone, D. R., & Galley, D. J. (1987). The generalizability of subliminal mere exposure effects: influence of stimuli perceived without awareness on social behavior. *Journal of personality and social psychology, 53*(6), 1070-1079.

Boudreaux, C. A., & Palmer, S. (2007). A charming little Cabernet: Effects of wine label design on purchase intent and brand personality. *International Journal of Wine Business Research, 19*(3), 170-186.

Cardello, A. V., & Sawyer, F. M. (1992). Effects of disconfirmed consumer expectations on food acceptability. *Journal of Sensory Studies, 7*(4), 253-277.

Childers, T. L., Houston, M. J., & Heckler, S. E. (1985).Measurement of Individual Differences in Visual Versus Verbal Information Processing. *Journal of Consumer Research, 12*(2), 125-134.

Cohen, S., &Orme, B. (2004). What's your preference? *Marketing Research, 16*(2), 32-37.

Cohen, S. H., &Neira, L. (2003). *Measuring preference for product benefits across countries: Overcoming scale usage bias with Maximum Difference Scaling.* Paper presented at the ESOMAR 2003 Latin America Conference Proceedings, Uruguay.

Cooley, C. H. (1983).*Human nature and the social order*: Transaction Publishers.

Dahan, E., &Srinivasan, V. (2000).The predictive power of Internet-based product concept testing using visual depiction and animation. *Journal of Product Innovation Management, 17*(2), 99-109.

Das, J. P., Kirby, J., &Jarman, R. F. (1975). Simultaneous and successive synthesis: An alternative model for cognitive abilities. *Psychological Bulletin, 82*(1), 87-103.

Deliza, R., MacFie, H., &Hedderley, D. (2003). Use of computer-generated images and conjoint analysis to investigate sensory expectations. *Journal of Sensory Studies, 18*(6), 465-486.

Deliza, R., &MacFie, H. J. H. (1996). The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: A review. *Journal of Sensory Studies, 11*(2), 103-128.

Domzal, T. J., & Unger, L. S. (1985). Judgments of verbal versus pictorial presentations of a product with functional and aesthetic features. *Advances in Consumer Research, 12*, 268-272.

Finn, A., & Louviere, J. J. (1992). Determining the Appropriate Response to Evidence of Public Concern: The Case of Food Safety. *Journal of Public Policy & Marketing, 11*(2), 12-25.

Gianluca, S., Donato, R., &Cavicchi, A. (2006). Consumer expectations, liking and willingness to pay for specialty foods: Do sensory characteristics tell the whole story? *Food Quality and Preference, 17*(1-2), 53-62.

Goodman, S., Lockshin, L., & Cohen, E. (2005).*Best-worst scaling : a simple method to determine drinks and wine style preferences*. Paper presented at the Second Annual International Wine Marketing Symposium, Sonoma State University, July 8-9.

Goodman, S., Lockshin, L., & Cohen, E. (2006).*Using the Best-Worst method to examine market segments and identify different influences of consumer choice.* Paper presented at the 3rd International Wine Business and Marketing Research Conference, July 6-8, Montpellier.

Goodman, S., Lockshin, L., & Cohen, E. (2007).influencers of consumer choice in a retail setting - more international comparisons. *Wine Industry Journal, 22*(6), 42-48.

Holbrook, M. B., & Moore, W. L. (1981). Feature Interactions in Consumer Judgments of Verbal Versus Pictorial Presentations. *Journal of Consumer Research, 8*(1), 103-113.

Huffman, C. (1997). Elaboration on Experience: Effects on Attribute Importance. *Psychology & Marketing, 14*(5), 451-474.

Imram, N. (1999).The role of visual cues in consumer perception and acceptance of a food product. *Nutrition and Food Science, 99*(5).

Islam, T., Louviere, J. J., & Burke, P. F. (2007). Modeling the effects of including/excluding attributes in choice experiments on systematic and random components. *International Journal of Research in Marketing, 24*(4), 289-300.

Jaeger, S. R. (2006).Non-sensory factors in sensory science research. *Food Quality and Preference, 17*(1-2), 132-144.

Jaeger, S. R., Hedderley, D., &MacFie, H. J. H. (2001). Methodological issues in conjoint analysis: a case study. *European Journal of Marketing, 35*(11/12).

Jarvenpaa, S. L. (1989).The effect of task demands and graphical format on information processing strategies. *Management Science, 35*(3), 285-303.

Kosslyn, S. M. (1994).*Elements of Graph Design*. New York: W. H. Freeman.

Lange, C., Martin, C., Chabanet, C., Combris, P., & Issanchou, S. (2002). Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. *Food Quality and Preference, 13*(7-8), 597-608.

Lohse, G. L. (1997). The role of working memory on graphical information processing. *Behaviour & Information Technology, 16*(6), 297-308.

Louviere, J., & Islam, T. (2008). A comparison of importance weights/measures derived from choice-based conjoint, constant sum scales and best-worst scaling. *Journal of Business Research, forthcoming.*

Louviere, J. J., Hensher, D. A., &Swait, J. D. (2000). *Stated Choice Methods: Analysis and Application*. Cambridge: Cambridge University Press.

Louviere, J. J., Schroeder, H., Louviere, C. H., & Woodworth, G. G. (1987). Do the parameters of choice models depend on differences in stimulus presentation: visual versus verbal presentation? *Advances in Consumer Research, 14*(1), 79-82.

Louviere, J. J., Eagle, T.C., E., & Cohen, S. H. (2005). Conjoint Analysis: Methods, Myths and Much More. Unpublished Working Paper, Centre for the Study of Choice (CenSoC), UTS Sydney.

Lurie, N. H., & Mason, C. H. (2007). Visual Representation: Implications for Decision Making. *Journal of Marketing, 71*(1), 160-177.

MacInnis, D. J., & Price, L. L. (1987). The Role of Imagery in Information Processing: Review and Extensions. *The Journal of Consumer Research, 13*(4), 473-491.

Magidson, J., &Vermunt, J. K. (2007). *Removing the scale factor confound in multinominal logit choice models to obtain better estimates of preference.* Paper presented at the Sawtooth Symposium Conference Proceedings.

Mandler, J., & Johnson, N. (1976). Some of thousands words a picture is worth. *Journal of Experimental Psychology: Human Learning and Memory, 2*, 529-540.

Marley, A. A. J., & Louviere, J. J. (2005). Some probabilistic models of best, worst, and best-worst choices.*Journal of Mathematical Psychology, 49*(6), 464-480.

Monahan, J. L., Murphy, S. T., &Zajonc, R. B. (2000). Subliminal Mere Exposure: Specific, General, and Diffuse Effects. *Psychological Science, 11*(6), 462-466.

Mueller, S., Francis, L., & Lockshin, L. (2007).Comparison of Best-Worst and Hedonic Scaling for the Measurement of Consumer Wine Preferences.Working Paper, Ehrenberg-Bass Institute for Marketing Science, University of South Australia.

Mueller, S., Lockshin, L., Louviere, J., & Hackman, D. (2007). Do respondents use extra information provided in online Best-Worst choice experiments? *Proceedings of the Xth Australian and New Zealand Marketing Academy (ANZMAC) Conference, Dunedin, New Zealand, 3-5 December 2007*, 3486-3493.

Mueller, S., Rungie, C., Goodman, S., Lockshin, L., & Cohen, E. (2008). Is there more information in Best Worst choice data? Using the variance-covariance matrix to consider respondent heterogeneity. Refereed paper, 4th *International Conference of the Academy of Wine Business Research*, Siena, 17-19thJuly, 2008.

Orth, U. R., &Malkewitz, K. (2006).Packaging design as resource for the construction of brand identity. Paper presented at the Proceedings of the *3rd Academy of Wine Business Research*, Montpellier.

Orth, U. R., &Malkewitz, K. (2008).Holistic packaging design and consumer brand impression. *Journal of Marketing*, 72, 64-81.

Paivio, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart and Winston, Inc.

Paivio, A., & Csapo, K. (1973). Picture superiority in free recall: Imagery or dual coding? *Cognitive Psychology, 5*(2), 176-206.

Pennings, J. M. E., & Smidts, A. (2003). The Shape of Utility Functions and Organizational Behavior. *Management Science, 49*(9), 1251-1263.

Pick, H. L., & Saltzman, E. (1978). Modes of perceiving and processing information. In P. H. L & E. Saltzman (Eds.), *Modes of perceiving and processing information*. Hillsdale, NJ: Lawrence Erlbaum.

Powell, M., &Ansic, D. (1997), Gender differences in risk behaviour in financial decision-making: An experimental analysis, *Journal of Economic Psychology*, 18(6), 605-628.

Rocchi, B., & Stefani, G. (2005). Consumers' perception of wine packaging: a case study. *International Journal of Wine Marketing, 18*(1), 33-44.

Sethuraman, R., Kerin, R. A., & Cron, W. L. (2005). A field study comparing online and offline data collection methods for identifying product attribute preferences using conjoint analysis. *Journal of Business Research, 58*(5), 602-610.

Silayoi, P., &Speece, M. (2007). The importance off packaging attributes: a conjoint analysis approach. *European Journal of Marketing, 41*(11/12), 1495-1517.

Smead, R. J., Wilcox, J. B., & Wilkes, R. E. (1981). How Valid Are Product Descriptions and Protocols in Choice Experiments? *Journal of Consumer Research, 8*(1), 37-42.

Sojka, J., & Giese, J. (2001). The Influence of Personality Traits on the Processing of Visual and Verbal Information. *Marketing Letters, 12*(1), 91-106.

Srinivasan, V., Lovejoy, W. S., & Beach, D. (1997).Integrated Product Design for Marketability and Manufacturing. *Journal of Marketing Research (JMR), 34*(1), 154-163.

Street, D. J., Burgess, L., & Louviere, J. J. (2005). Quick and easy choice sets: Constructing optimal and nearly optimal stated choice experiments. *International Journal of Research in Marketing, 22*(4), 459-470.

Szolnoki, G. (2007). *Die Messung des Einflusses der aeusserenProduktgestaltung auf die Kaufbereitschaft: dargestellt am Beispiel Weisswein (Measurement of the influence of extrinsic product design on purchase intent for white wine)*. Dissertation (PhD thesis) Justus-Liebig-UniversitaetGiesen, GeisenheimerBerichte Bd. 61, Geisenheim.

Van Ittersum, K., Pennings, J. M. E., Wansink, B., & van Trijp, H. C. M. (2007). The validity of attribute-importance measurement: A review. *Journal of Business Research, 60*(11), 1177-1190.

Venkatesh, V., Morris, M.G.,& Ackerman, P. (2000), A Longitudinal Field Investigation of Gender Differences in Individual Technology Adaptation Decision-Making Processes, *Organizational Behavior and Human Decision Processes*, 83(1), 33-60.

Vermunt, J. K., &Magidson, J. (2005). *Technical Guide for Latent GOLD 4.0: Basic and Advanced*. Belmont Massachusetts: Statistical Innovations Inc.

Vriens, M., Loosschilder, G. H., Rosbergen, E., &Wittink, D. R. (1998).Verbal versus Realistic Pictorial Representations in Conjoint Analysis with Design Attributes. *Journal of Product Innovation Management, 15*(5), 455-467.

Wittink, D. R., Krishnamurthi, L., &Reibstein, D. J. (1990). The Effect of Differences in the Number of Attribute Levels on Conjoint Results. *Marketing Letters, 1*(2), 113-123.

Modelling consumer sensory preference heterogeneity

A case study on how the choice of clustering method impacts implications for optimal product design

Simone Mueller, Leigh Francis, Larry Lockshin

The Australian Wine Research Institute

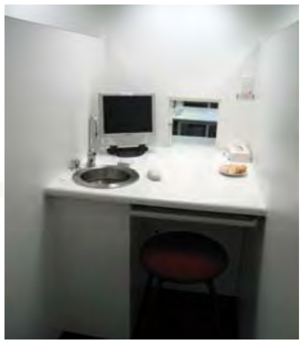
UniSA | Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Acknowledgements

Australian Government
Grape and Wine Research and Development Corporation

- This work is financially supported by Australia's grapegrowers and winemakers through their investment body the GWRDC, with matching funds from the Australian Government.
- The AWRI Brett research team: Belinda Bramley, Brooke Travis, Chris Curtin, Matt Holdstock, Geoff Cowey and Emma Kennedy.

Introduction



- Measuring *stated* wine preferences
- Modelling preference heterogeneity
  - Different consumes prefer different sensory wine characteristics (subjective quality)
- Modelling idiosyncratic scale usage
  - Rating: confound of preference and scale usage
- Optimal product design
  - Find drivers of sensory preferences

The Australian Wine Research Institute

Research questions

1) Which additional insights arise from taking consumer sensory preference heterogeneity into account?

2) Should idiosyncratic scale usage be considered?

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Case study:
Sensory scale test experiment

- Comparison of hedonic rating and Best Worst Scaling for wine evaluation
- Total sample n=112
- Only use hedonic rating of wines
  - structured 9-point scale

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Controlled experiment

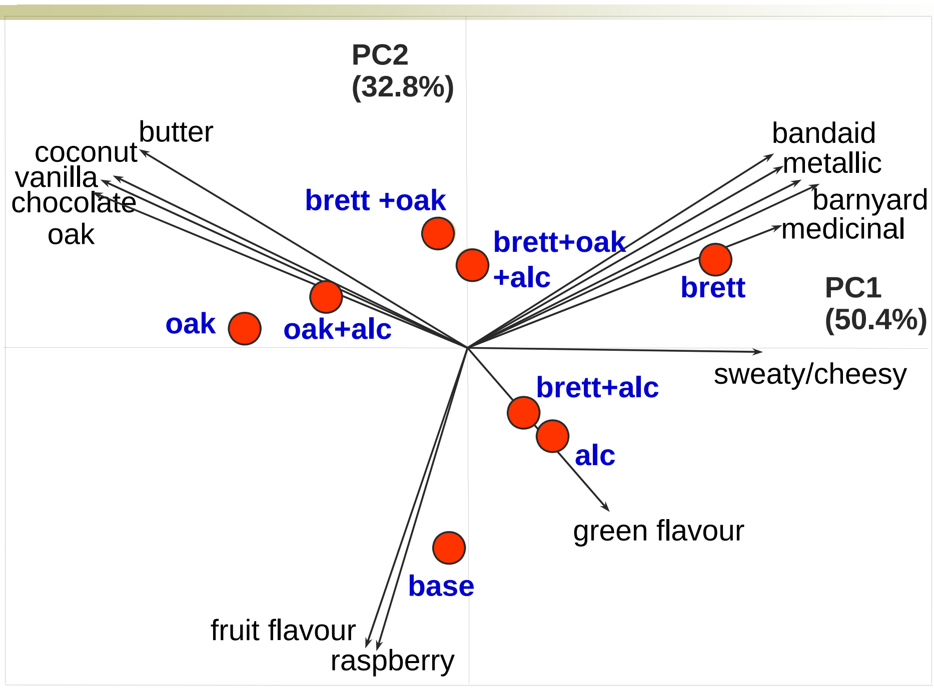
- 8 wines from 2006 Cabernet Sauvignon fruity base wine 14% Alc. adding three components
  - Oak flavour (oak lactone, vanillin, guaiacol)
  - Brettanomyces (4EP/4EG 9:1)
  - Alcohol (+ 2% ethanol)
- Full factorial design

	Code	Oak	Brett	Alcohol
1	Base	-	-	-
2	Brett	-	+	-
3	Brett + Alc	-	+	+
4	Brett + Oak	+	+	-
5	Brett + Oak + Alc	+	+	+
6	Oak	+	-	-
7	Oak + Alc	+	-	+
8	Alc	-	-	+

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Descriptive Analysis of the 8 wines



The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Liking: aggregated analysis

Wine	Components	Mean	Stdev
1	Base	5.85*	1.65
4	Brett + Oak	5.80	1.81
5	Brett + Oak + Alc	5.74	2.09
7	Oak + Alc	5.60	2.02
8	Alc	5.63	1.86
3	Brett + Alc	5.50	2.05
6	Oak	5.42	2.00
2	Brett	5.21*	2.06

ANOVA p=0.076

Only small difference in liking of wines on aggregated level

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Sensory drivers: aggregated

Component	HR Contrast		F
Brett	-0.03		0.29
Alc	0.02		0.16
Oak	0.05		0.74
Brett*Alc	0.03		0.34
Brett*Oak	**0.16**	**	8.46
Oak*Alc	0.01		0.02
Brett*Oak*Alc	**-0.09**	*	2.90
exposure	**-0.07**	*	1.69
R^2	0.38		
$F_{125,896}$	3.73		

Significance ** p<0.05, * p<0.10

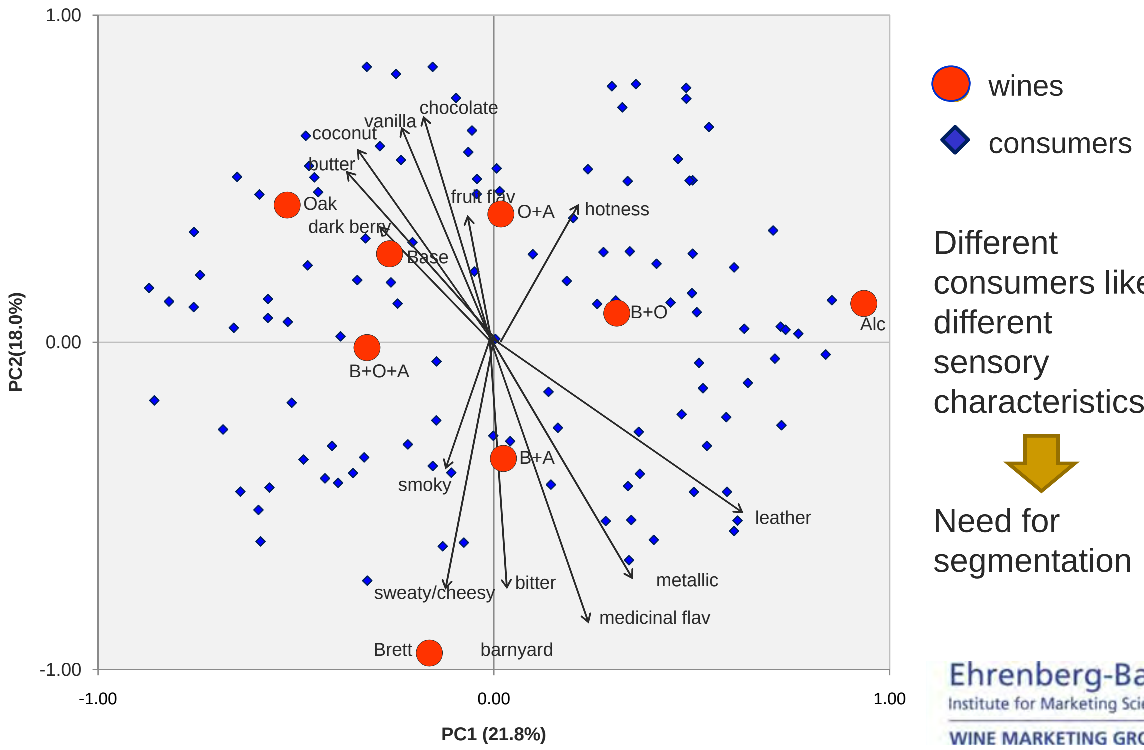
Only one significant factor driving preference on aggregated level

The Australian Wine Research Institute

UniSA

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

Extended internal preference map



Different consumers like different sensory characteristics

Need for segmentation

Ehrenberg-Bass Institute for Marketing Science
WINE MARKETING GROUP

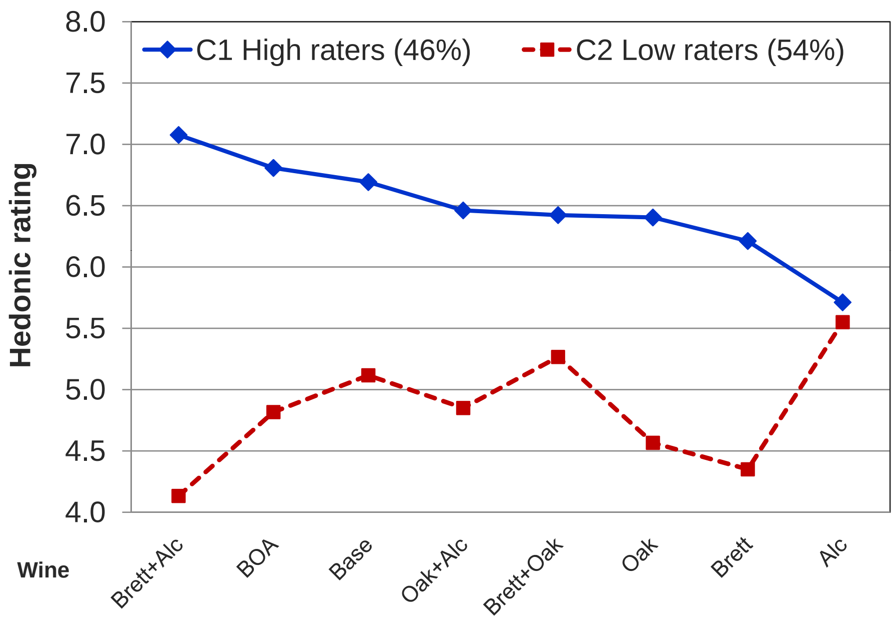
Segmentation without modelling scale usage

- Clustering with raw rating scores
  - Hierarchical clustering (Ward's)
  - Non-hierarchical clustering (K-Means)
  - Latent Class clustering
- All methods result in two clusters with low and high raters
- Example used here: Ward's clustering

The Australian Wine Research Institute

Ehrenberg-Bass Institute for Marketing Science
UniSA
WINE MARKETING GROUP

Example: Ward's clustering



The Australian Wine Research Institute

Ehrenberg-Bass Institute for Marketing Science
UniSA
WINE MARKETING GROUP

Sensory drivers

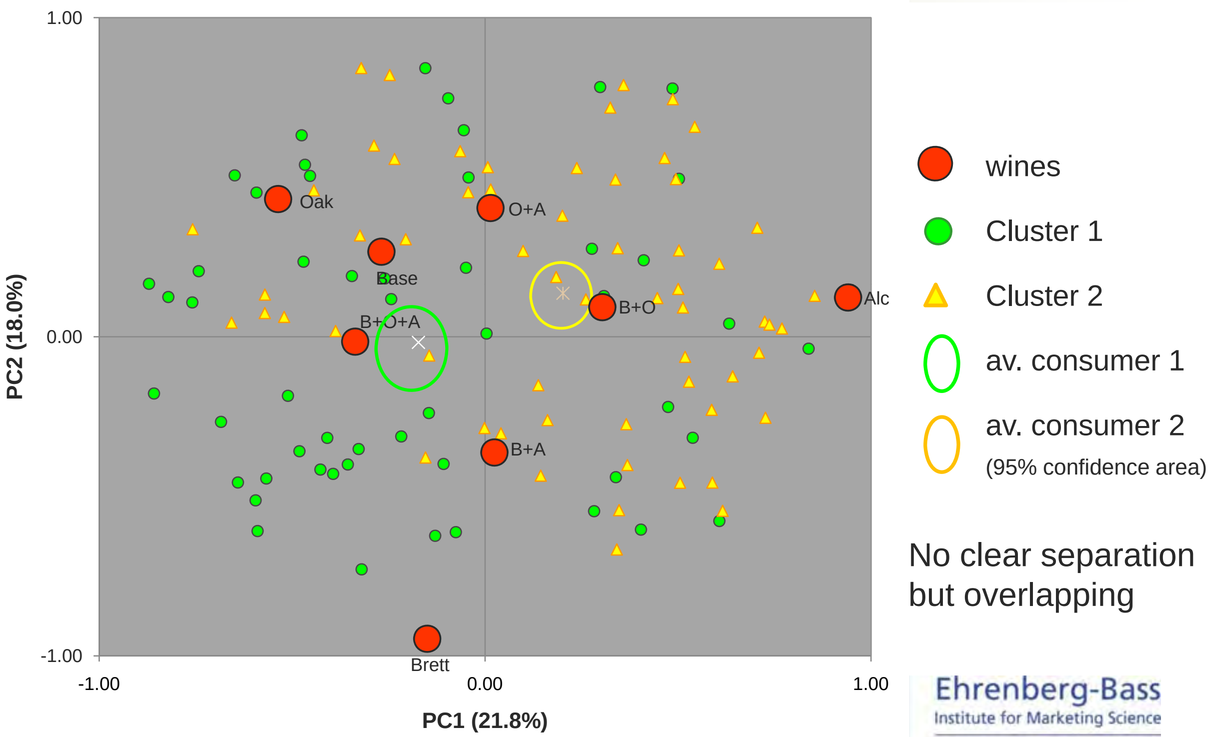
	Cluster 1 (n=52) Contrast		F	Cluster 2 (n=68) Contrast		F
Constant	**6.47**	**	685	**4.83**	**	415
Brett	**0.10**	**	4.36	**-0.10**	**	4.81
Alc	0.03		0.30	0.00		0.00
Oak	0.03		0.45	0.02		0.26
Brett*Alc	**0.17**	**	13.2	**-0.09**	**	4.00
Brett*Oak	-0.04		0.75	**0.18**	**	16.96
Alc*Oak	0.05		0.87	-0.03		0.31
Brett*Alc*Oak	**-0.12**	**	6.43	-0.01		0.01
exposure	0.00		0.00	0.07		2.72
Adj. R^2	0.28			0.34		
	$F_{80,416}=3.29$			$F_{80,544}=3.63$		

Significance **p<0.05;

The Australian Wine Research Institute

UniSA Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

Extended preference map



No clear separation but overlapping

Ehrenberg-Bass Institute for Marketing Science WINE MARKETING GROUP

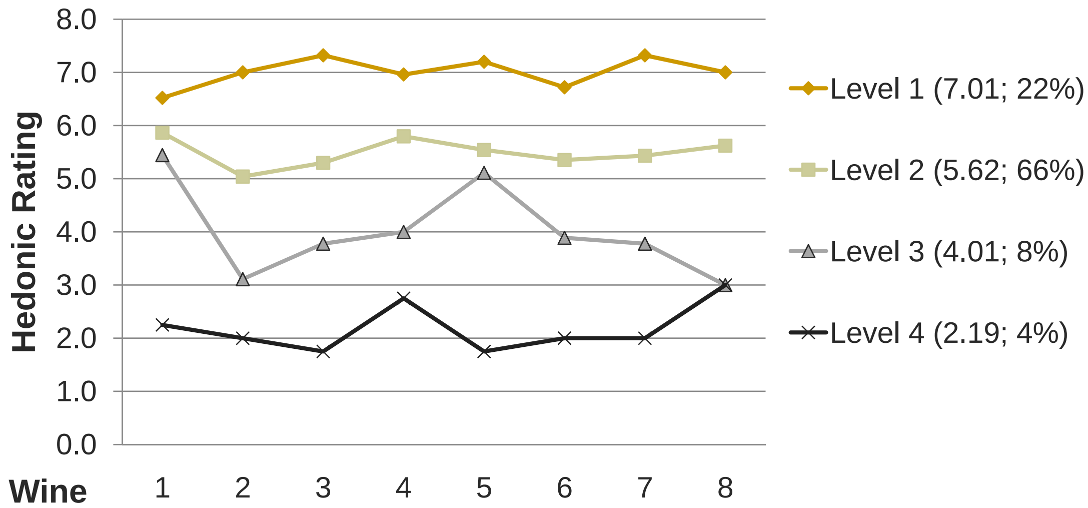
Considering scale usage

- 1) Remove scale influence before clustering
  - A) mean-centred rating data
    - Same rating anchor but different variance preserved
  - B) standardise: z-scores
    - Same rating anchor and rating variance
- 2) Model groups of similar average rating
  - Latent Class D-Factor Segmentation
  - 1st factor captures average scale
  - 2nd factor captures preference heterogeneity

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Scale usage factor

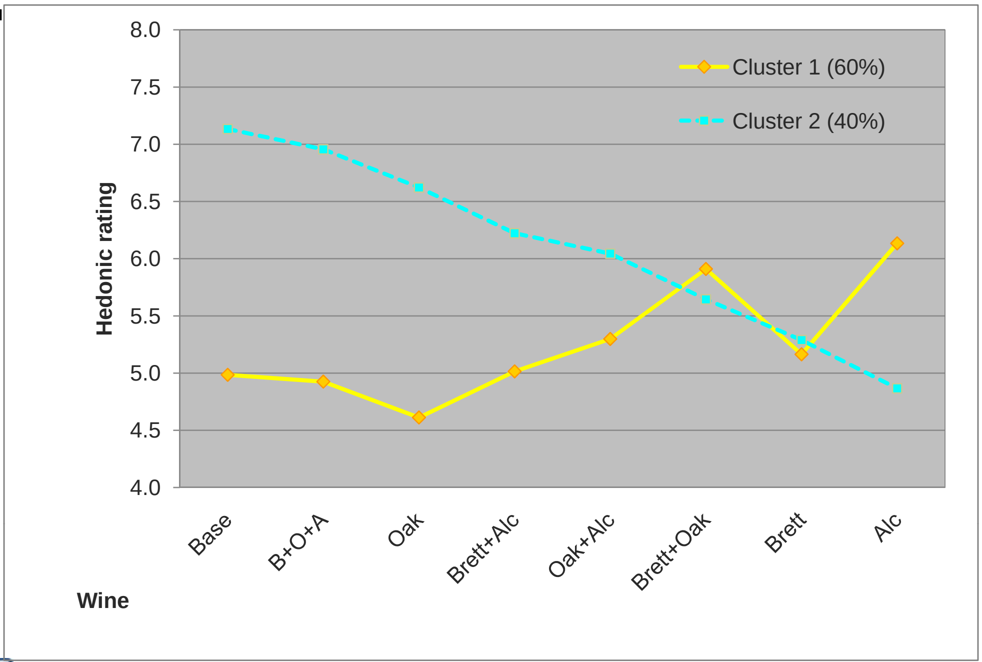


Separating groups of different scale usage (average rating)

The Australian Wine Research Institute

UniSA | Ehrenberg-Bass Institute for Marketing Science | WINE MARKETING GROUP

Preference
after correcting for scale usage

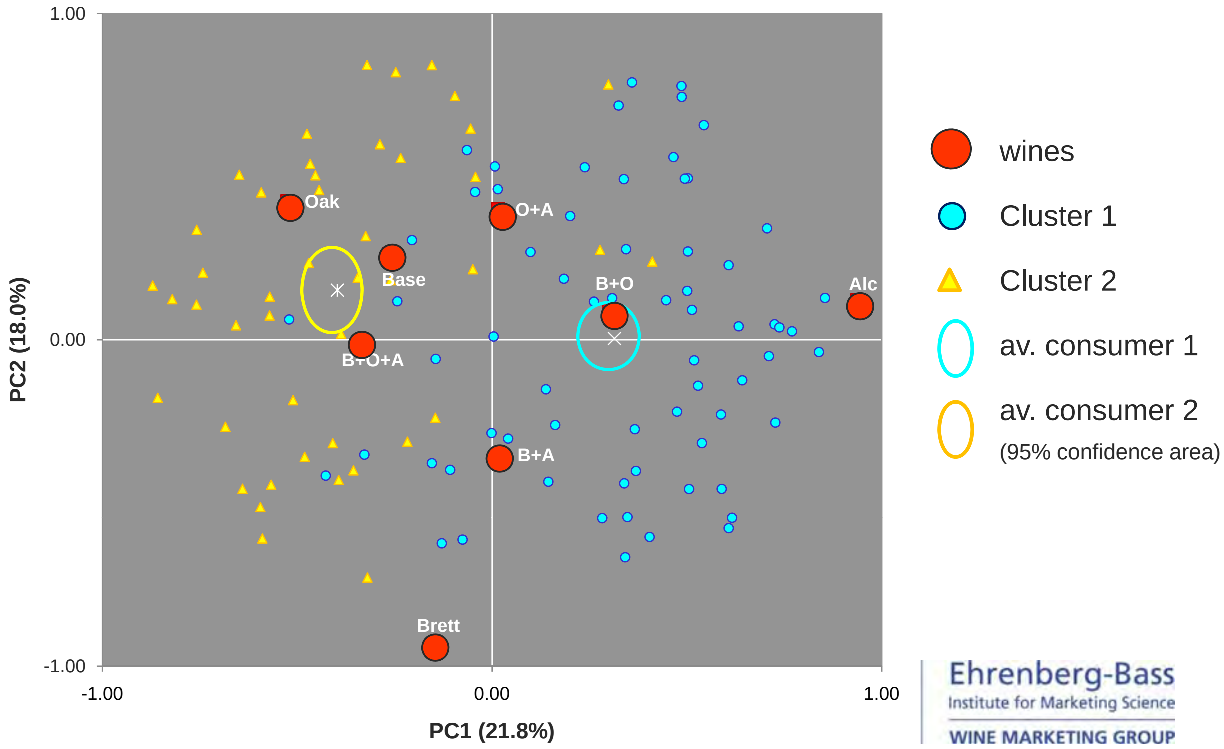


Sensory drivers

	Cluster 1 (n=67)			Cluster 2 (n=45)		
	Contrast		F	Contrast		F
Constant	**5.28**	**	5903	**6.10**	**	5827
Brett	-0.03		0.00	-0.06		0.63
Alc	0.09		1.75	-0.06		0.63
Oak	-0.08		1.22	**0.20**	**	6.45
Brett*Alc	**-0.36**	**	27.84	**0.64**	**	61.86
Brett*Oak	**0.22**	**	10.42	0.08		1.08
Alc*Oak	**-0.16**	**	5.40	**0.25**	**	9.69
Brett*Alc*Oak	-0.04		0.41	**-0.17**	**	4.58
exposure	-0.03		0.07	**-0.18**	**	2.97
Adj. R^2	0.43			0.44		
	$F_{80,536}$=4.41			$F_{80,360}$=4.08		

Significance **p<0.05; *p<0.10

Two preference clusters
(LatentClass D-Factor solution)



Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP

Summary

- Segmentation
  - captures consumer preference heterogeneity
  - allows analysis of factors driving liking
- Considering idiosyncratic scale usage for stated preferences
  - prevents segmentation of high and low raters
  - better separates preference groups
  - reveals more sensory drivers

The Australian Wine Research Institute

UniSA

Ehrenberg-Bass
Institute for Marketing Science
WINE MARKETING GROUP

Comparison of best–worst and hedonic scaling for the measurement of consumer wine preferences

S. MUELLER[1], I.L. FRANCIS[2] and L. LOCKSHIN[1]

[1] School of Marketing, University of South Australia, Adelaide, SA 5000, Australia
[2] The Australian Wine Research Institute, PO Box 197, Glen Osmond, Adelaide, SA 5064, Australia
Corresponding author: Dr Simone Mueller, fax +61 8 8302 0442, email simone.mueller@unisa.edu.au

Abstract

Background and Aims: Best–worst scaling (BWS) is compared to standard hedonic scaling for measuring consumer wine preferences. BWS is a relatively new method for producing ratio-level scales and has gained recent attention for application in sensory research, but has not been applied to wine.
Methods and Results: Regular wine consumers (112) evaluated eight designed wines with both scaling methods in an intra-subject design over two test periods. The methods did not result in comparable product liking results. The eight wines could almost be differentiated on an aggregated level with hedonic ratings ($P = 0.076$); there was no significant difference with BWS. Latent class analysis was used to identify two clusters, which differed on the preferences for the designed sensory components. The BWS design had to be split into several blocks, so no complete individual measures were available, which prevented analysing heterogeneity for this method.
Conclusions: BWS needs more wines to be assessed per person in order to discriminate between red wines and to allow modelling of consumer preference heterogeneity. Respondents would have to accomplish complete individual BWS designs, which requires repeated exposure to the same set of wines over several tasting sessions.
Significance of the Study: This study demonstrates that BWS is not as suitable for sensory consumer preference measurement of red wine as hedonic rating. While BWS has shown a higher discriminative ability for different products and in non-sensory research, the factors of alcohol, tannin and memory fatigue make it less practical for red wine sensory measurement compared to hedonic rating.

Abbreviations

BIBD Balanced Incomplete Block Design; **BWS** Best–Worst Scaling; **OMEP** Orthogonal Main Effects Plan

Keywords: *best–worst scaling, consumer wine preference measurement, designed wines, hedonic scaling, heterogeneity*

Introduction

A recent discussion initiated by Moskowitz (2005) came to the conclusion that sensory science needs to better understand the strengths and limitations of choice versus direct-scaling methods (Prescott 2005) for measuring consumer preferences. There has been a quiet revolution in consumer preference measurement with the advent of BWS, which is derived from the method of discrete choice (Finn and Louviere 1992, Marley and Louviere 2005). While choice methods such as paired preference comparisons have been used for a long time in sensory research, relatively few treatments can be examined with typical sample sizes. Choice-based conjoint methodology, which has a long tradition in social science, has only recently been applied to sensory measurement (Lange et al. 2000, Enneking et al. 2007, Jaeger and Rose 2008). Many food and beverage evaluations are made using hedonic scaling because of the perceived advantages of assessing samples monadically, reduced adaptation and fatigue effects and the efficiency of assessing multiple products. Hedonic scaling has its own set of disadvantages, but so far no other method has appeared that can be utilised as easily, conveniently and cost-effectively to assess acceptability.

BWS uses consumer choices of the best and worst items in a set of multiple items, which are usually concepts or written attributes, in a designed study to create an interval or ratio-based scale. BWS belongs to the family of stated choice methods, where traditionally only the best choice has been of interest to the researchers (Louviere et al. 2008). Recent research by Marley and Louviere (2005) and Marley et al. (2008) has proven that analysing the best and worst choices out of multiple items increases the information efficiency compared to only analysing the best choice. The BWS method overcomes several biases resulting from scores or ratings (Cohen and Neira 2003). BWS has been shown to be a powerful

doi: 10.1111/j.1755-0238.2009.00049.x

method for preference and importance measurement of products, attributes and other items that can be evaluated without tasting (Cohen and Orme 2004, Marley and Louviere 2005, Goodman et al. 2006, Auger et al. 2007, Louviere and Islam 2008).

There are at least two inherent problems known for rating scales: their measurement properties and their degree of discriminatory power. Regarding the first issue, scientists often assume that rating scales are interval scales with absolute differences between scale points (Crask and Fox 1987). This assumption of equal distance has been found to be frequently violated for rating scales in general (Gescheider 1988, Ben-Akiva et al. 1991, Bleichrodt and Johannesson 1997), as well as for the special case of sensory rating scales (Land and Shepherd 1984, Lawless and Malone 1986). While the 9-point hedonic scale (dislike extremely–like extremely) by Peryam and Pilgrim (1957) has been extensively studied and has been shown to be appropriate to be treated as an interval scale, there are known issues such as end effects and avoidance of the neutral category (Moskowitz 1980). Secondly, in social science, it is known that rating scales do not force consideration of relative importance; rating data can have poor discriminatory power, because each item is rated alone (Goodman et al. 2006, Flynn et al. 2007, Lee and Soutar 2007, Louviere and Islam 2008). Participants must guess at the level to assign for the first item without having any items to compare.

The BWS method was developed as a theory-driven procedure by Finn and Louviere (1992) to overcome these scaling problems. BWS is a multiple-choice extension of Thurstone's (1927) method of paired comparisons that is scale free and forces respondents to make a discriminating choice between the stimuli under consideration (Marley and Louviere 2005). According to Finn and Louviere (1992, p. 13) BWS 'models the cognitive process by which respondents repeatedly choose the two objects in varying sets of three or more objects that they feel exhibit the largest perceptual difference on an underlying continuum of interest'.

In our case of consumer preference measurement, the underlying continuum is the respondents' degree of liking of a set of sensory stimuli. From these sets, which are designed in accordance with a fractional factorial of a 2^N OMEP, respondents choose the most and least liked product in each set. BWS can be considered a special form of preference ranking. If a respondent completes a full BIBD, it is ensured that every possible stimuli pair is tasted the same number of times. The number of items in BIBD choice sets used in market research usually ranges between four and six, and rarely are more items presented (Finn and Louviere 1992, Chrzan 2005, Goodman et al. 2006, Auger et al. 2007, Louviere and Islam 2008). A choice set size of three allows a full ranking between the best, not chosen and the worst item. However, small choice sets restrict the number of usable BIBDs and the number of analyzable stimuli to a small subfraction of potential research questions.

The argument for the superiority of ranking over rating brought forward by Lee and O'Mahony (2005) is that ranking reduces the boundary variance between respondents. Respondents to rating scales have been shown to not agree on the positions of boundaries between numerical categories, whereas everyone is forced to agree on the boundary between the first and second ranked items, second and third ranked items, etc. The same is true for the boundary between the best and worst, or most and least liked. The task simplicity and familiarity to what humans do in many situations are assumed to increase the reliability of the BWS method (Cohen and Neira 2003, Auger et al. 2007). BWS forces respondents to make trade-offs between stimuli, and has been found to produce a higher level of discrimination than rating scales in market research (Flynn et al. 2007).

Various studies in sensory science give evidence that methods forcing trade-offs by respondents (e.g. pair-wise comparison or ranking tasks) also can have a higher discriminatory power than rating methods (e.g. Rodrigue et al. 2000, Villanueva et al. 2000, Dairou and Sieffermann 2002, Barylko-Pikielna et al. 2004, Delarue and Sieffermann 2004, Ishii et al. 2007).

Two first applications of BWS for measuring consumer preferences for meat patties and breakfast bars by Hein et al. (2008) and Jaeger et al. (2008) have recently revealed a slightly higher discriminative ability of BWS compared to hedonic rating, but BWS required a repeated product evaluation by respondents to produce individually complete BWS designs. Because red wine is a sensory fatiguing product, it seemed prudent to compare the discriminatory ability of both methods using the same number of consumer product evaluations.

This study has two research aims: to determine whether the 9-point hedonic scale and BWS produce comparable results when measuring sensory preferences for red wine; secondly, to establish whether BWS is better able to discriminate preferences for red wine than the 9-point hedonic scale. To address these research aims, we conducted two experiments. An initial pre-test estimated respondents' capacity to evaluate red wines in best–worst choice tasks, followed by a study using a set of designed wines, assessed using both BWS and, separately, the 9-point hedonic scale. The designed wines were derived by adding chemical components to a commercial base red wine. Two different groups of respondents participated in the capacity pre-test ($n = 24$) and the scale comparison test ($n = 112$).

Materials and methods

All sensory assessments were conducted in isolated sensory booths (ISO 8589: 1988), with a wine sample and room temperature of 22°C with aliquots of wine presented in three-digit coded ISO standard wine tasting glasses. Data were acquired using Biosystemes Fizz 2.3 (Couternan, France).

Pre-test

Subjects. Twenty-four regular red wine consumers between 23 and 56 years old, 58% women and 42% men, from the Adelaide Waite Agricultural Campus were recruited for the capacity pre-test. Respondents were regular red wine consumers consuming red wine at least once a month and were not trained in wine tasting.

Stimuli. Eight commercial Australian red wines with known sensory properties from a prior sensory descriptive consumer preference mapping study (Lattey et al. 2007) were used in the pre-test. Four Shiraz and four Cabernet Sauvignon wines were selected that were sufficiently different in their sensory characteristics.

Procedure. Respondents evaluated three sets of four wines, determining the best and worst in each set. The first and third sets contained the identical four Shiraz wines to assess respondents' response repeatability. A randomised presentation order within each set was used to control for order and carry-over effects (Macfie et al. 1989). In each glass, 30 mL of wine was presented and respondents were advised to only drink as much as necessary to make their decision of the best and worst wines of each set without expectorating. The respondents were allowed to taste wines more than once within a choice set if this was necessary for their decision. The amount of wine swallowed was quantified by measuring wine in the returned glasses for every respondent and choice set. After each set of four wines, the respondents rated the difficulty of the task (anchors – very difficult and very easy) and their perceived confidence in the decision (not confident, very confident) on a structured 7-point scale. Furthermore, tasters were able to comment after each choice set on how easy or difficult this tasting task was for them. After the final set, they were asked about the appropriateness of tasting three sets of four wines. The sensory data acquisition software recorded the time necessary to make the decision for each choice set. After the completion of the three choice sets, the respondents rested for at least 10 min before their blood alcohol content was measured by breath analysis using a breathalyser (Alcolizer LE from Alcolizer Pty Ltd, Cleveland, Australia).

Scale comparison test

Subjects. One hundred and twelve consumers were recruited via a commercial consumer panel provider (62% of sample) and also from the Adelaide Waite Campus (38%; Table 1). The national commercial consumer panel provider, PureProfile, has more than 420 000 Australian members and is actively managed to be representative for Australian consumers in general. Participants from the panel and the campus were recruited based on those consuming red wine at least once a month and who had purchased a bottle of red wine within the last month. An equal number of men and women from 18 to 65 years were targeted. Compared to the overall population of Australian red wine consumers, younger and more educated respondents are over-represented in the total sample of the scale comparison test (for more details comparing both subsamples, see Mueller et al. 2008). Respondents received a token payment of AUD 30 for their travel expenses and in appreciation of their time after both scale comparison tasting sessions.

Stimuli. Eight wines were prepared from a 2006 Cabernet Sauvignon base wine with 14% v/v alcohol, which was varied in a full factorial design across three attributes: oak flavour, alcohol and Brettanomyces flavour, were either added or not added components (see Table 2). The samples used were a subset of wines investigated as part of a larger sensory descriptive study (Bramley et al. 2008, Curtin et al. 2008). The major reason for using designed instead of commercial wines was to have closer control over the wines' attributes and to allow investigation of these important attributes on consumer acceptance (Hersleth et al. 2003, Nurgel 2005, Lambropoulos and Roussis 2007, Fontoin et al. 2008, Jones et al. 2008). The full factorial design allowed estimation of all two- and three-way interactions.

Table 1. Demographic profile of sample for scale comparison test ($n = 112$).

Gender	%	Personal income	%
Female	47	<$20 000 (AUD)	10
Male	53	$20–40 000	18
		$40–60 000	25
Age		$60–80 000	27
18–24	13	$80–100 000	10
25–34	29	$100–150 000	5
35–44	23	>$150 000	2
45–54	18		
55–64	13	Education	
>64	4	Under year 12	7
		High school	12
Marital status		Some tertiary	24
Single	48	degree	36
Married	47	Postgraduate	21
Divorced	3		
Widowed	2		

Table 2. Composition and codes for full factorial design wines for the scale comparison test.

No.	Code	Oak*	Brettanomyces†	Alcohol‡
1	Base	–	–	–
2	Brett	–	+	–
3	Brett + Alc	–	+	+
4	Brett + Oak	+	+	–
5	Brett + Oak + Alc	+	+	+
6	Oak	+	–	–
7	Oak + Alc	+	–	+
8	Alc	–	–	+

*Oak flavour (guaiacol 40 µg/L, 4-methylguaiacol 25 µg/L, vanillin 300 µg/L, *cis/trans* oak lactone 800 µg/L).
†*Brettanomyces* flavour (1200 µg/L 4-ethyl phenol, 133 µg/L 4-ethyl guaiacol).
‡Alcohol (+2% v/v ethanol).
–, no addition of sensory component to base wine; +, addition of sensory component to base wine.

Following a bench sensory assessment to ensure wines were sufficiently different in their sensory properties, a sensory descriptive analysis study was conducted. All eight wines were assessed in triplicate by 11 trained judges of the Australian Wine Research Institute's wine sensory descriptive panel. There were highly significant differences among the wines for numerous attributes. For further details, see Bramley et al. (2008).

Procedure. The respondents evaluated sensory liking of the eight wines with both methods, BWS and hedonic rating, using an intra-subject design on two separate days. After the first session, the participants returned after at least 1 day, and up to 1 week, for the second session. Half of the sample completed the BWS task before hedonic rating and vice versa.

For the hedonic rating task, the eight wines were monadically presented with a minute rest between each wine. The respondents indicated their overall opinion of each wine on the standard 9-point hedonic scale (dislike extremely–like extremely). For the BWS task, we chose the smallest orthogonal fraction for the eight wines to minimise respondent burden per choice task. We used a 14-choice-set orthogonal design with choice set size of four wines, where every stimulus appeared four times and pair frequency equalled three. The design was randomised to control for position and interaction effects: every wine appeared in each position the same number of times and each neighbour combination was equally distributed (Macfie et al. 1989). As determined by the pretest, every respondent only received a subset of two choice tasks of four wines each, requiring seven individuals to cover a whole replication of the 14 different choice tasks. The respondents were asked to choose the most and least liked wines in every choice set. They evaluated all four wines of each choice set at the same time and were allowed to retaste samples if necessary. As we wanted respondents to evaluate wines as naturally as possible and because consumers do not expectorate wine in normal consumption, we did not encourage them to spit out the wines during evaluation. Between the two choice sets, the respondents had a minute rest. For both methods, water and crackers for mouth cleansing were available to reduce carry-over effects.

Data analysis

According to Marley and Louviere (2005), taking the difference in the frequency of BWS scores (i.e. taking the number of times an item is considered 'most liked/best' and subtracting the number of times it is considered 'least liked/worst') is a close approximation of the true scale values (i.e. the scale obtained from multinomial logit (MNL) analysis). The statistical model underlying BWS assumes that the relative choice probability of a given pair is proportional to the distance between the two stimuli on the latent utility scale (Marley and Louviere 2005). In other words, this procedure scales each item against all others with zero representing the stimulus chosen most liked as often as chosen as least liked (Finn and Louviere 1992).

The difference between best and worst scores in a BWS experiment can either be calculated on a sample or a respondent level depending on the design (Flynn et al. 2007). Because respondents only completed a partial BIBD (2 out of 14 rows) in our experiment, available data on each respondent deviate from a typical verbal BWS task where every respondent completes a full design (e.g. Goodman et al. 2006, Auger et al. 2007, Louviere and Islam 2008). From the eight wines every respondent evaluated in two choice sets of four, s/he chose two as best (most liked), two as worst (least liked) and four were not chosen as best nor worst. A weighting method based on random ranking utility interpretations of the MNL model for forced choices suggested by Louviere et al. (2008) allows us to derive a (incomplete) ratio scale to calculate Sqrt($\text{best}_{\text{weighted}}/\text{worst}_{\text{weighted}}$) at the individual level. For a choice set size of four, this method implies weighting each option with 8, 4, 2 and 1 for the first to fourth ranks. In our case of the best and worst choice, only the non-chosen wine is weighted by its expected value of the second and third ranks which equals 3. Thus, each wine is weighted with 8, 3 or 1 if the wine was chosen as best, not chosen or chosen as worst, respectively. The resulting measure Sqrt(B_w/W_w) for every wine on an individual level therefore equals 0.35 if a wine was chosen worst, 1 if a wine was not chosen and 2.83 if it was chosen as best. Thus, the partial coverage of the BIBD where every respondent sees every wine only once results in a Sqrt(B_w/W_w) variable with only three distinct values and does not represent a complete ratio scale at the individual level.

Aggregated analysis. To test if the two methods are able to differentiate between the wines, an analysis of variance (ANOVA) was conducted for each method with liking (Sqrt(B_w/W_w)) and hedonic score as the dependent, and the eight wines and 112 consumers as the independent variables. A higher F value would be an indicator of higher discrimination among the wines. To evaluate the consistency of the aggregated preference rank order, we used Spearman's rho as the correlation coefficient. A high correlation between the mean rank orders of the wines for the two methods would indicate consistency. To compare if both methods reveal similar factors affecting consumer liking and disliking, we conducted a general linear model (GLM) analysis with hedonic rating and best–worst as dependent variables, and the three sensory components used for designing the wines and their interactions as independent variables, controlling for the effect of consumer.

ANOVA. All ANOVAs were conducted treating respondents as random effects in SPSS 16.0 (Chicago, IL, USA).

Considering heterogeneity. Consumers were clustered based on hedonic rating with a latent class k-factor clustering method (Magidson and Vermunt 2001, Vermunt and Magidson 2005) using Latent Gold (Statistical Innovations, Belmont, MA, USA). This clustering method is able to efficiently separate the relative difference in liking from the average response level. It identifies factors that group variables sharing a common source of variation. In this case of wine assessment, the first factor accounts for differences in response style between consumers, whereas the second factor segments consumers according to their preferences (Popper et al. 2004, Meullenet et al. 2007). For both resulting consumer preference clusters, we applied a GLM analysis separately and compared resulting factors affecting liking and disliking. Because of the large amount of missing data at the individual level caused by splitting the BWS design, clustering was not possible for the BWS data.

Results

Capacity pre-test

A small pre-test was conducted to indicate how many sets of BWS tasks with wine might be appropriate. It was found that respondents drank an average 174 mL (SD = 49 mL, minimum = 85 mL, maximum = 280 mL) of wine after the three BWS tasks. The volume of wine drunk did not significantly differ between the three BWS tasks, which indicates that there was no reduced sensitivity over the three sets in the sense that respondents had to drink more wine to come to a conclusion in the later BWS tasks. The blood alcohol concentration after the tasting reached an average 0.030 g/100mL (SD = 0.015 g/100 mL): three out of the 24 respondents exceeded the Australian legal driving limit of 0.05 g/100 mL blood alcohol concentration, all of whom were women.

The perceived ease of the BWS task was rated lower (more difficult) from the first and second to the third choice set (ANOVA: $F_{2,69} = 2.93$, $P = 0.06$). Perceived confidence in the decision reported by respondents also declined, but no significant difference was found between the choice sets (see Table 3). The average time per choice task increased slightly, but not significantly over the three BWS sets.

Eight of the 24 respondents stated they were able to evaluate more than 12 wines. Yet, the objective measure of repeatability between identical first and third choice sets indicates that the majority of respondents were overstrained by three choice sets with four wines each. Only a third of all respondents chose at least one wine consistently as best or worst in both sets. In contrast, 42% of respondents chose the wine they had chosen as best (worst) in the third set as worst (best) in the first set. Three respondents had a complete reversal of best and worst, and only one respondent replicated his best and worst chosen. When interpreting these findings, it should be considered that other studies of repeated exposure have shown a comparably weak replication consistency for untrained consumers (Köster *et al.* 2003, Cordelle et al. 2004). For wine, Lawless and Liu (1997) found that wine consumers had a significantly lower reliability between tasting sessions than experienced wine judges.

The significantly lower perceived ease of the task after two choice sets, the low evaluation repeatability and other measures, such as reduced confidence and longer decision time necessary, indicate that three choice sets of four wines are too much for most untrained wine consumers. These objective measures are also supported by the comments respondents gave after each choice task. Especially after the third task, the respondents reported comments such as 'rising astringency makes assessment difficult', 'I feel affected by the alcohol' and 'I had problems seeing differences between the last four wines'. Measures of perceived ease and perceived confidence suggest that two choice sets of four wines with a break in-between are feasible for untrained consumers. To ensure the reliability of consumer wine evaluations and to limit the impact of alcohol, we therefore decided to limit the BWS task to two choice sets of four wines per respondent. Nevertheless, eight wines per tasting sessions are in the upper range of other hedonic rating wine consumer studies (Lawless and Liu 1997, Hersleth et al. 2003).

Because respondents drank an average of 58 mL wine (SD 17.8 mL) per choice set, we decided to reduce the volume per glass to 20 mL in the final test. This allowed us to limit the maximum amount respondents could ingest to 160 mL per person, thereby decreasing exposure to alcohol.

Table 3. Perceived ease of task, confidence of the decision and time per best–worst scaling task.

	Average	SD
Perceived ease of task rating		
Set 1	4.92[a]	1.18
Set 2	4.83[a]	1.34
Set 3	4.08[b]	1.41
Perceived confidence rating		
Set 1	4.96	1.30
Set 2	4.92	1.38
Set 3	4.58	1.35
Time		
Set 1 (s)	194	89
Set 2 (s)	197	77
Set 3 (s)	199	92

Different superscript letters: significantly different $P < 0.05$

Scale comparison test

Aggregated analysis for each method. The hedonic ratings for the eight wines were assessed by a two-way ANOVA measuring the effects of wine and respondents, and showed almost significant differences between the wines ($F_{7896} = 1.85$; $P = 0.076$). A post hoc Tukey HSD difference test ($P < 0.10$) found that the most and least liked wines 1 and 2 were significantly different. Table 4 shows generally small differences in liking among the eight wines, the most and least liked wines differ only by 0.62 points on the 9-point scale. The base wine and complex wines derived by adding several components (e.g. Brett + Oak or Brett + Oak + Alc) were most liked by consumers according to the hedonic rating.

For analysing the BWS data, the difference of the number of times a wine was chosen as most liked (best) and least liked (worst) was calculated on an aggregated level. The square root of best divided by worst

(Sqrt(B/W)) results in a ratio scale with the 0-point represented by a wine that was only chosen as worst (Marley and Louviere 2005). This ratio scale was standardised to 100 for easier interpretation (see Table 5). In BWS, the ratio of the most and least liked wines of 67/100 can be interpreted as the least liked wine is only liked 0.67 times as much as the most liked wine. The standardised scale suggests that liking of the wines was only partially differentiated by BWS.

To conduct the two-way ANOVA assessing wine and respondents, the Sqrt(B_w/W_w) was used as the dependent variable, which can be calculated on an individual level. The rank correlation between the aggregate level Sqrt(B/W) and the means of individual Sqrt(B_w/W_w) was high with a value of 0.952 (Table 6). This showed the weighting system accurately portrayed the aggregate results while allowing individual level data.

From the ANOVA, there was no significant difference among respondents ($F_{111,896} = 0.001$) or wines ($F_{7,896} = 0.860$). These results indicate that in this case, BWS is not able to differentiate between preferences for the wines. The inability to discriminate between respondents is not surprising, as there were incomplete ratio scales at the individual level because of the fact that the design was divided over multiple respondents.

An assessment of statistical power for the ANOVA was investigated by weighting the sample with different factors. Doubling the BWS data resulted in an almost significant differentiation between the wines ($F_{7,1792} = 1.853$; $P = 0.074$), whereas tripling reaches significance ($F_{7,2688} = 2.519$; $P = 0.006$). This is an indication that fewer data per respondent are a possible explanation for the lower ability to differentiate between the wines using BWS. Thus, more respondents are necessary for BWS to reach comparable discriminative power as HR when using alcoholic beverages, such as wine, where capacity is limited. The ability of BWS to discriminate between respondents depends on each respondent accomplishing a full BWS design and would not improve with more respondents.

When comparing the order of wines in Tables 4 and 5, it is obvious that both methods derive a different liking order of the eight wines. The consistency of the resulting consumer preferences was measured by calculating the rank-order correlation of the wines' hedonic rating and Sqrt(B/W) with Spearman's rho. The low and insignificant value of rho = 0.286 confirms that the methods do not yield consistent rankings.

Table 4. Overall liking of wines with hedonic rating ($n = 112$) sorted in descending order.

Wine	Components	Mean	SD
1	Base	5.85	1.65
4	Brett + Oak	5.80	1.81
5	Brett + Oak + Alc	5.74	2.09
7	Oak + Alc	5.60	2.02
8	Alc	5.63	1.86
3	Brett + Alc	5.50	2.05
6	Oak	5.42	2.00
2	Brett	5.21	2.06

Factors affecting liking and disliking for both methods. Because the eight wines were designed from the same base wine, it was of interest to analyse if the three sensory components and their interactions can explain consumer liking within the two preference methods. We conducted separate GLM analysis with hedonic rating and Sqrt(B_w/W_w) as dependent variables, and sensory components, consumer and experimental order as independent variables (Table 7).

Only the regression for hedonic rating was significant ($F_{8,895} = 3.73$; $P = 0.00$; $R^2 = 0.38$). The interaction of Brettanomyces and oak (Brett*Oak) had a significant, but small positive influence on hedonic rating. The three-way interaction of Brettanomyces, oak and alcohol (Brett*Oak*Alc) was found to have an almost significant ($P = 0.09$) negative effect. The respondents' hedonic rating was significantly lower when they already experienced the same wine in the BWS tasting before. This exposure effect corresponds with findings for repeated exposure and stimulus satiation by Hetherington (2002), Köster et al. (2003) and Frøst (2006). Relating the sensory components to BWS scores did not result in any significant relationship.

Again, hedonic rating proved to be better able to explain consumer wine preferences based on sensory characteristics. Nevertheless, only two significant independent variables found for the hedonic rating data

Table 5. Overall liking of wines with best–worst scaling ($n = 112$) sorted in descending order.

Wine	Components	Best	Worst	B–W	Sqrt(B/W)	Std. Sqrt
4	Brett + Oak	32	23	9	1.18	100
8	Alc	33	24	9	1.17	99
6	Oak	31	27	4	1.07	91
1	Brett	25	23	2	1.04	88
2	Base	29	28	1	1.02	86
7	Oak + Alc	28	33	−5	0.92	78
5	Brett + Oak + Alc	26	34	−8	0.87	74
3	Brett + Alc	20	32	−12	0.79	67

Table 6. Correspondence of Sqrt(B/W) and Sqrt(Bw/Ww) ($n = 112$).

Wine	Components	Sqrt(B/W)	Sqrt(B_w/W_w)	
			Mean	SD
4	Brett	1.18	1.39	0.95
8	Brett + Alc	1.17	1.40	0.96
6	Oak + Alc	1.07	1.35	0.95
1	Brett + Oak	1.04	1.28	0.87
2	Alc	1.02	1.31	0.94
7	Brett + Oak + Alc	0.92	1.27	0.95
5	Base	0.87	1.23	0.93
3	Oak	0.79	1.14	0.84

Table 7. Influence of sensory components on liking with both methods ($n = 112$).

Component	HR		BWS	
	Beta	t	Beta	t
Brett	−0.01	−0.45	−0.03	−0.89
Alc	0.01	0.34	−0.04	−1.18
Oak	0.02	0.72	0.01	0.43
Brett + Alc	0.02	0.52	−0.05	−1.51
Brett + Oak	**0.08***	2.48	0.03	0.90
Oak + Alc	0.00	0.10	−0.03	−0.81
Brett + Oak + Alc	−0.05	−1.45	0.03	0.88
Exposure	**−0.10***	−2.95	0.00	−0.05
R^2	0.02		0.00	
F_{8895}	2.256		0.859	

Significance $*P < 0.05$

suggest that there is a relatively weak relationship between liking and the sensory composition of the eight designed wines. Those findings could also indicate that high preference heterogeneity is prevalent within the sample. Individual effects can cancel each other out on a sample level, if for instance, some respondents dislike a sensory attribute like Brettanomyces flavour, while others like it or are indifferent.

For both preference measurement methods, there are indicators which suggest consumer preference heterogeneity. The hedonic ratings in Table 4 have a relatively high standard deviation of 1.65–2.05 points on a 9-point scale. In contrast, the values of Sqrt(B_w/W_w) in Table 6 showed a lower standard deviation for every wine. A further indicator is the strength of the linear relationship between the frequency count of best and Sqrt(B/W), which is an indicator of existing heterogeneity between individuals (Marley and Louviere 2005). It can be assumed that the respondent group is homogeneous if the best counts can explain close to 100% of the variance of Sqrt(B/W). The comparatively low R^2 of 0.76 in our case suggests that individuals' preferences may be described more efficiently by separate clusters. In a next step, we will therefore consider sample heterogeneity when analysing factors affecting liking and disliking on a cluster level. Because of limited BWS data availability because of splitting up the BWS design over multiple respondents, this is only possible for hedonic rating.

Table 8. Two clusters of second latent class factor for hedonic rating representing different product liking.

Code		Cluster 1 ($n = 67$)		Cluster 2 ($n = 45$)	
		Mean	SD	Mean	SD
1	Base	4.99[a]	1.44	7.13[d]	0.97
2	Brett + Oak	5.16[ab]	1.93	5.29[ab]	2.27
3	Brett + Oak + Alc	5.01[a]	2.00	6.22[bcd]	1.94
4	Oak + Alc	5.91[cb]	1.86	5.64[ab]	1.73
5	Alc	4.93[a]	2.18	6.96[cd]	1.19
6	Brett + Alc	4.61[a]	1.92	6.62[cd]	1.45
7	Oak	5.30[ab]	2.09	6.04[bc]	1.83
8	Brett	6.13[c]	1.66	4.87[a]	1.90
	Delta HR	1.52		2.27	

Means within a column with different letters are significantly different $P < 0.05$

Modelling consumer segments. For hedonic rating, a comparison of results from several cluster methods (hierarchical methods, K-means, latent class cluster models) found strong evidence of inter-individual differences in scale usage, as has been previously shown by Yeh et al. (1998), Cox et al. (2001) and Cordelle et al. (2004). Derived clusters mainly differed in their average rating (high raters and low raters), but also to a lesser extent in their relative wine preference. Grouping consumers according to liking levels across products is not very meaningful in differentiating products from one another (Meullenet et al. 2007).

A 2-(4,2) LC factor model of two factors with four and two levels each provided the best fit to the data (Bayesian information criterion = 3674), whereby the first factor with four levels corresponds to the respondents' rating level effects. Average hedonic scores across the eight wines for the four levels of the first scale usage factor were 7.01 (level 1 with 22% of respondents), 5.49 (level 2 with 66%), 4.01 (level 3 with 8%) and 2.19 (level 4 with 4%). The interpretation of the first factor as a level effect is further supported by the fact that the correlation between individual respondents' hedonic ratings and the average liking of the level was 0.89.

The second dichotomous factor with two levels represents the relative difference in liking of the eight wines (Table 8 and Figure 1). These two levels of the preference factor are referred to as clusters in the following. A two-way ANOVA assessing the effects of wine and respondent shows significant differences in liking for six of the eight wines between the two clusters, and one wine nearly significant with $P = 0.054$. Compared to the aggregated analysis, both clusters show larger differences of rating

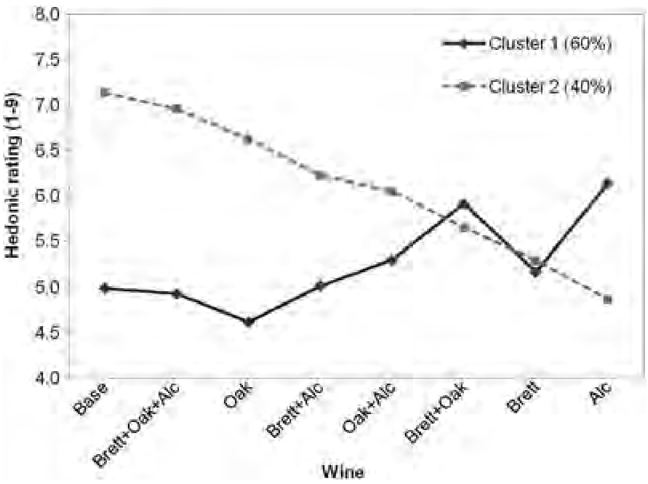


Figure 1. Average liking for the eight wines for both hedonic rating preference clusters.

between the most and least liked wines of each cluster (1.52 and 2.27 points compared to 0.64).

For both clusters, an ANOVA of hedonic ratings within wines (cluster 1: $F_{7,536} = 7.137$, $P = < 0.001$; cluster 2: $F_{7,360} = 12.557$, $P < 0.001$) and respondents (cluster 1: $F_{66,536} = 4.50$, $P < 0.001$; cluster 2: $F_{44,360} = 3.195$, $P < 0.001$) was strongly significant. Post hoc Tukey tests found three and four homogeneous subsets of hedonic ratings for the two clusters (see Table 8). These findings substantiate our prior statement that distinct wine preferences have cancelled each other out on the aggregated level, and thereby caused a weak discrimination between the wines for hedonic rating.

A cluster-wise GLM with hedonic rating as dependent and sensory components and their interactions as independent variables reveals different factors affecting like and dislike for both clusters and is able to explain a higher share of variance than on aggregated sample level (Table 9). Significant sensory compounds have the opposite sign for both clusters signalling different effects on sensory preferences. There was a significant positive interaction effect of Brett*Oak for the first cluster, with a negative effect on liking scores of Brett*Alc and Oak*Alc. The second cluster mostly dislikes wine eight with high Brett. If Brettanomyces is combined with either of the other sensory components, hedonic liking by this cluster increases. Therefore, it is not surprising that Oak and the two-way interactions between Brett*Alc and Alc*Oak were found to be significantly positive in the regression. Only the second cluster shows a significant negative 'exposure' effect of the wines, with the hedonic rating decreasing when wines were previously experienced in the BWS tasting.

Considering consumer heterogeneity, the cluster-wise regression reveals that Oak and all two- and three-way interactions of the three sensory compounds influence consumer liking over all clusters and not only the interaction Brett*Oak as suggested by the aggregated analysis (see Table 6). Cluster analysis also shows that most of the wines can be discriminated by hedonic rating, which was not obvious from the aggregated analysis.

Table 9. Cluster-wise regression of hedonic rating against sensory components.

	Cluster 1 ($n = 67$)		Cluster 2 ($n = 45$)	
	Beta	*t*	Beta	*t*
Constant	**5.28****	64.7	**6.10****	67.4
Brett	0.00	−0.02	−0.04	−0.77
Alc	0.05	1.08	−0.04	−0.83
Oak	−0.04	−0.85	**0.12****	2.43
Brett + Alc	**−0.19****	−4.57	**0.34****	7.05
Brett + Oak	**0.12****	2.87	0.03	0.59
Alc + Oak	**−0.08****	−2.00	**0.14****	2.86
Brett + Alc + Oak	−0.02	−0.57	**−0.09***	−1.82
Exposure	**−0.13****	−3.17	0.00	0.08
Adj. R^2	0.065		0.145	
	$F_{8,535} = 5.676$		$F_{8,559} = 8.598$	

Significance $*P < 0.10$; $**P < 0.05$

The respondents' limited tasting capacity for red wine made splitting up the design into more than one individual necessary. For n stimuli, there exist $\frac{n*(n-1)}{2}$ pair-wise preference relationships which could be completely reconstructed by n ratings. When every respondent tastes the same number of wines n as in hedonic rating, BWS only gives data on a fraction of those preference pairings. In our case of eight stimuli and two choice sets with a size of four, only 10 out of 28 possible pair-wise preference rankings are known, which equals 35.7% of those revealed by hedonic rating. Which of the pair-wise preference rankings are known for every respondent depends on how the wines were allocated to the two choice sets of four wines. Only respondents who had the same wines in their two choice sets (in our case four of all 112 respondents) produce a comparable pattern of revealed and unknown pair-wise rankings. Thus, because of the large amount of missing data at the individual level caused by splitting the design, modelling heterogeneity is not possible for our BWS data.

This is certainly a disadvantage of BWS over hedonic rating when using alcoholic beverages. Future wine preference studies using a full individual design will have to test if modelling individual preferences with BWS sufficiently improves the discriminatory power compared to hedonic rating as confirmed for meat patties by Jaeger et al. (2008).

Discussion

Hedonic rating and BWS did not yield consistent consumer preferences for red wines in this experiment where respondents evaluated the same number of stimuli with both methods. On the aggregated sample level, hedonic rating had a higher discriminative power than BWS, even when the same respondents evaluated the same wines on different days.

As confirmed by our pre-test, the respondents face sensory and alcohol ingestion-capacity limitations when evaluating alcoholic beverages like wine. This implies that individuals cannot complete a full BIBD of practical size for wine at the same sensory session, given two or more sets of four wines. A full BIBD would have to be split up over several sensory sessions incurring potential inter-day inconsistencies and significantly higher data collection costs. But, subdividing a BIBD into more than one person does not allow the generation of complete BWS ratio scales on an individual level. In our experiment where respondents completed two choice sets of four stimuli, BWS only generated 10 out of 28 possible pair-wise preference rankings for eight stimuli. BWS can generate more information by using two potential strategies. The first is to ask respondents to accomplish more BWS choice tasks per person. This is less likely for alcohol-based beverages, but could be used with a wide range of other food and beverage products (Jaeger et al. 2008). The second strategy is to generate as many pair-wise preference rankings as possible within each BWS task. Choice sets of three items result in a complete ranking when the best and worst are chosen by respondents; all three possible pair-wise preference rankings are revealed. Choice sets of larger size only generate a subset of possible pair-wise rankings within a set; in our example of four stimuli, only five of all six existing preference pairs are disclosed. This can be increased merely by asking respondents to choose the best and worst, and then to choose the 'next best' and 'next worst'. For both strategies, increasing the number of possible BWS choice tasks has a greater influence on data availability. Even for the minimum choice set size of three, respondents have to encounter stimuli several times to elicit complete pair-wise preference relationships.

Reduced data availability for the same number of stimulus encounters was substantiated in our research by the sensitivity analysis of the statistical power of ANOVA, which became significant with between two and three times as many respondents. Merely copying the existing responses and reanalysing showed BWS to significantly discriminate between the wines. BWS had lower standard deviations, so there may be uses when more discrimination is needed, but there are fewer wines to rate, such as when comparing similar wines to choose a blend.

Psychological and physiological impacts are the two major experimental influences causing response bias in sensory stimulus discrimination. A BWS task can be modelled as finding the pair of wines which has the greatest difference on a scale (Marley and Louviere 2005), in our case a liking scale. Rousseau and O'Mahony (2002) and Lee and O'Mahony (2004) reviewed cognitive strategies for the comparison of distances in Thurstonian contexts, and pointed out memory decay and memory interference as potential cognitive influences.

To generate a response in a sensory BWS task, successive stimulus sensations have to be stored in memory until all samples have been tasted and a comparison with the memorised sensation can be completed. In a choice task with four stimuli, the final stimulus is compared with the decaying memory trace of the adjacent third tasted stimulus, the more decayed memory trace of the second tasted stimulus and finally the most decayed memory trace of the first tasted stimulus.

The bias of memory decay is amplified by the mutual interference of memories, where a memory trace of a preceding stimulus can be distorted or less readily retrieved because of mutual interference with new tasting impressions. Because of those memory-related issues, three-sample task difference tests were found to be less sensitive to stimulus differences than two-sample tasks. Lau et al. (2004) showed for a triangle test that the memory interference effect was more important than mere stimulus decay. The task of memorizing four stimuli in a BWS choice task before being able to make a decision is more complex compared to the monadic presentation in hedonic rating. Cognitive distortion effects by memory decay and memory interference can be one explanation of the weaker wine discrimination of BWS. Both effects could be reduced in BW choice tasks by using only three stimuli instead of four.

Carry-over between stimuli and taste fatigue are two important physiological effects, which are more likely to bias responses in BWS than in monadic hedonic rating. Carry-over is a sequence effect that is caused by sensory adaptation from one stimulus to the succeeding in the sense that stimulus A might not elicit the same perceptual sensation if tasted after itself or tasted after an alternative stimulus B (Köster 2003, O'Mahony and Rousseau 2003). The tasting design of our study controlled for order effects, but the retasting possibility in BWS might have caused unaccounted carry-over effects. Carry-over effects are also potentially higher because tastings within a BWS choice set did not include a certain time distance between the four stimuli. As mouth cleansing was not enforced within a choice set, taste residuals between the four wines were more likely.

Taste fatigue is not fully understood, but it can be reduced by inter-stimulus rinsing which we did not enforce within a choice set. Because of its content of alcohol and tannins, red wine is a product which imposes higher taste fatigue on the respondent (Guinard et al. 1986, Gawel et al. 2001, Colonna et al. 2004, Pickering and Robert 2006). Prior studies, which found a higher discriminatory power of ranking compared to rating methods, predominantly used less fatigue causing stimuli (e.g. sweet corn by Rodrigue et al. 2000, vanilla pudding by Ishii et al. 2007 and apple juice by Barylko-Pikielna et al. 2004). More research into the general suitability of trade-off enforcing sensory methods like ranking and BWS for untrained consumer wine evaluation is necessary. Certainly, assessment of white wines should result in fewer of these carry-over effects.

Both physiological effects might have been further increased by retasting which was allowed in the BWS task at any time and as much as desired. In practice, respondents could have retasted many more times than in the monadic hedonic rating procedure, before they made their judgement. Future studies should test if compulsory rinsing between all stimuli in the BW choice task and not allowing the retasting of wine might reduce carry-over and taste fatigue without decreasing memorizing the stimuli.

To sum up, in visual and auditory stimuli, physiological interference from carry-over and fatigue is minimal, and the duration of a test with a comparable number of stimuli is relatively short (Lee et al. 2007). Methods forcing respondents to build trade-offs, such as ranking (Lee and O'Mahony 2005) and BWS (Goodman et al. 2006, Auger et al. 2007, Flynn et al. 2007) have proven to be powerful in the discrimination of visual stimuli. In sensory tasting tasks, cognitive factors such as imperfect memory and more pervasive physiological effects (carry-over and fatigue) can play a considerable role and most likely have decreased the performance of respondents in the BWS task for wine. The only prior sensory study by Jaeger et al. (2008) applying BWS to meat patties which also varied in their visual appearance (consistency and colour of the surface and inside) allowed respondents a better visual orientation than is possible for designed wines with identical appearance. Furthermore, these stimuli had a less fatiguing effect than alcoholic beverages like wine.

In conclusion, as BWS requires more product exposures than hedonic rating, BWS studies would have to trade-off higher testing costs by substantially increased product discrimination or a better prediction of consumers' product choice in real markets if it is to be of academic or commercial use for consumer red wine evaluation.

Acknowledgements

The authors wish to thank Brooke Travis and Belinda Bramley from the Australian Wine Research Institute (AWRI) sensory team; the AWRI sensory panel; and the AWRI 'Brett' research team, including Matt Holdstock, Chris Curtin, Emma Kennedy and Geoff Cowey. This work was financially supported by Australia's grapegrowers and winemakers through their investment body, the Grape and Wine Research and Development Corporation, with matching funds from the Australian government.

References

Auger, P., Devinney, T. and Louviere, J.J. (2007) Using best–worst scaling methodology to investigate consumer ethical beliefs across countries. Journal of Business Ethics **70**, 299–326.

Barylko-Pikielna, N., Matuszewska, I., Jeruszka, M., Kozlowska, K., Brzozowska, A. and Roszkowski, W. (2004) Discriminability and appropriateness of category scaling versus ranking methods to study sensory preferences in elderly. Food Quality and Preference **15**, 167–175.

Ben-Akiva, M., Morikawa, T. and Shiroishi, F. (1991) Analysis of the reliability of preference ranking data. Journal of Business Research **23**, 253–268.

Bleichrodt, H. and Johannesson, M. (1997) An experimental test of a theoretical foundation for rating-scale valuations. Medical Decision Making **17**, 208–216.

Bramley, B., Curtin, C., Cowey, G., Holdenstock, M., Coulter, A., Kennedy, E., Travis, B., Mueller, S., Lockshin, L., Godden, P. and Francis, L. (2008): Wine style alters the sensory impact of 'Brett' flavour compounds in red wines. In: Proceedings of the Thirteenth Australian Wine Industry Technical Conference, 28 July–2 August 2007, Adelaide, SA, Australia. Eds. R. Blair, P. Williams and S. Pretorius (Australian Wine Industry Technical Conference Inc.: Urrbrae, South Australia) p. 294.

Chrzan, K. (2005) The options pricing model: An application of best-worst measurement, Sawtooth Software Research Paper Series. Sawtooth Software Inc., Sequim, WA.

Cohen, S.H. and Neira, L. (2003) Measuring preference for product benefits across countries: overcoming scale usage bias with maximum difference scaling. ESOMAR 2003 Latin America Conference Proceedings, Punte del Este, Uruguay.

Cohen, S. and Orme, B. (2004) What's your preference? Marketing Research **16**, 32–37.

Colonna, A., Adams, D. and Noble, A. (2004) Comparison of procedures for reducing astringency carry-over effects in evaluation of red wines. Australian Journal of Grape and Wine Research **10**, 26–31.

Cordelle, S., Lange, C. and Schlich, P. (2004) On the consistency of liking scores: insights from a study including 917 consumers from 10 to 80 years old. Food Quality and Preference **15**, 831–841.

Cox, D.N., Clark, M.R. and Mialon, V.S. (2001) A cross-cultural methodological study of the uses of two common hedonic response scales. Food Quality and Preference **12**, 119–131.

Crask, M.R. and Fox, R.J. (1987) An exploration of the interval properties of three commonly used marketing research scales: a magnitude estimation approach. Journal of the Market Research Society **29**, 317–339.

Curtin, C., Bramley, B., Cowey, M., Holdstock, E., Kennedy, E., Lattey, K., Coulter, A., Henschke, P., Francis, L. and Godden, P. (2008) Sensory perceptions of 'Brett' and relationship to consumer preference. In: Proceedings of the Thirteenth Australian Wine Industry Technical Conference 28 July–2 August 2007, Adelaide, SA, Australia. Eds. R. Blair, P. Williams and S. Pretorius (Australian Wine Industry Technical Conference Inc.: Urrbrae, South Australia) pp. 207–211.

Dairou, V. and Sieffermann, J.M. (2002) A comparison of 14 jams characterized by conventional profile and a quick original method, the Flash Profile. Journal of Food Science **67**, 826–834.

Delarue, J. and Sieffermann, J.-M. (2004) Sensory mapping using Flash profile. Comparison with a conventional descriptive method for the evaluation of the flavour of fruit dairy products. Food Quality and Preference **15**, 383–392.

Enneking, U., Neumann, C. and Henneberg, S. (2007) How important intrinsic and extrinsic product attributes affect purchase decision. Food Quality and Preference **18**, 133–138.

Finn, A. and Louviere, J.J. (1992) Determining the appropriate response to evidence of public concern: the case of food safety. Journal of Public Policy and Marketing **11**, 12–25.

Flynn, T.N., Louviere, J.J., Peters, T.J. and Coast, J. (2007) Best–worst scaling: what it can do for health care research and how to do it. Journal of Health Economics **26**, 171–189.

Fontoin, H., Saucier, C., Teissedre, P.-L. and Glories, Y. (2008) Effect of pH, ethanol and acidity on astringency and bitterness of grape seed tannin oligomers in model wine solution. Food Quality and Preference **19**, 286–291.

Frøst, M.B. (2006) Liking and exposure: first, second and tenth time around. Physiology and Behavior **89**, 47–52.

Gawel, R., Iland, P.G. and Francis, I.L. (2001) Characterizing the astringency of red wine: a case study. Food Quality and Preference **12**, 83–94.

Gescheider, G.A. (1988) Psychophysical scaling. Annual Review of Psychology **39**, 169–200.

Goodman, S., Lockshin, L. and Cohen, E. (2006) Using the best–worst method to examine market segments and identify different influences of consumer choice. Proceedings of the 3rd International Wine Business and Marketing Research Conference, Montpellier, France (Academy of Wine Business Research: Montpellier).

Guinard, J.-X., Pangborn, R.M. and Lewis, M. (1986) The time-course of astringency in wine upon repeated ingestion. American Journal of Enology and Viticulture **37**, 184–189.

Hein, K.A., Jaeger, S.R., Carr, T.B. and Delahunty, C.M. (2008) Comparison of five common acceptance and preference methods. Food Quality and Preference **19**, 651–661.

Hersleth, M., Mevik, B.-H., Naes, T. and Guinard, J.-X. (2003) Effect of contextual factors on liking for wine-use of robust design methodology. Food Quality and Preference **14**, 615–622.
Hetherington, M.M. (2002) Stimulus satiation: effects of repeated exposure to foods on pleasantness and intake. Appetite **38**, 19–28.
Ishii, R., Chang, H.K. and O'Mahony, M. (2007) A comparison of serial monadic and attribute-by-attribute protocols for simple descriptive analysis with untrained judges. Food Quality and Preference **18**, 440–449.
Jaeger, S.R. and Rose, J.M. (2008) Stated choice experimentation, contextual influences and food choice: a case study. Food Quality and Preference **19**, 539–564.
Jaeger, S.R., Jørgensen, A.S., Aaslyng, M. and Bredie, W. (2008) Best–worst scaling: an introduction and initial comparison with nomadic rating for preference elicitation with food products. Food Quality and Preference **19**, 579–588.
Jones, P.R., Gawel, R., Francis, I.L.Waters, E.J. (2008) The influence of interactions between major white wine components on the aroma, flavour and texture of model white wine. Food Quality and Preference **19**, 596–607.
Köster, E.P. (2003) The psychology of food choice: some often encountered fallacies. Food Quality and Preference **14**, 359–373.
Köster, E.P., Couronne, T., Leon, F., Levy, C. and Marcelino, A.S. (2003) Repeatability in hedonic sensory measurement: a conceptual exploration. Food Quality and Preference **14**, 165–176.
Lambropoulos, I. and Roussis, I.G. (2007) Inhibition of the decrease of volatile esters and terpenes during storage of a white wine and a model wine medium by caffeic acid and gallic acid. Food Research International **40**, 176–181.
Land, D.G. and Shepherd, R. (1984) Scaling and ranking methods. In: Sensory analysis of foods. Ed. J.R. Piggott (Elsevier Applied Science: London) pp. 141–177.
Lange, C., Issanchou, S. and Combris, P. (2000) Expected versus experienced quality: trade-off with price. Food Quality and Preference **11**, 289–297.
Lattey, K., Bramley, B., Francis, I.L., Herderich, M. and Pretorious, S. (2007) Wine quality and consumer preferences: understanding consumer needs. Australian and New Zealand Wine Industry Journal **225**, 31–39.
Lau, S., O'Mahony, M. and Rousseau, B. (2004) Are three-sample tasks less sensitive than two-sample tasks? Memory effects in the testing of taste discrimination. Perception and Psychophysics **66**, 464–474.
Lawless, H. and Liu, Y.F. (1997) Evaluation of wine quality using a small-panel hedonic scaling method. Journal of Sensory Studies **12**, 317–332.
Lawless, H. and Malone, G. (1986) The discriminative efficiency of common scaling methods. Journal of Sensory Studies **1**, 85–98.
Lee, H.S. and O'Mahony, M. (2004) Sensory difference testing: Thurstonian models. Food Science and Biotechnology **13**, 841–847.
Lee, H.S. and O'Mahony, M. (2005) Sensory evaluation and marketing: measurement of a consumer concept. Food Quality and Preference **16**, 227–235.
Lee, H.S., van Hout, D. and Hautus, M.J. (2007) Comparison of performance in the A-Not A, 2-AFC, and same-different tests for the flavor discrimination of margarines: the effect of cognitive decision strategies. Food Quality and Preference **18**, 920–928.
Lee, J.A. and Soutar, G.N. (2007) Measuring values using best–worst scaling: the LOV example. Psychology & Marketing **24**, 1043–1058.
Louviere, J.J. and Islam, T. (2008) A comparison of importance weights and willingness-to-pay measures derived from choice-based conjoint, constant sum scales and best-worst scaling. Journal of Business Research **61**, 903–911.
Louviere, J.J., Street, D., Burgess, L., Wasi, N., Islam, T. and Marley, T. (2008) Modeling the choices of individual decision-makers by combining efficient choice experiment designs with extra preference information. Journal of Choice Modelling **1**, 128–163.
Macfie, H.J., Bratchell, N., Greenhoff, K. and Vallis, L.V. (1989) Designs to balance the effect of order of presentation and first-order carry-over effects in Hall tests. Journal of Sensory Studies **4**, 129–148.
Magidson, J. and Vermunt, J.K. (2001) Latent class factor and cluster models, bi-plots, and related graphical displays. Sociological Methodology **31**, 223–264.
Marley, A.A.J. and Louviere, J.J. (2005) Some probabilistic models of best, worst, and best–worst choices. Journal of Mathematical Psychology **49**, 464–480.
Marley, A.A.J., Flynn, T.N. and Louviere, J.J. (2008) Probabilistic models of set-dependent and attribute-level best-worst choice. Journal of Mathematical Psychology **52**, 281–296.
Meullenet, J.-F., Xiong, R. and Findlay, J. (Eds.) (2007) Consumer segmentation techniques. In: Multivariate and probabalistic analyses of sensory science problems. (IFT Press, Blackwell Publishing: Oxford, UK) pp. 111–127.
Moskowitz, H.R. (1980) Psychometric evaluation of food preferences. Journal of Foodservice Systems **1**, 149–167.
Moskowitz, H.R. (2005) Thoughts on subjective measurement, sensory metrics and usefulness of outcomes. Journal of Sensory Studies **20**, 347–362.
Mueller, S., Francis, L. and Lockshin, L. (2008) The relationship between wine liking, subjective and objective wine knowledge: does it matter who is in your 'consumer' sample? 4th International Conference of the Academy of Wine Business Research, Siena 17–19 July 2008 (Academy of Wine Business Research: Siena).
Nurgel, C. (2005) Contribution of glycerol, ethanol and sugar to the perception of viscosity and density elicited by model white wines. Journal of Texture Studies **36**, 303–323.
O'Mahony, M. and Rousseau, B. (2003) Discrimination testing: a few ideas, old and new. Food Quality and Preference **14**, 157–164.
Peryam, D.R. and Pilgrim, F.J. (1957) Hedonic scale method of measuring food preferences. Food Technology **11**, 9–14.
Pickering, G.J. and Robert, G. (2006) Perception of mouthfeel sensations elicited by red wine are associated with sensitivity to 6-*n*-propylthiouracil. Journal of Sensory Studies **21**, 249–265.
Popper, R., Kroll, J. and Magidson, J. (2004) Application of latent class models for food product development: a case study. 11th Sawtooth Software Conference Proceedings, San Diego, CA (Sawtooth Software, Inc.: Sequim, WA) pp. 157–176.
Prescott, J. (2005) Commentary: choice versus direct scaling: is 'no preference' an option? Journal of Sensory Studies **20**, 363–366.
Rodrigue, N., Guillet, M., Fortin, J. and Martin, J.F. (2000) Comparing information obtained from ranking and descriptive tests of four sweet corn products. Food Quality and Preference **11**, 47–54.
Rousseau, B. and O'Mahony, M. (2002) Investigating more powerful discrimination tests with consumers: effects of memory and response bias. Food Quality and Preference **13**, 39–45.
Thurstone, L.L. (1927) A law of comparative judgment. Psychological Review **34**, 273–286.
Vermunt, J.K. and Magidson, J. (2005) Factor analysis with categorial indicators: a comparison between traditional and latent class approaches. In: New developments in categorial data analysis for the social and behavioral sciences. Eds. A. Van der Ark, M.A. Croon and K. Sijtsma (Erlbaum: Mahwah) pp. 41–62.
Villanueva, N.D.M., Petenate, A.J. and Silva, M. (2000) Performance of three affective methods and diagnosis of the ANOVA model. Food Quality and Preference **11**, 363–370.
Yeh, L.L., Kim, K.O., Chompreeda, P., Rimkeeree, H., Yau, N.J.N. and Lundahl, D.S. (1998) Comparison in use of the 9-point hedonic scale between Americans, Chinese, Koreans, and Thai. Food Quality and Preference **9**, 413–419.

Manuscript received: 2 June 2008
Revised manuscript received: 5 September 2008
Accepted: 9 December 2008

Market Lett
DOI 10.1007/s11002-009-9098-x

What you see may not be what you get: Asking consumers what matters may not reflect what they choose

Simone Mueller · Larry Lockshin · Jordan J. Louviere

Abstract We compared a direct way to measure the relative importance of packaging and other extrinsic cues like brand name, origin, and price with the relative importance of these variables in an indirect discrete choice experiment. We used best–worst scaling (BWS) with visual and verbal presentation of the attribute descriptions as a way to directly ask consumers about wine packaging relevance. Both direct methods gave low packaging importance scores contrary to anecdotal industry evidence and beliefs. BWS results indicated all visual extrinsic cues were less important than verbal cues, with small variance among respondents, suggesting strong agreement about non-importance. We compared those results with a multi-media-based discrete choice experiment (DCE) that varied label and packaging attributes to produce shelf-like choice scenarios. The DCE results revealed much higher impacts due to packaging-related attributes, as well as significant preference heterogeneity. Our results suggest considerable caution in using direct importance measures with visual packaging attributes.

Keywords Direct versus indirect preference elicitation · Visual attributes · Unconscious processing · Research methodology · Discrete choice analysis · Best–worst scaling · Packaging

S. Mueller · L. Lockshin
Ehrenberg-Bass Institute for Marketing Science, University of South Australia, GPO Box 2471, Adelaide, South Australia 5001, Australia

S. Mueller
e-mail: simone.mueller@unisa.edu.au

L. Lockshin
e-mail: larry.lockshin@unisa.edu.au

J. J. Louviere (✉)
Centre for the Study of Choice (CenSoC), School of Marketing, University of Technology, Sydney, PO Box 123, Broadway, New South Wales 2007, Australia
e-mail: jordan.louviere@uts.edu.au

Published online: 20 November 2009

1 Introduction

The purpose of this paper is to describe and discuss a case where direct consumer reports of product features that underlie their choices differ from both anecdotal industry evidence and evidence from a discrete choice experiment (DCE), as described below. Academic and commercial researchers often use some form of direct "feature importance" measurement to ascertain overall importance, or in advance of designing DCEs in order to reduce the number of attributes and levels measured. Our results suggest that direct measurement of attribute importance may not reveal true preferences. In turn, this suggests a clear need for theoretical and/or empirical research into situations or contexts when researchers should be cautious about relying on consumer direct reports of product feature importance.

Our research focuses on red wine packaging, but the context is similar for many packaged consumer goods. Wine is clearly an experience good and a typical retail wine store would have many dozens of bottles of red wines from which to choose. Both industry and academic research suggest that wine appearance and packaging play important roles in consumer perceptions and choices (Imram 1999), especially as the first taste is almost always with the eye. Wine researchers recently have begun to study packaging (Barber et al. 2006; Boudreaux and Palmer 2007; Orth and Malkewitz 2008; Rocchi and Stefani 2005; Szolnoki 2007). In general, packaging attributes provide consumers with social and aesthetic utility and strongly influence expectations of sensory perception (Deliza and MacFie 1996; Gianluca et al. 2006; Jaeger 2006; Lange et al. 2002). Such expectations seem to be robust against possible disconfirmation when consumers actually taste the product (Cardello and Sawyer 1992). It is likely that the importance of packaging design and other product features differ across wine consumers, consistent with empirical findings for food products (Deliza et al. 2003; Silayoi and Speece 2007). Unfortunately, few previous packaging studies considered consumer preference heterogeneity.

Despite research that suggests that packaging affects product evaluations, findings about the relative importance of wine packaging compared to other extrinsic product cues like brand name, region, country of origin, and price offer contradictory evidence about its influence. For example, Goodman (2009) and Mueller et al. (2007) each directly measured the importance of wine attributes and concluded that wine packaging design was relatively unimportant. Other researchers found strong consumer impressions evoked by wine packaging design elements, but these used graphical representations of these elements in isolation (Boudreaux and Palmer 2007; Orth and Malkewitz 2008).

Existing insights into consumer behavior from the two research streams of unconscious product evaluation processes (Dijksterhuis et al. 2005; Fitzsimons et al. 2002; Nisbett and Wilson 1977) and of psychological processes associated with visual versus verbal cues (Fazio 2001) provide possible explanations for these diverging findings of packaging importance. Accordingly, consumer decision-making may often be influenced by factors not recognized consciously by the decision maker (Fitzsimons et al. 2002; Chartrand 2005). In particular, visual cues like color and form trigger automated responses without individuals being able to articulate the effect on their judgment (Breitmeyer et al. 2004; Ro et al. 2009). Despite this existing body of knowledge of automated and unconscious processing of visual cues, a major unresolved question is whether and how the likely effects on consumer product choices of product features like packaging can be reliably and validly measured.

We provide a modest contribution to resolving this issue by conducting a relatively rigorous comparison of two methods for evaluating and measuring product feature effects. One method is a direct measurement of feature importance, which we accomplish with best–worst scaling along with graphical representations of some packaging elements (Marley and Louviere 2005; Finn and Louviere 1992; Flynn et al. 2007), and a second, indirect method is based on a DCE (Louviere and Woodworth 1983; Louviere et al. 2000), using multi-media and graphics imaging methods to simulate store shelves on which bottles differ systematically in several product features, including packaging features.

Before we describe and discuss our research approach, we first review prior research comparing direct verbal and indirect visual attribute importance measures, prior insights on evaluation processes that are unconscious to consumers, existing empirical work associated with visual and verbal information, and how ambiguity and context affect attribute presentation.

2 Literature review

2.1 Differences between direct versus indirect attribute importance measurement

While *direct* approaches typically try to measure the importance of a set of dimensions by asking individuals to state the degree of importance on some scale, *indirect* approaches generally infer importance by analyzing an outcome measure like choice (Louviere and Islam 2008; Van Ittersum et al. 2007). We compare two methods in this paper. Best–worst scaling (BWS) is a direct approach, asking respondents to indicate the most and least important attribute from sub-sets of all attributes to infer a ratio level importance scale (Marley and Louviere 2005) and is based on respondents' introspection and awareness of each attribute's impact on his or her evaluations. On the contrary, DCEs infer the importance of an attribute indirectly from respondents' choices from stimuli that differ in attribute levels without requiring the respondent to be aware of each attribute's influence.

Recently, several researchers have suggested that there may be fundamental differences in direct and indirect importance measures; however, they did not focus on differences for visual attributes such as packaging. For example, Van Ittersum et al. (2007) conducted a meta-analysis that showed different measures of attribute importance usually correlate lower with one another than measures that tap potentially different aspects of importance. That is, direct methods largely reflect personal values and desires, while indirect methods measure attribute determinacy or relevance in judgment and choice (Van Ittersum et al. 2007). Louviere and Islam (2008) found large differences in direct and indirect product feature importance measures comparing BWS and a DCE, and attributed them to differences in the degree of attribute ambiguity and context influence between the methods.

2.2 Ambiguity and context effects in attribute importance measurement

Louviere and Islam (2008) argue that the importance of product features depends on the ranges of values a respondent previously experienced in real life, the ranges they expect to experience, and/or the ranges provided by researchers. Because direct methods do not provide survey respondents with identical contexts of concrete attribute levels, individual responses may relate to different value ranges, resulting in biased responses.

Indistinct attribute descriptions in direct measurement can also be responsible for a higher degree of ambiguity in direct attribute importance measurement. While this ambiguity may be resolved in a verbal reference frame for attributes like price or brand, ambiguity is highest for visual attributes like color or design. Different respondents may imagine different shades of red or different "traditional" labels, and a researcher cannot know which shade or style any particular respondent imagines. In such cases, visual attribute presentation can resolve this problem, that is, "a picture is worth a thousand words." Graphical presentations have been found to add clarity and precision to visualization and information processing. They facilitate product evaluation, increase cognitive elaboration, and enhance the number of product-relevant associations in memory (MacInnis and Price 1987).

Prior research found that using visual information in indirect attribute measurement provides better quantitative attribute importance measures and captures between-respondent preference heterogeneity better than verbal presentation (Vriens et al. 1998; Dahan and Srinivasan 2000; Silayoi and Speece 2007). However, to our knowledge, the ability of visual cues to decrease ambiguity and reduce context effects in direct importance measurement has not been tested previously; hence, it would be useful to know if associating graphics with attribute descriptions can mitigate some of the bias in direct attribute measurement.

3 Research propositions

Drawing from prior findings on the differences between direct and indirect attribute importance measurement, and verbal and visual information presentation formats, we consider four research propositions:

P1: Visual versus verbal presentation in direct measurement (BWS)

- (a) Using visual attribute information in direct attribute measurement (BWS) will not increase the importance of packaging attributes compared with verbal presentation.
- (b) Using visual attribute information in direct attribute measurement (BWS) will decrease the heterogeneity of the relative importance of packaging attributes compared with verbal presentation.

P2: Visual direct versus visual indirect measurement (BWS versus DCE)

- (a) The relative effect/importance of packaging attributes will be significantly lower for direct visual attribute importance measures (BWS) than indirect visual attribute importance measures (DCE).

(b) Heterogeneity in relative attribute importance will be larger for indirect visual presentation (DCE) than direct visual presentation (BWS).

The four research propositions are derived from the following considerations:

P1a) Recent consumer research insights provide evidence that a large part of decision-making occurs outside of conscious awareness and is influenced by factors unrecognized by the decision maker (Bargh 2002; Fitzsimons et al. 2002). Perception–behavior links, where behavior unfolds unconsciously as a result of a mere perception of cues, were found to be one important unconscious process (Dijksterhuis et al. 2005). When individuals' responses are driven by a stimulus that occurs below the level of conscious awareness or when they are aware of the stimulus but unaware of the automatic processing itself (Chartrand 2005), their meta-cognition about the impact is poor (Fitzsimons et al. 2002). If visual packaging cues are processed unconsciously without individuals being aware of this process, they cannot introspect and report the impact from merely being presented with a visual example of the attribute (Dijksterhuis and Smith 2005; Nisbett and Wilson 1977). Neither verbal nor visual attribute presentation format can trigger the unconscious process; hence, respondents will report similarly low attribute importance for packaging cues due to their unawareness of its effect.

P1b) Visual and verbal information induce different types of cognitive processing, which can lead to response differences for verbal and graphical product representations (Paivio and Csapo 1973). While abstract verbal attribute information requires intentional effortful processing into mental images, concrete pictorial attribute information requires considerably fewer cognitive resources, which are limited in capacity (Lang 2000), and reduces ambiguity about the meaning of the attribute. This should be reflected in lower heterogeneity in attribute importance for visual attribute presentation.

P2a) The non-conscious influence on consumer choice discussed above was found to be the strongest for the perception of visual cues (Fitzsimons et al. 2002). More specifically, visual information has been found to automatically and unintentionally activate attitudes from memory at very early stages of information processing, prior to higher-level perceptual and response-related processes (Breitmeyer et al. 2004; Fazio 2001; Ro et al. 2009). The specific visual information selected and encoded into a mental representation was found to be an unconscious and unintentional process that is activated by the stimulus itself (Roskos-Ewoldsen and Fazio 1992). Such automatically activated attitudes can guide behavior in a relatively spontaneous manner without an individual's active consideration of the attitude and without an awareness of its influence (Fazio et al. 1992). Direct measurement requires conscious reflection on prior experiences with packaging effects, so importance of packaging will be underestimated due to respondents using their meta-cognition that packaging is unimportant. In contrast, visual attribute *level* presentation using indirect measurement allows automated processing of packaging cues, and their importance will be reflected in subsequent choices.

P2b) We expect the importance of packaging attributes to exhibit less “apparent” heterogeneity in direct measurement because respondents will uniformly discount its effect. That is, the missing conscious awareness of the impact of packaging cues should lower heterogeneity in direct measurement, but should increase heterogeneity in indirect visual presentation due to the improved ability to measure actual preferences, which likely vary among the population.

4 Research method

4.1 Direct attribute importance measures

We used BWS to directly measure the importance of wine packaging attributes. BWS was pioneered by Finn and Louviere (1992), and now is widely used by the marketing research community and academics (e.g., Auger et al. 2007; Louviere and Islam 2008; Marley and Louviere 2005; Bacon et al. 2008). We selected 16 attributes/features to describe bottles of red table wine based on prior work (Orth and Malkewitz 2008; Rocchi and Stefani 2005) and extensive analysis of wines in retail outlets. A comprehensive list of the attributes is provided in Table 2. We assigned the 16 attributes to comparison sets using a balanced incomplete block design (BIBD), resulting in 24 comparison sets, each containing six attributes. Each attribute appears nine times and co-appears with each other attribute three times.

In addition, we used a split design to offer one third of the respondents the ability to view photographs of nine of the 16 attributes that could be represented this way (for one example, see Fig. 1). Some attributes, such as alcohol level, price, and region of origin, could not be shown graphically (see Table 2 for presentation form of each attribute). This allowed us to test whether graphical representations in BWS had an impact on attribute importance compared to a verbal-only presentation.

We sampled regular wine consumers (defined as purchasing and consuming a bottle of red wine in the last 30 days) from an online web panel provider that

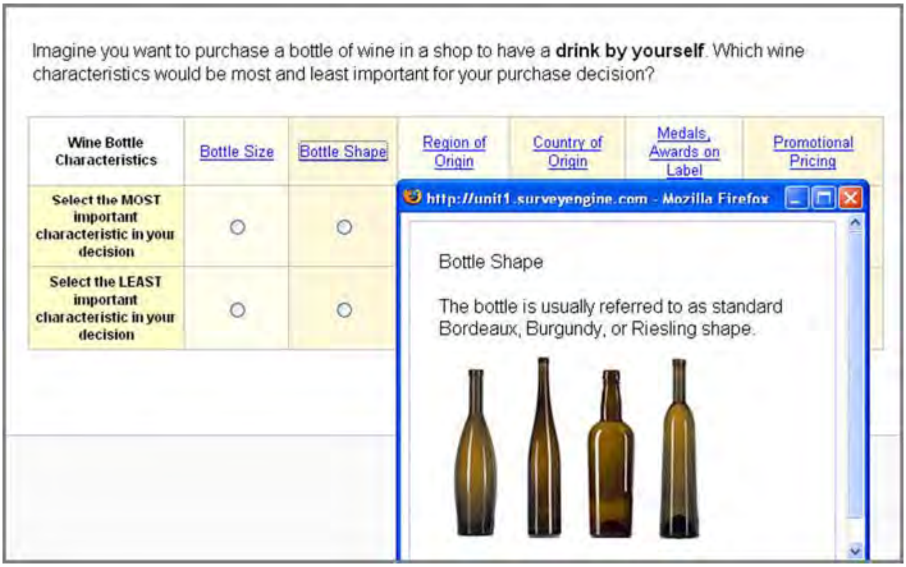


Fig. 1 Sample BWS experiment with visual attribute information

maintains a panel designed to be nationally representative. Panelists were randomly sampled, yielding a sample of 740 people in March 2007, which was nationally representative of regular wine consumers (detailed sample comparisons can be obtained from the authors). In the BWS exercise, respondents were asked to indicate which two wine attributes were, respectively, the most and least important in purchasing a bottle of red wine in a retail store for each comparison set.

4.2 Indirect attribute importance measurement

We also indirectly measured attribute importance by designing a DCE survey involving a subset of the 16 attributes used in the BWS exercise. DCEs are a well-established way to model choices and estimate preferences (or utilities) for each attribute/level (see, e.g., Louviere et al. 2000). The DCE was a "proof of concept" exercise in so far as we used multi-media techniques to construct hypothetical bottles of red wine.

We limited the number of attributes in the DCE to three expressed verbally that scored highly in the BWS (brand, price, and region) and three that could be varied visually (label style, label color, and bottle shape). Attributes and levels are displayed in Table 1 and a sample screen is presented in Fig. 2. The design we used was sufficiently small, so that each respondent was able to complete the entire DCE (Street and Burgess 2007). The latter aspect of the DCE allows us to compare preference heterogeneity without confounding differences in choice sets with differences in preferences.

Price levels were chosen to cover a range that reflects the vast majority of national wine sales for standard 750-ml bottled wines. We conducted in-store research on wine labels, using content analysis to identify four label styles (traditional, chateau, graphic, and minimalistic) representing most labels. Wine labels in retail outlets were analyzed to identify predominant colors, choosing four that represent most current offerings (off-white, yellowish, orange/red, and gray/black). We chose brands and regions to give well-known and unknown examples of each. Bordeaux and Burgundy bottle shapes predominate; therefore, we used them as bottle shape levels.

The attributes and levels in Table 1 represent a $2^3 \times 4^3$ factorial. We used an orthogonal main-effects plan (OMEP) as a starting design to construct 16 choice sets with six bottles per set as shown in Fig. 2. We determined the choice set size after multiple rounds of testing various graphical image displays; six bottles were

Table 1 Attribute and levels for visual DCE

	Attribute	Levels	1	2	3	4
1	Price	4	$7.99	$12.99	$17.99	$22.99
2	Label style	4	Traditional	Chateau	Graphic	Minimalistic
3	Label color	4	Whitish	Yellowish	Orange	Dark gray
4	Brand	2	Jinks Creek	McWilliams		
5	Region	2	Henty	McLaren Vale		
6	Bottle shape	2	Bordeaux	Burgundy		

Fig. 2 Sample DCE with graphical bottle representations

sufficient to simulate a small retail shelf display, and bottle details could be read in most browsers. A team of graphic designers developed simulated bottles from the DCE design. We recruited 244 regular wine consumers from the same national online panel provider to participate in the DCE.

5 Analysis and results

5.1 Direct attribute importance measurement

We followed the logic in Marley and Louviere (2005) to derive a measure of attribute importance in the BWS sample. Briefly, the square root of the ratio of best and worst (B/W) counts is a ratio scale measure of importance (Lee et al. 2008), which is proportional to the best counts; it is also a more reliable measure as it combines both sources of information. Relative attribute importance can be compared easily relative to the most important attribute; for example, country of origin is about half as important as brand for the total sample, as shown in Table 2.

Table 2 gives the raw B/W mean[1] and its standard deviation, as well as the standardized importance measure (0 to 100 interval), to allow for easy comparison. For the total sample, the results indicate that brand, price, and region are the most important attributes reported by respondents, with medals/awards, country of origin, and alcohol level of moderate importance; all visual wine attributes were consistently reported to be unimportant. This result implies that wine producers should pay little attention to label designs, label color, bottle color, and bottle shapes.

[1] $\frac{1}{S}\left(\sum_{s=1}^{S}\text{Best}-\sum_{s=1}^{S}\text{Worst}\right)$, where is S is number of respondents; also see Mueller and Rungie (2009).

Table 2 BWS results for visual and verbal presentation

	Visual present.*	B/W mean	Stdev	Sqrt (B/W) std.				
		n=740		Total 100%	Classes			
					C1 39%	C2 23%	C3 21%	C4 17%
Brand		3.93	2.94	100	100	99	57	44
Midpriced wine		2.96	3.07	75	71	100	22	100
Promotional pricing		3.07	3.35	64	63	63	19	70
Region of origin		2.86	3.18	60	50	87	100	20
Medals awards	yes	2.61	3.50	53	55	54	42	17
Country of origin		2.14	2.91	53	45	83	57	20
Bottle size	yes	−0.09	1.99	21	32	11	4	17
Alcohol level		−0.25	3.21	19	21	10	4	41
Closure material	yes	−0.80	2.42	14	14	10	9	9
Organic		−1.34	3.22	11	12	12	7	4
Capsule material	yes	−1.39	2.46	10	11	6	4	7
Label style	yes	−2.20	2.38	7	23	1	1	1
Bottle shape	yes	−2.34	2.23	6	14	2	2	1
Bottle color	yes	−2.63	2.37	5	13	1	1	1
Label shape	yes	−3.44	2.78	5	17	1	1	1
Label color	yes	−3.11	2.60	5	15	1	1	1

*yes, attribute was visually presented in BWS experiment

We calculated whether or not the importance of the packaging attributes was affected by the photographic representations available to one third of the respondents. We used logistic regression to test if attributes had different importance weights, comparing respondents who saw photographs with those that did not.[2] No packaging attributes included in the BWS measurement condition (label color, label style, or bottle shape) differed significantly in importance between the two groups. Merely presenting packaging attributes as pictures did not increase importance or heterogeneity, consistent with our first research proposition P1a, but disconfirming P1b.

To determine if this result was due to aggregating unequal preferences, we calculated the standard deviation of the best–worst counts per attribute (which could range from +4 to −4) to determine how much reported attribute importance varies over the sample (see Mueller and Rungie 2009). We graphed the relationship between attribute importance and heterogeneity in Fig. 3, where it is clear that visual packaging attributes form a distinct group with low importance and a low standard deviation. This finding is also confirmed in a latent cluster analysis (Magidson and Vermunt 2002) of the raw best–worst scores, which resulted in an optimal solution with four classes. These four classes differ in the importance of brand, price, origin,

[2] Seeing the photograph or not was the dependent variable and individual best–worst scores for each attribute were the independent variables in the logistic regression (for details, see Mueller et al. 2007).

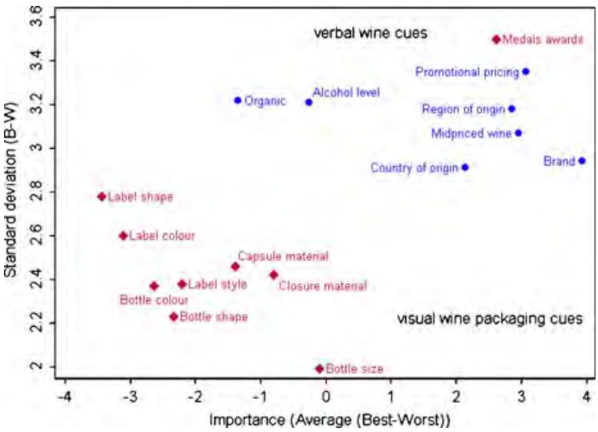


Fig. 3 Relationship between attribute importance and heterogeneity in BWS experiment (visual packaging cues have *diamond markers*, verbal cues are in *blue circles*)

and awards but packaging is unimportant in all the classes (Table 2). We will not discuss these segments in more detail, as these results are unlikely to be valid.

5.2 Indirect importance measurement

To take importance heterogeneity into account in the DCE results and test whether our findings of low importance for packaging attributes were simply due to aggregating over heterogeneous importances, we estimated a scale-extended latent class regression model (Magidson and Vermunt 2002) that simultaneously estimates part-worth utility parameters and class membership from the DCE choices, while controlling for differences in respondents' error variability (choice consistency).[3] We regressed individual-level best–worst scores for every attribute combination against the effects-coded attribute levels. We used the general linear model component in Latent Gold Syntax 4.5 to specify a regression model in which parameters (part worth utilities) differed across latent classes (Vermunt and Magidson 2008).

The best fit (lowest BIC value) was achieved for five indirect utility function classes and two scale classes (λ_1=1, λ_2=0.39, n_{s1}=191, n_{s2}=53). The estimated model utilities for the attribute levels for each class are in Table 4. Wald statistics indicate that all attribute effects, except bottle form, are significant at conventional levels; attribute level utilities also differ between classes, with the exception of bottle form, which seems unimportant in all classes. We estimated relative attribute importance by calculating partial log-likelihoods associated with each attribute across all levels as described by Louviere and Islam (2008).

The last column of Table 3 shows that, across the sample, label style was on average almost as important as price. Brand and label color were third and fourth most important, with region and bottle form least important. In the case of the

[3] Random parameter choice models not accounting for differences in respondents' choice consistency (error variance) confound utility heterogeneity with the unobserved distribution of error variances (Islam et al. 2007; Louviere and Eagle 2006). We accounted for differences in error variance by modeling two scale classes with high (higher λ) and low (smaller λ) choice consistency (Swait and Louviere 1993).

Table 3 Attribute importance weights for classes (%)

	Class 1	Class 2	Class 3	Class 4	Class 5	Mean
Class size	30	23	27	10	10	100
Price	62	86	4	5	0	39
Label style	1	3	86	71	96	37
Brand	25	11	1	11	3	12
Label color	7	1	8	13	0	6
Region	4	0	0	1	1	1
Bottle form	1	0	0	0	0	0

attribute levels (Table 4), all classes preferred a known brand (McWilliams) to an unknown name (Jinks Creek). Similarly, all classes were more likely to choose a known region (McLaren Vale) over a relatively unknown region (Henty).

Turning now to the visual extrinsic packaging cues (label style and label color), as revealed in Table 4, the effects of these attributes contrast starkly with what was found in the direct BWS approach. The reliability and discrimination power of the indirect DCE graphical image approach is clearly revealed by these results. That is, all three packaging cues were almost equally unimportant with the direct BWS approach (Fig. 3), even when photographs of them were viewed, but were important when using visual cues with indirect measurement (Fig. 4). The latent class analysis and Fig. 3 show strong heterogeneity among respondents in the importance of packaging attributes and the utility of attribute levels, while the BWS study showed the same attributes to be uniformly unimportant (Fig. 3). These results are consistent with P2a and P2b.

We extended the preceding analysis by further characterizing respondents in the five latent classes by differences in sociodemographics and wine behavior. We found no significant differences in wine purchase or consumption frequency, wine involvement, or subjective wine knowledge in the five classes. In contrast, we found that the sociodemographic measures of age and gender could discriminate among the classes. The two classes with preferences for higher prices and greater brand sensitivity exhibit a higher-than-average proportion of males, whereas classes 4 and 5, which exhibit stronger preferences for label style contained a higher proportion of females. The latter finding is consistent with prior work on gender differences in decision-making (Venkatesh et al. 2000; Powell and Ansic 1997) that suggest females tend to be more affective than cognitive in their choices.

6 Discussion

Our empirical results provide strong support for the expectation that an indirect method based on a graphical DCE would produce higher sensitivity to visual packaging attributes. Label style and label color on average exhibited the most (34%) and fourth-most sensitivity (13%) in the DCE, respectively. This contrasts with the direct BWS method, where label style and label color were clearly least

Table 4 Estimates of scale extended Latent Class choice model

Class size		Price+brand		Label style+color		Class 5 10%	Mean 100%	Std.Dev.	Wald	df	p
		Class 1 30%	Class 2 23%	Class 3 27%	Class 4 10%	Label style					
		Brand	Price	Flexible	Chateau, graphic	Minimalistic					
Predictors											
Brand	Jinks Creek	−0.835	−0.558	−0.195	−0.522	−0.250	−0.506	0.032	228.3	5	0.00
	McWilliams	0.835	0.558	0.195	0.522	0.250	0.506	0.032			
Region	Henty	−0.306	−0.072	−0.085	−0.173	−0.151	−0.163	0.022	33.1	5	0.00
	McLaren	0.306	0.072	0.085	0.173	0.151	0.163	0.022			
Bottle form	Bordeaux	0.145	−0.002	0.010	0.022	0.011	0.049	0.017	5.8	5	0.32
	Burgundy	−0.145	0.002	−0.010	−0.022	−0.011	−0.049	0.017			
Label style	Traditional	0.101	0.029	0.910	−2.729	−2.118	−0.202	0.072	954.8	15	0.00
	Chateau	0.168	−0.114	1.230	1.447	−0.497	0.461	0.073			
	Graphic	−0.123	−0.303	1.129	1.443	−0.501	0.303	0.069			
	Minimalistic	−0.145	0.388	−3.269	−0.161	3.116	−0.561	0.036			
Label color	White	0.627	−0.073	0.223	0.648	0.010	0.297	0.066	172.5	15	0.00
	Yellow	0.016	0.094	0.449	0.427	−0.050	0.188	0.065			
	Orange	−0.016	0.183	0.161	−0.081	0.046	0.078	0.064			
	Gray	−0.627	−0.204	−0.832	−0.994	−0.005	−0.563	0.029			
Price	$7.99	1.577	−2.612	−0.302	0.238	0.050	−0.188	0.073	883.7	15	0.00
	$12.99	−2.022	2.012	−0.367	−0.538	−0.028	−0.294	0.073			
	$17.99	−0.434	1.347	0.296	−0.149	−0.045	0.243	0.069			
	$22.99	0.879	−0.747	0.373	0.449	0.023	0.239	0.028			
R-square		42.2%	53.6%	54.6%	57.0%	54.4%	53.2%				

R^2 =0.5325; LL=−8,048.99; BIC(LL)=16,493.77, n=244, #parameters=72; classification error=0.0857, five classes and two scale classes

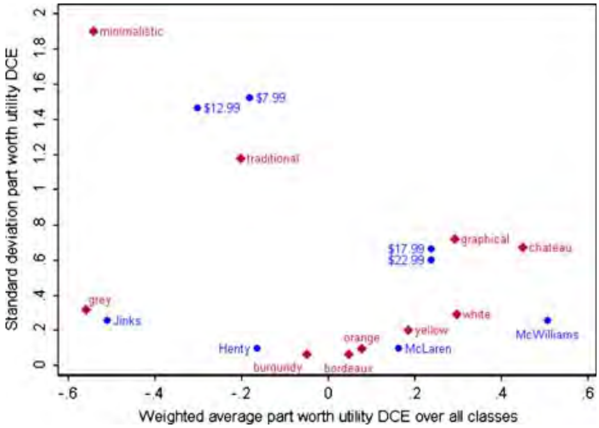


Fig. 4 Relationship between attribute level utility and heterogeneity in DCE experiment (visual packaging cues have *diamond markers*, verbal cues are in *blue circles*)

important, regardless of whether respondents viewed photos of the packaging attributes or not. Contrary to the direct method, the DCE method with visual attribute level presentation may have better captured respondents' automated and unconscious processing of packaging cues. We found strong differences in the attribute importance for visual packaging cues between the methods that suggest respondents report a meta-cognition that packaging is unimportant in direct measurement, but show strong packaging preferences in the indirect condition (Szolnoki 2007).

Visual packaging cues, when measured indirectly, exhibited comparable or higher variance than verbal cues; e.g., the DCE resulted in label color and label style being significant drivers of importance heterogeneity (Fig. 4). This contrasts with the BWS results in which visual packaging cues showed much less heterogeneity than verbal extrinsic cues (Fig. 3). These findings are consistent with P2b and further strengthen our argument above that, in the direct method, respondents reported a meta-cognition that packaging is unimportant, a tendency we believe could be explained by an inability to introspect about the unconscious impact of packaging.

We also analyzed differences due to sociodemographic variables and found that gender and age primarily accounted for differences in respondents who seem to place high importance on cognitive cues (brand and price) compared to visual cues (label style and label color). Our research should be viewed as "proof of concept" research because our objective was to compare and test differences in the importance of visual packaging and labeling cues. We included only a limited number of such cues for one product, so future studies should include a broader range of products, attributes, and levels to further study the phenomenon.

7 Conclusion

Despite previous research highlighting general differences between direct and indirect attribute measurement, we find serious issues associated with directly measuring the importance of visual packaging attributes, even when one provides visual examples. Instead, one may need to use multi-media and graphical displays of attribute levels to reliably and validly measure the effects of such cues. In turn, this implies that one should be cautious about results based on direct measures of the importance of packaging factors or other similar attributes that may be influenced by subliminal or automatic information processing. From a general point of view, researchers should be cautious about using BWS or other direct elicitation methods to reduce the number of attributes for DCEs, if some attributes are packaging-related or are likely to be subject to unconscious processing and direct perception–behavior links. Our results show that such packaging-related attributes are likely to score low and perhaps be deleted from follow-up research. This finding is relevant for all researchers using direct elicitation methods for any products, where some attributes can be better and more accurately represented visually than verbally.

Our results also have relevance for managers. It is likely that marketers can use DCEs with multi-media graphical imaging for concept tests in new product development to infer packaging attributes that are likely to impact target consumer segments. It also may be that one can test the relative performance of competing products using photographically realistic labels, prototypes, and innovative wine packages, such as cans and tetra packs (Srinivasan et al. 1997). As far as we are aware, tactile experiences cannot (yet) be simulated with computer-based experiments. But today's available graphical computer methods, high Internet bandwidth, and representative online panels give marketers a way to test and develop product packaging in close to real-life shelf settings in a relatively inexpensive and efficient way.

References

Auger, P., Devinney, T., & Louviere, J. (2007). Using best–worst scaling methodology to investigate consumer ethical beliefs across countries. *Journal of Business Ethics, 70*, 299–326.

Bacon, L., Lenk, P., Seryakova, K., & Veccia, E. (2008). Comparing apples to oranges. *Marketing Research Magazine*, Spring, 29–34.

Barber, N., Almanza, B. A., & Donovan, J. (2006). Motivational factors of gender, income and age on selecting a bottle of wine. *International Journal of Wine Business Research, 18*(3), 218–232.

Bargh, J. A. (2002). Losing consciousness: automatic influences on consumer judgment, behavior, and motivation. *Journal of Consumer Research, 29*, 280–285.

Boudreaux, C. A., & Palmer, S. (2007). A charming little Cabernet: effects of wine label design on purchase intent and brand personality. *International Journal of Wine Business Research, 19*(3), 170–186.

Breitmeyer, B. G., Ogmen, H., & Chen, J. (2004). Unconscious priming by color and form: different processes and levels. *Consciousness and Cognition, 13*, 138–157.

Cardello, A. V., & Sawyer, F. M. (1992). Effects of disconfirmed consumer expectations on food acceptability. *Journal of Sensory Studies, 7*(4), 253–277.

Chartrand, T. L. (2005). The role of conscious awareness in consumer behavior. *Journal of Consumer Psychology, 15*, 203–210.

Dahan, E., & Srinivasan, V. (2000). The predictive power of internet-based product concept testing using visual depiction and animation. *Journal of Product Innovation Management, 17*(2), 99–109.

Deliza, R., & MacFie, H. J. H. (1996). The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: a review. *Journal of Sensory Studies, 11*(2), 103–128.

Deliza, R., MacFie, H., & Hedderley, D. (2003). Use of computer-generated images and conjoint analysis to investigate sensory expectations. *Journal of Sensory Studies, 18*(6), 465–486.

Dijksterhuis, A., & Smith, P. K. (2005). What do we do unconsciously? And how? *Journal of Consumer Psychology, 15*, 225–229.

Dijksterhuis, A., Smith, P. K., Van Baaren, R. B., & Wigboldus, D. H. J. (2005). The unconscious consumer: effects of environment on consumer behavior. *Journal of Consumer Psychology, 15*, 193–202.

Fazio, R. H. (2001). On the automatic activation of associated evaluations: an overview. *Cognition & Emotion, 15*(2), 115–141.

Fazio, R. H., Blasovich, J., & Driscoll, D. M. (1992). On the functional value of attitudes: the influence of accessible attitudes upon the ease and quality of decision making. *Personality and Social Psychology Bulletin, 18*, 388–401.

Finn, A., & Louviere, J. J. (1992). Determining the appropriate response to evidence of public concern: the case of food safety. *Journal of Public Policy & Marketing, 11*(2), 12–25.

Fitzsimons, G. J., Hutchinson, J. W., Williams, P., Alba, J. W., Chartrand, T. L., Huber, J., et al. (2002). Non-conscious influences on consumer choice. *Marketing Letters, 13*, 269–279.

Flynn, T. N., Louviere, J. J., Peters, T. J., & Coast, J. (2007). Best–worst scaling: what it can do for health care research and how to do it. *Journal of Health Economics, 26*, 171–189.

Gianluca, S., Donato, R., & Cavicchi, A. (2006). Consumer expectations, liking and willingness to pay for specialty foods: do sensory characteristics tell the whole story? *Food Quality and Preference, 17*(1–2), 53–62.

Goodman, S. (2009). An international comparison of retail consumer wine choice. *International Journal of Wine Business Research, 21*(1), 41–49.

Imram, N. (1999). The role of visual cues in consumer perception and acceptance of a food product. *Nutrition and Food Science, 99*(5), 224–228.

Islam, T., Louviere, J. J., & Burke, P. F. (2007). Modeling the effects of including/excluding attributes in choice experiments on systematic and random components. *International Journal of Research in Marketing, 24*(4), 289–300.

Jaeger, S. R. (2006). Non-sensory factors in sensory science research. *Food Quality and Preference, 17*(1–2), 132–144.

Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication, 50*(1), 46–70.

Lange, C., Martin, C., Chabanet, C., Combris, P., & Issanchou, S. (2002). Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. *Food Quality and Preference, 13*(7–8), 597–608.

Lee, J. A., Soutar, G., & Louviere, J. (2008). The best–worst scaling approach: an alternative to Schwartz's values survey. *Journal of Personality Assessment, 90*(4), 335–347.

Louviere, J., & Eagle, T. (2006). Confound it! That pesky little scale constant messes up our convenient assumptions, 2006 Sawtooth Software Conference Proceedings, Sequim (WA).

Louviere, J., & Islam, T. (2008). A comparison of importance weights/measures derived from choice-based conjoint, constant sum scales and best-worst scaling. *Journal of Business Research, 61*, 903–911.

Louviere, J. J., & Woodworth, G. (1983). Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregated data. *Journal of Marketing Research, 20*(4), 350–367.

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2000). *Stated choice methods: Analysis and application*. Cambridge: Cambridge University Press.

MacInnis, D. J., & Price, L. L. (1987). The role of imagery in information processing: review and extensions. *The Journal of Consumer Research, 13*(4), 473–491.

Magidson, J., & Vermunt, J. K. (2002). Latent class models for clustering: a comparison with K-means. *Canadian Journal of Marketing Research, 20*, 37–44.

Marley, A. A. J., & Louviere, J. J. (2005). Some probabilistic models of best, worst, and best–worst choices. *Journal of Mathematical Psychology, 49*(6), 464–480.

Mueller, S., & Rungie, C. (2009). Is there more information in best–worst choice data? Using attitude heterogeneity structure to identify consumer segments. *International Journal of Wine Business Research, 21*(1), 24–40.

Mueller, S., Lockshin, L., Louviere, J., & Hackman, D. (2007). Do respondents use extra information provided in online Best–Worst choice experiments? *Proceedings of the Xth Australian and New Zealand Marketing Academy (ANZMAC) Conference, Dunedin, New Zealand, 3–5 December 2007*, 3486–3493.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know—verbal reports on mental processes. *Psychological Review, 84*, 231–259.

Orth, U. R., & Malkewitz, K. (2008). Holistic packaging design and consumer brand impression. *Journal of Marketing, 72*, 64–81.

Paivio, A., & Csapo, K. (1973). Picture superiority in free recall: imagery or dual coding? *Cognitive Psychology, 5*(2), 176–206.

Powell, M., & Ansic, D. (1997). Gender differences in risk behaviour in financial decision-making: an experimental analysis. *Journal of Economic Psychology, 18*(6), 605–628.

Ro, T., Singhal, N. S., Breitmeyer, B. G., & Garcia, J. O. (2009). Unconscious processing of color and form in metacontrast masking. *Attention, Perception & Psychophysics, 71*, 95–103.

Rocchi, B., & Stefani, G. (2005). Consumers' perception of wine packaging: a case study. *International Journal of Wine Marketing, 18*(1), 33–44.

Roskos-Ewoldsen, D. R., & Fazio, R. H. (1992). In the orienting value of attitudes. Attitude accessibility as a determinant of an object's attraction of visual attention. *Journal of Personality and Social Psychology, 63*, 198–211.

Silayoi, P., & Speece, M. (2007). The importance of packaging attributes: a conjoint analysis approach. *European Journal of Marketing, 41*(11/12), 1495–1517.

Srinivasan, V., Lovejoy, W. S., & Beach, D. (1997). Integrated product design for marketability and manufacturing. *Journal of Marketing Research, 34*(1), 154–163.

Street, D. J., & Burgess, L. (2007). *The construction of optimal stated choice experiments: Theory and methods*. New York: Wiley-Interscience.

Swait, J., & Louviere, J. (1993). The role of the scale parameter in the estimation and comparison of multinominal logit models. *Journal of Marketing Research, 30*, 305–314.

Szolnoki, G. (2007). *Measurement of the influence of extrinsic product design on purchase intent for white wine*. PhD thesis, Justus-Liebig-University Giessen, Geisenheimer Berichte Bd. 61, Geisenheim.

Van Ittersum, K., Pennings, J. M. E., Wansink, B., & van Trijp, H. C. M. (2007). The validity of attribute–importance measurement: a review. *Journal of Business Research, 60*(11), 1177–1190.

Venkatesh, V., Morris, M. G., & Ackerman, P. (2000). A longitudinal field investigation of gender differences in individual technology adaptation decision-making processes. *Organizational Behavior and Human Decision Processes, 83*(1), 33–60.

Vermunt, J. K., & Magidson, J. (2008). *LG-Syntax™ user's guide: manual for Latent GOLD® 4.5 syntax module*. Belmont Massachusetts: Statistical Innovations Inc.

Vriens, M., Loosschilder, G. H., Rosbergen, E., & Wittink, D. R. (1998). Verbal versus realistic pictorial representations in conjoint analysis with design attributes. *Journal of Product Innovation Management, 15*(5), 455–467.

Food Quality and Preference 21 (2010) 22–32

Contents lists available at ScienceDirect

Food Quality and Preference

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

Message on a bottle: The relative influence of wine back label information on wine choice

Simone Mueller *, Larry Lockshin, Yaelle Saltman, Jason Blanford

Ehrenberg-Bass Institute for Marketing Science, University of South Australia, P.O. Box 2471, Adelaide SA 5000, Australia

ARTICLE INFO

Article history:
Received 19 February 2009
Received in revised form 22 June 2009
Accepted 10 July 2009
Available online 15 July 2009

Keywords:
Back label information
Discrete choice experiment
Scale extended latent class choice model
Ingredient information

ABSTRACT

This study examines the importance consumers attach to wine back label statements when choosing wine and identifies the utility of these attributes relative to price. Ten different back label statements plus price were examined and tested through a discrete choice experiment. Three hundred thirty-one regular wine drinkers representative of frequent Australian wine consumers were asked to choose a wine they were most likely to purchase for a special occasion based on different sets of back label statements. The application of a latent class choice model allowed the analysis of how strongly individual consumers differed in their reaction to back label information. Five distinct segments emerged from the overall sample with significant differences found for the relative importance of back label statements along with price, price sensitivity, and the acceptance of an ingredient list on the back label. Overall winery history, elaborate taste descriptions and food pairing were found to be the most highly valued back label statements, while ingredient information had a large negative impact on one segment in particular.

1. Introduction

1.1. Perceived purchase risk for wine

The wine market presents the consumer with a vast array of products and product attributes to consider when making a purchase decision (Dodd, Laverie, Wilcox, & Duhan, 2005). There are thousands of brand names, dozens of grape varieties, regions, labels, wine styles and a large range of prices to choose from (Johnson & Bruwer, 2004; Overby, Gardial, & Woodruff, 2004; Rasmussen & Lockshin, 1999). It is for this reason that purchasing wine for various occasions is associated with a perception of risk (McCarthy & Henson, 2005), which often leads consumers to approach the purchase with a degree of fear, insecurity, scepticism and caution (Gluckman, 1990; Lockshin, 2003; Mitchell & Greatorex, 1989; Spawton, 1991a). Furthermore, if the wine is being bought for a special occasion (e.g., for a gift or a festive social dinner) then the perception of risk will potentially increase (Olson, Thompson, & Clarke, 2003).

In order to choose a wine, consumers examine the products' attributes as part of a risk reduction strategy. Some of a wine's attributes, such as quality or sensory characteristics (taste) can only be assessed during consumption (Lockshin, 2003; Mueller, 2004). Other attributes such as brand name, awards, production procedures and cellaring advice are found on the wine's front or back label and may assist consumers in evaluating the wine prior to purchase (Charters & Pettigrew, 2003; Ling & Lockshin, 2003; Thomas, 2000).

Front labels convey (with some exceptions) the most essential and legally required information about the product: the winery's name, grape variety, grape origin, vintage year and alcohol content (Gluckman, 1990). The back label often describes the sensory characteristics of the wine, winemaker's notes and compatible meals for the specific style of wine. Sensory descriptions on a wine's back label are argued by d'Hauteville (2003) to provide an objective base for reassuring potential wine consumers of their purchase decision. A wine's front and back label are the most cost effective form of marketing promotion and an information source available for wine producers to communicate directly to their customers at the point of sale (Rocchi & Stefani, 2005).

It is therefore surprising that no previous research exists quantifying which back label statements are most effective in influencing consumers' wine choice. This empirical study examines the importance consumers attach to the back label information of wine relative to price by the means of discrete choice analysis. Previous studies involving wine back labels have primarily focused on qualitative methods and thus this research is a pioneer in the methodology involved in examining a consumer's choice of wine and in particular the trade-off between back label information and other cues (i.e., price).

1.2. The importance of wine back label statements

The wine labelling literature is restricted so far to studies examining only some aspects of wine back label information such as: the

* Corresponding author. Tel.: +61 8 8302 0906; fax: +61 8 8302 0442.
E-mail address: simone.mueller@unisa.edu.au (S. Mueller).

0950-3293/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.foodqual.2009.07.004

importance of back label statements versus front label attributes (Barber, Almanza, & Donovan, 2006; Thomas & Pickering, 2005); the perception of quality and value of wine according to back label statements (Shaw, Keeghan, & Hall, 1999); and the importance consumers attach to various back label attributes (Chaney, 2000; Charters, Lockshin, & Unwin, 1999). In addition to the scarcity of literature, none of these studies have examined in detail the relationship between utility levels of back label attributes and consumers' user profiles. These studies are limited regarding the type of methodology used, either a qualitative methodology or a narrow stream of quantitative methods, not forcing consumers to trade-off back label attributes against other wine characteristics, especially price.

In the remainder of this section, the existing body of literature on back label research will be reviewed with a focus on identifying candidates for back label attributes to be included in a quantitative study. This literature review will also highlight the relationship between consumer characteristics and the importance they attach to wine back labels. The section finishes with a set of research objectives based on the literature reviewed.

1.2.1. Taste descriptions

In their foundation article Charters et al. (1999) established in a qualitative study that back label statements provide useful information for wine consumers, with over half (57%) of respondents also claiming to use the back label regularly as an information source when making a purchase. Their findings suggest that the most valued attribute of back labels is the "sensory characteristic" description also known as the taste attribute. However, it should be noted that their study included a highly involved and experienced sample, thus did not represent the entire wine market and is likely to be biased.

From sensory and psychological research it is known that consumers prefer different levels of sensory information, which can broadly be categorized into "simple" and "elaborate" taste descriptions. It was found that highly involved or experienced wine tasters value more "elaborate" descriptions of wine, such as: "displaying elements of dark chocolate, ripe plums, and finely chalky tannins" (Charters & Pettigrew, 2006; Gawel, 1997; Lawless, 1985; Lehrer, 1975; Solomon, 1990). On the other hand wine consumers who consider themselves novices or inexperienced wine drinkers prefer "simple" taste descriptors for wine, for instance: "a full-bodied, red wine". It is for this reason that the taste attribute can be divided into "simple" taste and "elaborate" taste to answer the needs of both experienced and inexperienced wine drinkers.

1.2.2. Manufacturing and history related statements

The first quantitative study in wine back label research by Shaw et al. (1999) examined how back label information influences consumers' perceived value and quality of a wine and their purchase intent. Their findings support Charters et al. (1999), concluding that the taste description had the highest value of all the attributes. Additionally Shaw et al. (1999) found that "manufacture", also known as production statement ("...wine went through this process"), was highly valued by their respondents. An attribute significantly less valued was "parentage" which can be referred to as history ("...family owned winery") or "authenticity" (Beverland, 2006; Gade, 2004; Hayes, 2004; Lunardo & Guerinet, 2007). These findings led researchers to assert that statements based on taste and manufacturing procedures have the greatest propensity to enhance consumers' perception of the quality and value of the product.

1.2.3. Cellaring advice

Cellaring information (e.g., drink now or within next two years) was found to be important to New Zealand wine consumers by Thomas and Pickering (2005). The importance of cellaring advice was also confirmed in a study by Barber et al. (2006) using Likert scales to explore the importance of back label information for US consumers. Although both studies agree that cellaring advice is an important wine attribute, they disagree about the relative importance of front and back labels. While Thomas and Pickering (2005) found that front labels are more valuable to consumers, Barber et al. (2006) argued that back label information is more important than front labels. Possibly these differences could be a result of cultural differences between New Zealand and American wine consumers.

1.2.4. Website information

Two studies by Rocchi and Stefani (2005) and Kimura et al. (2008) came to the conclusion that food consumers in general and wine consumers specifically expect to find some sort of information on the back label and did not appreciate instances when there was no information available. While having the winery's website included on the back label was perceived to be inappropriate for an important wine by Italian consumers (Rocchi & Stefani, 2005), Japanese students preferred to have the product's website displayed on food products to investigate more sources of information (Kimura et al., 2008).

1.2.5. Food pairing and sociodemographic differences

Food pairing, which recommends compatible meals for that specific style of wine, was found by Barber et al. (2006) to be an influential wine back label attribute. This study is also the first to report demographic differences in consumer preferences for wine back labels, with women appreciating food pairing information more than men. Even though women attach more importance to food pairing, overall women thought that back labels are more confusing and harder to read and had too much information for their liking. Gender was not the only differentiating sociodemographic characteristic in this study. Income also had a significant influence, with low income earners showing a higher appreciation for food pairing information as opposed to higher income earners. These sociodemographic differences found in Barber et al. (2006) contrast with the findings of Charters et al. (1999) who stated that there were no significant differences between the genders, age, income and purchasing habits in the wine labelling area.

In a different study, Chaney (2000) showed that there were no significant differences in the perceived importance of the various back label attributes, but rather consumers rely on various sources of information in making a purchase decision. UK wine consumers were asked to rate the utility of wine back label statements on a five point Likert scale, which does not force consumers to make trade-offs between the attributes. The lack of significant differences could possibly be a result of the research method applied (Goodman, Lockshin, & Cohen, 2006).

1.3. Objectives

Conflicting results indicate that there is still uncertainty regarding the type and level of information that should be displayed on wine back labels. In addition there are ambivalent results regarding the existence of preference heterogeneity and the influence of consumer characteristics on the importance attached to back label statements.

The objective of this study is to quantitatively examine which back label attributes are of highest value to consumers. The differences between consumers' choice behaviour will be considered by modelling consumer segments based on the relative importance of back label attributes and differences in preferred back label statements. These emerging segments will also be characterised by any differences in their general wine purchase behaviour and sociodemographic structure. This study is the first of its kind in consumer food research to apply a latent class choice modelling approach to labelling. Instead of looking for back label attribute differences between pre-specified clusters, segments in this study are derived from differences in simulated choice behaviour, which has a higher predictive validity for their real purchases (Wedel & Kamakura, 2000).

2. Materials and methods

2.1. Method and model

This research studies the importance consumers place on back label attributes through a discrete choice experiment (DCE). Discrete choice analysis has been used in consumer research for food in general and wine specifically as a means to assess individual attribute preferences in different purchase situations (Barreiro-Hurlé, Colombo, & Cantos-Villar, 2008; Enneking, Neumann, & Henneberg, 2007; Jaeger & Rose, 2008; Lockshin, Jarvis, d'Hauteville, & Perrouty, 2006; Lockshin, Mueller, Louviere, Francis, & Osidacz, 2009; Mueller & Lockshin, 2008; Teratanavat & Hooker, 2006). DCEs simulate real choices and have proven to be highly predictive for consumers' market behaviour (Louviere, Hensher, & Swait, 2000). Respondents are asked to choose from several stimuli, each a combination of several attributes. When making their choice, respondents are forced to trade-off between levels of different attributes, thereby revealing their preferences.

2.1.1. Modelling preference heterogeneity in choice models

One of the limitations of the standard multinominal logit model (McFadden, 1974), the assumption that preference heterogeneity is related to observable characteristics such as sociodemographics, was overcome with the introduction of later generations of choice models. The random parameter logit (RPL) model approach (Train, 1998) models preference heterogeneity by allowing parameters to vary randomly across individuals. This is achieved by including a respondent-specific stochastic component that specifies the individual specific deviation from the overall utility mean (Gracia, Loureiro, & Nayga, 2009; Jaeger & Rose, 2008). The individual part worth utilities follow a distribution that has to be pre-specified by the researcher. Latent class (LC) models (Kamakura & Russell, 1989) are an alternative approach that assume that the overall preference distribution is made up of a combination of unobservable, latent groups or classes that differ in their utility between the groups but are similar within. With the help of statistical criteria the researcher has to specify the optimal number of these underlying groups. Simulation procedures estimate class-specific part worth utilities for each attribute level and assign each person a probability of belonging to each of the pre-specified classes.

Both approaches are related in the sense that a latent class model converges to a random parameter model for an endless number of classes (Greene & Hensher, 2003), so that each individual becomes its own class. According to Provencher and Moore (2006), the choice between both methods should depend on what researchers believe about the underlying preference structure. If they are unique to individuals like a fingerprint then a random parameter model is appropriate. If instead the spread of preferences is "lumpy" in a way that broad classes of consumers exist with similar preferences to each other, but different preferences to everyone else, then the latent class approach is more appropriate (Hynes, Hanley, & Scarpa, 2008). For food in general and wine specifically, the assumption that every consumer has individually unique preferences seems less adequate than the notion of a certain number of consumer groups with similar preferences.

Accordingly, a latent class model was chosen for the analysis of wine choices to simultaneously approximate scale and part worth utility parameters and class membership from the DCE choices. The model is based on the random utility framework, postulating a composite utility function of the following form:

$$U_{ni/c} = \beta_c X_{in} + \varepsilon_{ni/c} \tag{1}$$

where the utility of the n_{th} respondent belongs to a particular class s from choosing an alternative i from the available choice options, where S is a linear combination of attribute part worths β_c, and an error term. The Vector $X_{ni/s}$ consists of the choice-specific product attributes. Preference heterogeneity is operationalised by estimating for each class c its own utility parameter vector β_c. Under the usual assumptions that the errors ε_{ni} are IID and follow a Type I distribution the probabilistic response function follows as:

$$\pi_{ni/c}(i) = e^{\lambda_c(\beta_c X_{in})} \Big/ \sum_{j\in S} e^{\lambda_c(\beta_c X_{jn})} \tag{2}$$

A complete mathematical derivation of the LC choice model can be found in Boxall and Adamowicz (2002), Louviere et al. (2000), and Swait (1994).

Both random parameter and latent class models usually assume that all individuals respond to the choice experiment with the same consistency, that is identical error variances are assumed by setting the scale factor λ in Eq. (2) to one. Recent research has found strong evidence that this assumption frequently is strongly violated (Louviere, 2001). In fact error variances are not constant within or between respondents (Islam, Louviere, & Burke, 2007). If random parameter and latent class models do not account for differences in respondents' consistency (error variance) then the estimated utility parameters are confounded with the unobserved distribution of error variances (Louviere & Eagle, 2006). In other words, these models may show differences in consumers' preferences for product attributes, which are instead partially caused by differences in respondents' choice consistency or certainty (Louviere & Meyer, 2007). That is these models overestimate the true preference heterogeneity.

2.1.2. Scale extended latent class model

New developments in latent class choice modelling (Vermunt & Magidson, 2008) can at least partially overcome the assumption of identical error variances by not only modelling different attribute preference classes, but by also modelling (independent) certainty classes that differ in their error variance. While each individual could indeed have its own specific error variance, a scale extended latent class model approximates this continuous error distribution with a limited number of scale classes for which the scale is assumed to be identical within a scale class but different between the scale classes.

As the error variance is inversely related to the scale parameter λ (Swait & Louviere, 1993), certain or consistent respondents are assigned a larger λ than uncertain or inconsistent respondents. These different scale parameters are taken into account when simultaneously estimating the class-specific attribute part worth utilities, which are adjusted to an identical (or at least similar) underlying preference scale (Magidson & Vermunt, 2007). This ensures that different part worth values indeed reflect different product attribute preferences and are not confounded with different degrees of choice uncertainty.

We estimated the LC choice model with the syntax module of Latent Gold Choice 4.5, which allows the estimation of both part worth utility β_c and scale factor λ_c in Eq. (2) simultaneously (Vermunt & Magidson, 2008). To avoid identification issues the scale parameter of one scale class is set to 1.

The resulting segments (latent classes), as defined by their segment specific attribute level part worths and attribute importance

Table 1
Attributes and levels used in discrete choice experiment.

	Attribute	Levels	Information level
1	History	2	Family-owned for 75 years using our time-honoured methods to ensure unparalleled quality
2	Grape source	2	All grapes sourced locally
3	Production	2	Matured in French oak barrels for 12 months prior to bottling
4	Simple taste	2	A full-bodied, red wine
5	Elaborate taste	2	Displaying elements of dark chocolate, ripe plums, and fine chalky tannins
6	Food pairing	2	Match with red meat, poultry dishes, and good Indian curries
7	Consumption advice	2	Drink now, or with careful cellaring, enjoy in 5–6 years
8	Environmental	2	This environmentally-conscious wine was produced using biodynamic techniques
9	Website	2	For more information please visit www.barossawines.com.au
10	Ingredients	2	Ingredients: Grapes, Sulphur dioxide, Yeast, Diammonium phosphate, Bentonite, Pectinolytic enzymes
11	Price	4	$13.99, $19.99, $25.99, $31.99

Note: All two level attributes either had the statement or not.

estimates, were later characterised by sociodemographic and wine behaviour characteristics in a post hoc analysis. SPSS 17.0 was used to conduct ANOVAs and X^2-tests to assess if segments of different choice drivers significantly differ in these characteristics.

2.2. Attributes and choice stimuli

2.2.1. Back label statements

Based on previous studies and after examining wines available in wine stores, ten back label statements were selected to be included in the experiment: "simple" and "elaborate taste" (Charters et al., 1999); "history" and "production" (Shaw et al., 1999); "website" (Rocchi & Stefani, 2005); "consumption" or "cellaring advice" (Thomas & Pickering, 2005); "grape source" (Lunardo & Guerinet, 2007) and "food pairing" (Barber et al., 2006).

In addition, due to the exploratory nature of this study it was decided to examine two additional back label attributes of relevance not previously examined in the back labelling literature. These include "environmental" statements and "ingredient" information. The environmental attribute (i.e., this environmentally-conscious wine was produced using biodynamic techniques) was included, because recent research found that some wine buyers are concerned about the environment and it might affect their purchases (Orth, Wolf, & Dodd, 2005; Remaud, Mueller, Chvyl, & Lockshin, 2008).

Though not (yet) permitted in Australia, a list of six hypothetical ingredient components selected from various examples in the UK market and the US winery Bonny Doon was used to gauge Australian consumer perceptions of a wine's ingredient composition (i.e., grapes, sulphur dioxide, yeasts, bentonite). This was motivated by the recent move by US winemaker Randall Grahm to include ingredients on the back label of all Bonny Doon Vineyard's wines and the general trend shown by pending litigation in the US court system to include ingredients (Sogg, 2007). Also consumer groups in other countries support the mandatory labelling of wine ingredients (Port, 2008).

Food consumers were found to value the availability of general nutritional facts when making food product choices (Gracia et al., 2009). Especially certain items, such as fat content (Mathios, 2000; Wansink & Chandon, 2006) and genetic modification (Carneiro et al., 2005; Matsumoto, 2004) are used by consumers as heuristic decision cues. Consumer valuation of chemical ingredient information was previously tested for functional food additions (milk desserts) by Ares, Giménez, and Gámbaro (2009), who found consumers were impacted negatively, if scientific ingredient names (β-glucan, flavonoids) instead of common names like fibre and antioxidants were used. No ingredient information has been tested for wine to the best knowledge of the authors.

The 10 attributes and the levels of information presented for each attribute are displayed in Table 1.

2.2.2. Price

Price is perceived by consumers as the most salient attribute in product choice in general (Jenster & Jenster, 1993; Quester & Smart, 1998) and serves as the most important cue for the quality perception of wine in particular (Keown & Casey, 1995; Mitchell & Greatorex, 1988; Olson, 1977). Previous studies (Lockshin, 2003; Lockshin, Jarvis, d'Hauteville, & Perrouty, 2006; Lockshin et al., 2009; Mueller & Lockshin, 2008; Tustin & Lockshin, 2001) identified price as key driver of wine choice. Price is particularly significant when intrinsic cues such as wine flavour are not available in the pre-purchase stage (Mitchell & Greatorex, 1989) and is utilised by consumers as part of their risk reduction strategies (Dodds & Monroe, 1985; Spawton, 1991b; Zeithamel, 1988).

Therefore, in this study price was included as a known driver, allowing the measurement of the importance of the ten back label attributes relative to price. After examining representative prices of Barossa Shiraz at wine shops and liquor stores in a major Australian city, $13.99, $19.99, $25.99, and $31.99 were selected to represent four distinct price tiers for a special consumption situation.

2.2.3. Statistical design and choice stimuli

In total 11 attributes are included in the experiment (Table 1). Of these 10 are information attributes where the utility was measured based on the presence of the information on the back label relative to when it is absent.[1] Accordingly, these information attributes have two levels, one for their presence and one for their absence. Every wine alternative in a choice set showed one of four price levels (see Fig. 1).

Attributes and levels were assigned according a $2^{10} \times 4$ orthogonal main effects plan (OMEP) in 16 choice sets with choice set size four and statistical efficiency of 100% (Street & Burgess, 2007). Every respondent completed a complete choice design, allowing the subsequent analysis of respondent heterogeneity.

Graphical back labels were developed, representing all attribute levels with prices given below, typical for a retail environment. Shiraz as the red variety with the highest popularity in Australia and Barossa as one of the most reputable Australian wine regions, famous for its Shiraz wines, were chosen as wine type and origin. All the labels were identified as a product of Australia, at 13.5% alcohol level and with a dummy brand name (Brand X wines). The decision to choose a nonexistent brand (Brand X wines) is based on studies (Orth & Malkewitz, 2008; Underwood & Klein, 2002; Zeithamel, 1988), which showed that when a brand is un-

[1] As both the "simple" and "elaborate" taste description could be present in the same back label we worded them in a way that allowed a combination of both (see Table 1).

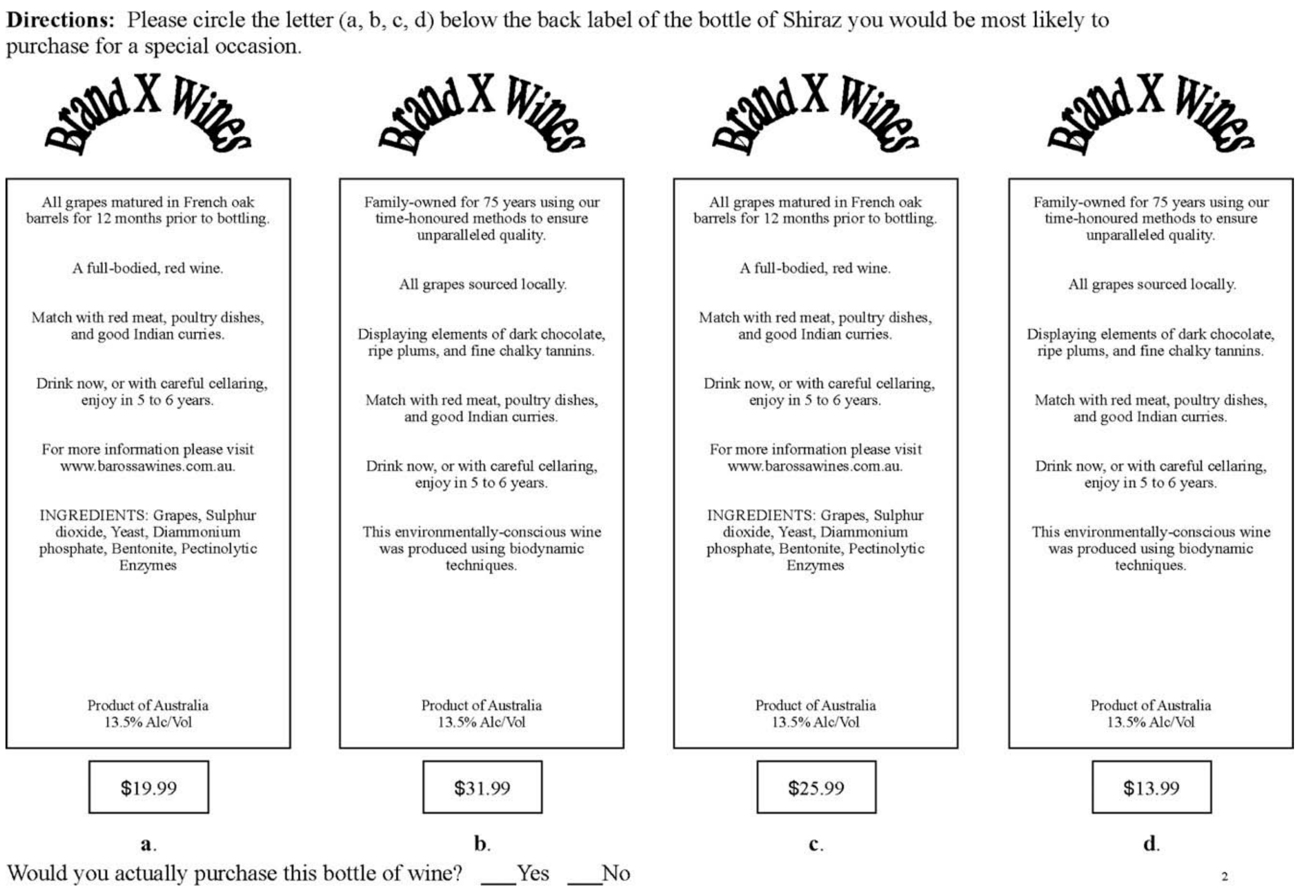


Fig. 1. Example choice set.

known or unfamiliar, consumers tend to rely more on other extrinsic cues (e.g. taste, manufacture) in order to form a judgment of the wine. This ensured that any back label information effects would be measurable and not dominated or affected by brand effects in this exploratory study.

2.3. Survey

A paper and pencil survey was used for the choice experiment (see Fig. 1 for one example of a choice set). The survey was tested for the associations with the attributes, readability and length in a pilot study with graduate marketing students from a major Australian university. The order of the 16 choice sets was randomised over all respondents to balance any attention or concentration effects over the duration of the survey. For each choice set, participants were asked to choose the option they would most likely purchase from the four that were displayed (A–D).

For this first study measuring the relative importance of back label statements relative to price, a purchase situation for a special occasion was selected, because consumers are very likely to use risk reduction strategies such as reading back label information for such an occasion. This situation, according to Hall and Lockshin (2000) represents approximately a quarter of wine consumption occasions in Australia.

General wine behaviour was confirmed through a number of questions at the end of the survey. These measured information regarding the frequency of wine consumption, the number of years of drinking wine, wine involvement, subjective wine knowledge, the individuals' risk adverseness associated with wine purchasing and the price of the last wine purchased. Before the survey concluded with sociodemographic questions, respondents were asked four items regarding their perceived importance of back labels (see Table 5).

2.4. Consumers

The sample of regular wine consumers ($n = 331$) was provided in May 2008 by a sensory laboratory in North Sydney. Respondents were screened according to their wine purchasing and drinking habits. To qualify, participants had to drink wine at least once per fortnight, had to consume Shiraz at least once in the last three months, had to have purchased a bottle of red wine at least once in the past month, and finally had to occasionally buy wine in the $10–20 price range. The screening process ensured that respondents had previous purchase experience with the red grape variety Shiraz, in bottled form and at higher price points.

A sociodemographic comparison (Table 2) indicates that the sample for this study is largely similar to the general Australian wine consumer population as reported by Roy Morgan (2007) single source data, which is based on a representative survey of consumption behaviour of more than 50,000 Australian individual consumers per year. While the gender ratio is balanced, there are slightly more younger participants and fewer older and low educated wine consumers in this study's sample. These deviations are very likely caused by screening out bag in box-only wine consumers, who were found to be older with lower education levels in a recent large representative consumer study by Mueller and Umberger (2009). Overall, the sample can be assumed to be representative for frequent Australian wine consumers that occasionally buy wine in the $10–20 price range.

Table 2
Sociodemographic sample characteristics compared to overall Australian wine consumer population (Roy Morgan single source data January–December 2006).

		Australian wine consumer population (Roy Morgan) (%)	Sample (n = 331) (%)
Gender	Female	52.2	48.3
	Male	47.8	51.7
Age	18–24	8.2	19.8
	25–34	16.1	21.0
	35–49	31.4	27.1
	>50	44.3	32.1
Marital status	Single	30.7	48.3
	Married/de facto	69.3	51.7
Children in household	Yes	31.8	27.7
	No	68.2	72.3
Number of children	1	13.3	12.6
	2	12.7	12.3
	3+	5.7	2.8
Personal income (AUD)	Under $20,000	18.1	13.6
	$20,000 to $29,999	12.0	9.1
	$30,000 to $49,999	25.5	25.8
	$50,000 to $69,999	19.8	24.6
	$70,000 or More	24.7	26.9
Education	Some Secondary/Tech.	14.6	4.6
	High school/Year 12	34.1	41.7
	Have Diploma or Degree	51.3	53.7

3. Results

3.1. Discrete choice experiment

Respondents had to make a forced decision between the four alternatives in each choice set to prevent an easy opt out with a 'no-choice' option (Dhar & Simonson, 2003). To assess the degree to which respondents would not purchase any of the alternatives respondents were also asked whether they would actually purchase their choice (see Fig. 1). Overall, respondents stated a willingness to purchase for 86.4% of all the chosen alternatives, indicating a very small bias from forced choice.

For the latent class choice model the researcher has to specify the number of underlying latent classes. The decision for their optimal number was based on fit statistics (BIC value), the relative size of the resulting segments and significant parameter differences between the classes (Ruto & Scarpa, 2008; Scarpa, Thiene, & Tempesta, 2007). Solutions with five and six indirect utility function classes and two scale classes achieved very similar fit statistics (BIC_{C5S2} = 11,889.56 and BIC_{C6S2} = 11,889.09) but one parameter was not significantly different for the six-class solution. Hence, five utility function classes (or segments) and two scale classes ($\lambda_1 = 1$, $\lambda_2 = 3.04$, $n_{S1} = 154$, $n_{S2} = 177$) were selected. As previously discussed in Section 2.1.2, for identification purposes the scale factor of the first class is set to one which represents the less consistent or more uncertain class, to which 46.5% of respondents were assigned. The higher scale value of the second class is identical to a lower error variance (Magidson & Vermunt, 2007) and represents the part of the sample that chose more consistently (53.5%).

Estimated part worth values for attribute levels for each class are in Table 3. Wald statistics indicate that all attribute effects were significant at conventional levels; attribute level utilities also differ between the classes.

The relative attribute importance was estimated by calculating partial R-Squares, that is the partial log-likelihood associated with each attribute across all its levels was calculated for each of the five classes according to Louviere and Islam (2008). Because of the binary nature of the back label information attributes, which were either shown on the back label or not, their part worth utilities (Table 3) are closely related to their attribute importance in Table 4.

As a measure for the average importance over the total sample, a weighted average over all classes was calculated for each attribute and is given in the last column of Table 4. Overall, price is the most important attribute on average accounting for two thirds (66%) of the variance explained. The remaining 34% of attribute importance is largely shared by four main attributes. Listing "ingredients" on the back label accounted for 9% of this importance

Table 3
Estimates of latent class choice model.

Class	C1		C2		C3		C4		C5				
Class size	31%		18%		20%		18%		13%		Wald	df	p
Label preference	Food pairing		History, production, environment, elaborate taste		Food pairing, simple taste		Elaborate taste, history		No ingredients				
Price preference	Low		Low/med		Med		Med/high		Low/med				
	Coef.	z-Value	Coef.	z-Value	Coef.	z-Value	Coef.	z-Value	Coef.	z-Value			
History	0.05	1.15	1.17	7.99**	0.18	3.75**	0.15	4.35**	−0.03	−0.16	43.8	5	0.00
Grape source	0.16	3.82**	0.55	7.28**	0.19	4.03**	0.10	2.80**	0.65	4.01**	52.9	5	0.00
Production	0.08	2.01**	0.99	7.70**	0.25	5.07**	0.08	2.61**	0.08	0.54	39.1	5	0.00
Simple taste	0.07	1.74*	0.54	7.03**	0.30	5.81**	0.03	1.03	0.22	1.21	39.8	5	0.00
Elaborate taste	0.22	5.32**	0.68	7.44**	0.03	0.54	0.18	4.66**	0.26	1.62	51.1	5	0.00
Food pairing	0.34	7.89**	0.21	4.25**	0.28	5.59**	0.06	1.92*	0.79	4.93**	60.7	5	0.00
Consumption advice	0.11	2.70**	0.58	7.22**	−0.13	−2.77**	0.12	3.43**	0.21	1.34	34.7	5	0.00
Environmental	0.11	2.68**	0.61	7.46**	0.10	2.20**	0.08	2.51**	0.81	4.48**	49.7	5	0.00
Website	0.00	0.09	0.06	1.36	−0.05	−0.97	0.08	2.47**	0.52	3.48**	16.3	5	0.01
Ingredients	0.12	2.75**	0.33	5.30**	0.07	1.40	−0.13	−3.96**	−2.29	−11.72**	84.9	5	0.00
Price													
$13.99	0.78	14.19**	0.61	9.07**	0.16	3.65**	−0.62	−6.88**	0.90	9.93**	149.6	15	0.00
$19.99	0.11	3.58**	0.55	8.73**	0.73	11.05**	0.18	5.77**	0.53	7.25**			
$25.99	−0.38	−8.62**	−0.17	−3.43**	0.11	2.57**	0.34	6.85**	−0.36	−5.12**			
$31.99	−0.52	−9.30**	−0.99	−8.68**	−1.00	−9.66**	0.10	3.27**	−1.08	−9.08**			
R^2	30%		33%		26%		15%		48%				

R^2 = 0.308; LL = −5,727.2; BIC(LL) = 11,889.6; classification error = 0.138; n = 331, #parameters = 75; df = 256; 5 classes, 2 scale classes.

* $p < 0.05$.

** $p < 0.01$.

Table 4
Attribute importance weights for classes and total sample sorted by importance.

Class size	C1 31(%)	C2 18(%)	C3 20(%)	C4 18(%)	C5 13(%)	Total sample *N* = 331
Price	88.1	31.3	80.1	69.4	33.2	65.9
Ingredients	.6	1.9	.2	4.3	59.0	9.0
History	.1	18.1	1.8	6.4	.0	4.8
Elaborate taste	2.4	7.9	.0	8.9	.3	3.8
Food pairing	6.1	1.6	4.7	.8	2.8	3.7
Production	.3	10.8	3.9	1.7	.0	3.1
Grape source	1.1	6.7	2.2	2.0	1.4	2.5
Environmental	.5	9.0	.6	1.5	1.8	2.4
Simple taste	.2	6.0	5.3	.2	.1	2.3
Consumption advice	.5	6.6	1.0	3.3	.1	2.1
Website	.0	.1	.1	1.5	1.2	.5

(though with a negative impact), followed by the "history" attribute at 4.8%. Information about "food pairing" and the "elaborate taste" of the wine followed at 3.8% and 3.7%, respectively.

Results for the five segments in Table 4 show that consumers differ quite substantially in the relative impact of back label information on their choice and preference for specific back label attributes. The five distinct preference segments (C1–C5) are ordered according to their price preference (see utility estimates in Table 3) from low prices (C1) to medium and high prices (C4). For the first four classes those back label attributes found to have a substantive influence on wine choice have a positive part worth utility, implying that their presence increases the likelihood of a wine being chosen. But the fifth class (C5), representing 13% of the sample, is different from the others. For these consumers ingredients have a very strong (59%) negative influence on choice, implying that their presence on a back label makes a purchase of that wine very unlikely. Ingredients are also negative for the fourth class (C4), but the relative influence of this attribute is smaller (4.3%) and not the main choice driver for this segment.

Turning to the other classes in detail, it appears that consumers, who strongly prefer lower prices ($13.99), value food pairing information (C1). Most other back label information has no or a very small influence on this group which represents 31% of the population. The second class (C2) shows the strongest influence of back label information, which explains about two thirds of choice variance. These consumers equally prefer lower ($13.99) and medium prices ($19.99) and strongly value information on the winery's history, production method, environmental production and both simple taste and elaborate taste. In contrast, a website, food pairing information or ingredients have no or a very small influence on this information sensitive group. The next group (C3), representing a fifth of frequent Australian wine consumers, prefers medium prices and to a minor extent is influenced by back label information such as food pairing and simple taste descriptors. Consumers (C4) who are willing to pay medium and high prices ($25.99) for a special occasion value elaborate taste descriptions and information about the history of a winery but dislike information on wine ingredients. Finally, an eighth of frequent Australian wine consumers who prefer lower and medium prices are strongly negatively impacted by ingredient information (C5).

Overall, those classes for which price is the predominant and almost only choice driver represent about half of the population (C1 and C3). About a third of frequent Australian wine consumers (C2 and C4) can be positively influenced by back label information, especially valuing history and elaborate taste descriptions. About a third of frequent Australian wine consumers are adversely affected by stating ingredients on the back label, with a small share of about 13% of consumers (C5) refusing to choose labels with them.

3.2. Post hoc segmentation

The five segments characterised above were derived from differences in respondents' choice behaviour and this can be complemented by a post hoc characterisation of respondents by their wine behaviour and sociodemographic characteristics. This aims to answer the question of whether consumers with different choice patterns also differ in other characteristics, which might allow wine producers to target them with specific products. Differences between the segments for back label valuation, wine behaviour and sociodemographics are now discussed.

3.2.1. Back label valuation

In order to establish the overall importance of back labels in the purchase decision making process, participants were presented with four questions regarding the value and perceived importance of back label information, using a structured 7-point scale (see Table 5). In general across all items slightly more than half of the sample reports that they read back labels, find them interesting, and helpful and tend to be able to identify the flavours described in the sensory information. Specifically, the helpfulness of back labels is evaluated slightly higher, whereas the identification of flavours receives less confirmation by respondents.

A factor analysis confirmed that all four items load on one factor and form one construct. A Cronbach's alpha of 0.89 indicates high scale reliability allowing the sum of the scale values to be considered as one construct. An analysis of variance revealed significant differences between the five latent classes using a post hoc Tukey test. The results indicate that segments C2 and C4 evaluate the importance of back labels significantly higher than segment C1 with a confidence level of $\alpha = 0.10$ (see Table 6). These findings concur with the results of the DCE (see Table 4) as segment C1 revealed the lowest influence of back label information (11.9%) and segments C2 and C4 had the highest influence of 68.7% and

Table 5
Items of back label importance scale (7-point).

Item	Anchors	Mean	Standard deviation
When I shop for wine I normally read the back labels	Never–always	4.51	1.84
For me, reading wine back labels is	Boring–interesting	4.93	1.70
For me, wine back labels are	Useless–helpful	5.32	1.51
When tasting wine I can identify the flavours described on the back label	Never–always	4.44	1.42

Table 6
Analysis of variance for back label importance.

	C1	C2	C3	C4	C5	F	p
Back label importance	18.0[a]	20.5[b]	18.9	20.5[b]	18.9	2.930	0.021

ANOVA: Tukey post hoc tests, classes with different superscript are different at $\alpha = 0.10$.

Table 7
Price of the last bottle of red wine purchased (percentage within latent class).

Price	C1	C2	C3	C4	C5	Total
Under $10	**15.2%**	7.0%	6.2%	5.1%	10.0%	9.4%
$10.01 to $15	**46.5%**	**40.4%**	23.1%	25.4%	32.5%	35.0%
$15.01 to $20	*28.3%*	38.6%	**55.4%**	28.8%	35.0%	36.6%
$20.01 to $30	*9.1%*	12.3%	13.8%	**30.5%**	20.0%	15.9%
Over $30	1.0%	1.8%	1.5%	**10.2%**	2.5%	3.1%

$\chi^2_{(DF=16)} = 49.66$, $p = 0.001$.

30.4%, respectively, but we cannot differentiate between these segments.

3.2.2. General wine behaviour and sociodemographics

Significant differences between the latent classes were only found for the price of the last wine purchased and are strongly consistent with the price levels showing the highest utility in the DCE. While 61.7% of respondents from C1 had purchased wine for $15 or less, 40.2% of C5 spent more than $20 (see Table 7). The price preferences revealed in the DCE are strongly related to consumers' past behaviour, which underlines the validity of the method. It was also found that respondents of C1 and C2 were more likely to have purchased their last bottle of wine on a price promotion, either at a discounted price or at a price discount for multiple bottles.

For the rest of the questions involving general wine behaviour there were no significant differences between the classes, apart from a very marginal difference between participants from C4 who drink wine significantly more often outside their homes (cafés, bars, restaurants) than respondents in C5. While wine involvement was found previously to be a significant moderator for consumers' attitudes and purchase decisions (Lockshin, Jarvis, d'Hauteville, & Perrouty, 2006), we could not find evidence that consumers who are more wine involved are significantly different in their wine choice behaviour. There was also no significant difference between consumers who had more or less wine experience (Ballester, Patris, Symoneaux, & Valentin, 2008). Also, high involvement consumers' preference for elaborate taste descriptions could not be confirmed for wine choice behaviour. The special purchase situation respondents faced when making their choices might have put all of them in a high involvement state, which did not reflect their normal purchase patterns. This may possibly explain a lack of differences between the segments based on involvement.

Analysing demographic variables for each class shows that there were no significant differences between men and women, age groups, household income and other consumer characteristics between the segments.

4. Discussion

This study is the first of its kind in wine research to quantify the importance consumers place on back label information through a discrete choice experiment, which forced respondents to trade-off different products varying in price and back label attributes. Based on consumers' choices, five segments of frequent Australian wine consumers were derived with a latent class choice model, each varying in their preferred price levels and the relative importance of back label attributes. The results of this method, as compared to findings from previous studies in wine back labelling, allow a more valid assessment of the relative importance of different back label statements to different consumer groups.

4.1. No sociodemographic segment differences

Instead of comparing differences between consumer groups defined a priori based on their sociodemographics, we examined if observed differences in consumers' choice behaviour was related to differences in sociodemographic or wine behaviour characteristics. Our finding is negative in a sense that there were no differences in back label choice behaviour linked to sociodemographic or wine consumption behaviour differences. The only significant post hoc differences found between the segments confirm the results already derived from respondents' choices, such as preferred price levels and the stated importance of back labels. The inability to match choice heterogeneity with sociodemographic differences agrees with findings of Mueller and Lockshin (2008) who did not find strong sociodemographic deviations between segments based on distinct wine choices. They are also consistent with Charters et al. (1999), who could not find sociodemographic differences for back label importance.

4.2. Attribute importance and optimal attribute combinations

As a result of the above, producers cannot specifically target the five consumer segments by supplying different products to different sales channels. However, this study outlines certain combinations of wine attributes, which are valued by certain groups of consumers. For instance, lower priced wine should display information on food pairing and elaborate taste descriptions, which are of high utility for about a third of consumers (C1). A smaller share of about a fifth of consumers who value environmental back label attributes likes to read history and production method information as well as elaborate taste description (C2). Wines sold at medium and higher price points are recommended to display food pairing, elaborate taste descriptions and winery history information on their back labels (C3 and C4). All of these additions had positive impacts on choice probabilities, and none would decrease the probability of choice.

For the overall sample of wine consumers, information on the history of a winery including a unique production method and quality statement had the largest positive impact, followed by elaborate taste information and food pairing advice. While the first two concur with previous findings by Charters et al. (1999) and Barber et al. (2006), the large impact of history information is somewhat surprising and might have partially been caused by combining it with a reference to winery specific methods and a quality claim. It also should be considered that Australia is different from many old world countries as there are few wineries able to look back at a 75 year history, which makes the history statement used in this study rather rare and unique. Also, the lower revealed importance of cellaring advice compared to Thomas and Pickering (2005) might be attributed to the fact that the majority of wines sold in Australia are not cellared and that consumers are used to consuming Shiraz wines at a relatively young age and hence do not value cellaring recommendations.

The low importance of an environmental message is in congruence with findings by Remaud, Mueller, Chvyl, and Lockshin (2008) who found only 15% of Australian wine consumers consider environmental claims when making a purchase decision for wine. Also here it only has a notable impact for one consumer segment (C2). A winery's website had the smallest impact of all back label statements overall but was not perceived as negative as suggested by Rocchi and Stefani (2005).

4.3. Ingredient information

While almost all back information was found to have a positive impact on consumer choice, the display of ingredient information was found to have a strong negative effect for about a third of frequent Australian wine consumers. For a small segment of 13%, a negative impact on choice of 59% implies that a very positive attribute such as a very low price would have to compensate the substantive disutility from the ingredient information.

This strong aversion to the list of ingredients was surprising and its reasons cannot be explained completely by this study. Compared to our findings the impact of scientific ingredient statements found by Ares et al. (2009) was minor and varied only slightly between gender and age groups. The size of the impact can be compared to the strong aversion of some consumer segments for genetically modified food (Boecker, Hartl, & Nocella, 2008; O'Connor, Cowan, Williams, O'Connell, & Boland, 2006). But while genetic modification is highly controversial, the ingredient list used in this experiment reflects traditional manufacturing methods.

Possible reasons for the strong negative impact of wine ingredients can be tied to previous research findings for food risk perception and food technology knowledge. One possible explanation could be cognitive dissonance caused by the chemical information which conflicts with the widely held image of wine to be healthy and pure (Selvanathan, 2004). Some consumers might react to this conflicting information by totally refusing products with ingredient information, as they are perceived to be an exception from the perceived norm. Also the novelty of the ingredient information, recently not yet allowed in Australia, might increase this effect.

Another potential explanation is unknown chemical information may trigger perceived food risks for certain consumers (McCarthy & Henson, 2005; Yeung & Morris, 2001). Most wine consumers can be assumed to neither know nor understand the role of chemicals such as 'diammonium phosphates', 'bentonites' or 'pectionolitic enzymes' in the process of winemaking (Port, 2008). This assumption is backed by low consumer knowledge of food-processing technologies for other regularly consumed foods such as meat and cheese (Frewer, Howard, Hedderley, & Shepherd, 1997; McCarthy et al., 2007). Consumers were found to attribute higher risks to food products where they have less knowledge of chemical or technological processes and ingredients (Department of the Environment, 1995). This missing knowledge and understanding inhibits them from making an informed assessment and is likely to lead to a perception of risk (McCarthy & Henson, 2005). Subjective uncertainty regarding the impact of those ingredients on consumers' health may lead to risk reduction strategies such as refusing to purchase the offending product (Yeung & Morris, 2001) or wineries having to develop expensive new processing regimes.

These findings have important implications for a government considering compulsory labelling of wine ingredients as recently supported by Australia's leading consumer organisation 'Choice' (Port, 2008). The government has to ensure that consumers are educated and informed about the meaning, risk and potential health impact of those ingredients and needs to find terms and language understandable to buyers. Otherwise, these information measures are likely to have an adverse impact by creating risk perceptions instead of reducing consumer uncertainty.

4.4. Limitations and future research

Participants were instructed to make their choices based on selecting a wine for one specific consumption occasion hence limiting the generalization of results. No front label was used in the experiment, so all choices were made using price and back label statements, which reduced the realism of the task. The experimental design did not allow the measurement of the effect of the number of back label statements. It may be that consumers are overwhelmed if all the possible statements are included together (Kimura et al., 2008). This should be tested in future research by using a design that allows this to be examined empirically.

Based on this study three major future avenues for back label research emerge. While this first study applying discrete choice analysis included back label information and price only, more extrinsic attributes should be incorporated into further studies. Larger DCE designs should be used by also including product cues like brand, region and packaging that are likely to reduce purchase risk and potentially decrease the effect of back label statements on wine choice.

This and previous back label studies confronted consumers with back label statements to measure their effect on liking or choice. In a real purchase situation consumers first have to actively turn the bottle around and read the information before being potentially impacted by it. There is no research available on how many consumers look at any back label information at the shelf or when consuming the product. Observational research in the store or in controlled shelf settings should shed some light on this.

Further research is necessary to better understand the reasons for the aversion against ingredient information observed in this study. Qualitative and quantitative research could further explore consumer knowledge of wine production ingredients and processes as well as consumers' subjective risk perceptions and cognitive and behavioural risk reduction strategies.

5. Conclusion

Wine back label information was found to have a positive effect on consumer choice, except for chemical wine ingredients which caused strong adverse reactions for some consumers. On average, winery history combined with a quality statement, elaborate taste descriptions and food pairing have the strongest influence on frequent Australian wine consumers. Relative to price, back label information only has about a 33% impact on wine choice, even if consumers do not have to actively look for the back label but are confronted with it.

Only about a third of consumers show a medium to strong influence of wine back label attributes. Consumer segments differing in their price and back label preferences are not different in their sociodemographic characteristics or wine behaviour, and hence, cannot be specifically targeted by wine producers. Despite its relative small effect, it is recommended that wine producers furnish their wines with back labels, as this is the only option available to many smaller and medium sized wineries to actively inform consumers about their product and themselves. While no damage can be done by providing most additional information, producers should avoid chemical ingredients on back labels as they might not be understood and cause negative perceptions and reactions by some consumers.

References

Ares, G., Giménez, A., & Gámbaro, A. (2009). Consumer perceived healthiness and willingness to try functional milk desserts. Influence of ingredient, ingredient name and health claim. *Food Quality and Preference, 20*(1), 50–56.

Ballester, J., Patris, B., Symoneaux, R., & Valentin, D. (2008). Conceptual vs. perceptual wine spaces: Does expertise matter. *Food Quality and Preference, 19*(3), 267–276.

Barber, N., Almanza, B., & Donovan, J. (2006). Motivational factors of gender, income and age on selecting a bottle of wine. *International Journal of Wine Marketing, 18*(3), 218–232.

Barreiro-Hurlé, J., Colombo, S., & Cantos-Villar, E. (2008). Is there a market for functional wines? Consumer preferences and willingness to pay for resveratrol-enriched red wine. *Food Quality and Preference, 19*(4), 360–371.

Beverland, M. (2006). The 'real thing': Branding authenticity in the luxury wine trade. *Journal of Business Research, 59*(2), 251–258.

Boecker, A., Hartl, J., & Nocella, G. (2008). How different are GM food accepters and rejecters really? A means-end chains application to yogurt in Germany. *Food Quality and Preference, 19*(4), 383–394.

Boxall, P. C., & Adamowicz, W. L. (2002). Understanding heterogeneous preferences in random utility models: A latent class approach. *Environmental and Resource Economics, 23*, 421–446.

Carneiro, J. D. S., Minim, V. P. R., Deliza, R., Silva, C. H. O., Carneiro, J. C. S., & Leao, F. P. (2005). Labelling effects on consumer intention to purchase for soybean oil. *Food Quality and Preference, 16*, 275–282.

Chaney, I. (2000). External search effort for wine. *International Journal of Wine Marketing, 12*(2), 5–21.

Charters, S., & Pettigrew, S. (2006). How effectively do we communicate about wine? In *Proceedings of the 3rd international wine business and marketing research conference, July 6–8, Montpellier*.

Charters, S., Lockshin, L., & Unwin, T. (1999). Consumer responses to wine bottle back labels. *Journal of Wine Research, 10*(3), 183–195.

Charters, S., & Pettigrew, S. (2003). I like it, But how do I know if it's any good? Quality and preference in wine consumption. *Journal of Research for Consumers, 5*, 1021–1027.

Department of the Environment (1995). *A guide to risk assessment and risk management for environmental protection*, London, UK: HMSO (ISBN 978-0117530911).

Dhar, R., & Simonson, I. (2003). The effect of forced choice on choice. *Journal of Marketing Research, 40*(2), 146–160.

d'Hauteville, F. (2003). Communicating on the sensory quality of wine: Questions about sensory training and expertise. In *First international wine marketing colloquium*, Adelaide.

Dodd, T. H., Laverie, D. A., Wilcox, J. F., & Duhan, D. F. (2005). Differential effects of experience subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing. *Journal of Hospitality and Tourism Research, 29*(1), 3–19.

Dodds, W., & Monroe, K. B. (1985). The effect of brand choice information on subjective product evaluations. In E. C. Hirschman & M. R. Holbrook (Eds.). *Advances in consumer research* (Vol. 12, pp. 85–90). Provo, UT: Association for Consumer Research.

Enneking, U., Neumann, C., & Henneberg, S. (2007). How important intrinsic and extrinsic product attributes affect purchase decision. *Food Quality and Preference, 18*(1), 133–138.

Frewer, L. J., Howard, C., Hedderley, D., & Shepherd, R. (1997). Consumer attitudes towards different food-processing technologies used in cheese production – The influence of consumer benefit. *Food Quality and Preference, 8*(4), 271–280.

Gade, D. W. (2004). Tradition, territory and terroir in French viticulture. *Annals of the Association of American Geographers, 94*(4), 848–867.

Gawel, R. (1997). The use of language by trained and untrained experienced wine tasters. *Journal of Sensory Studies, 12*(4), 267–284.

Gluckman, R. L. (1990). A consumer approach to branded wines. *European Journal of Marketing, 20*(6), 27–46.

Goodman, S., Lockshin, L., & Cohen, E. (2006). Using the Best–Worst method to examine market segments and identify different influences of consumer choice. In *Proceedings of the 3rd international wine business and marketing research conference, July 6–8*, Montpellier.

Gracia, A., Loureiro, M., & Nayga, R. M. (2009). Consumers' valuation of nutritional information: A choice experiment study. *Food Quality and Preference, 20*(7), 463–471.

Greene, W. H., & Hensher, D. A. (2003). A latent class model for discrete choice analysis: Contrasts with mixed logit. *Transportation Research Part B: Methodological, 37*(8), 681–698.

Hall, J., & Lockshin, L. (2000). Using means-end chains for analysing occasions – Not buyers. *Australasian Marketing Journal, 8*(1), 45–54.

Hayes, D. J. (2004). Farmer-owned brands? Case studies. *Agribusiness, 20*(3), 269–285.

Hynes, S., Hanley, N., & Scarpa, R. (2008). Effects on welfare measures of alternative means of accounting for preference heterogeneity in recreational demand models. *American Journal of Agricultural Economics, 90*(4), 1011–1027.

Islam, T., Louviere, J. J., & Burke, P. F. (2007). Modeling the effects of including/excluding attributes in choice experiments on systematic and random components. *International Journal of Research in Marketing, 24*(4), 289–300.

Jaeger, S. R., & Rose, J. M. (2008). Stated choice experimentation, contextual influences and food choice. A case study. *Food Quality and Preference, 19*(6), 539–564.

Jenster, P., & Jenster, L. (1993). The European wine industry. *International Journal of Wine Marketing, 5*(1), 30–74.

Johnson, T., & Bruwer, J. (2004). Generic consumer risk-reduction strategies (RRS) in wine-related lifestyle segments of the Australian wine market. *International Journal of Wine Marketing, 16*(1), 5–35.

Kamakura, W., & Russell, G. (1989). A probabilistic choice model for market segmentation and elasticity structure. *Journal of Marketing Research, 26*, 379–390.

Keown, C., & Casey, M. (1995). Purchasing behavior in the Northern Ireland wine market. *British Food Journal, 97*(1), 17–20.

Kimura, A., Wada, Y., Tsuzuki, D., Goto, S. I., Cai, D., & Dan, I. (2008). Consumer valuation of foods. Interactive effects of amount and accessibility of information. *Appetite, 51*, 628–634.

Lawless, H. (1985). Psychological perspectives on wine tasting and recognition of volatile flavors. In G. Birch & M. Lindley (Eds.), *Alcoholic beverages*. London: Elsevier.

Lehrer, A. (1975). Talking about wine. *Language, 51*(4), 901–923.

Ling, B.-H., & Lockshin, L. (2003). Components of wine prices for Australian wine: How winery reputation. Wine quality, region, vintage, and winery size contribute to the price of varietal wines. *Australasian Marketing Journal, 11*(3), 19–32.

Lockshin, L. (2003). Consumer purchasing behaviour for wine: what we know and where we are going. In *First international wine marketing colloquium*, Adelaide.

Lockshin, L., Jarvis, W., d'Hauteville, F., & Perrouty, J. P. (2006). Simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. *Food Quality Preference, 17*, 166–178.

Lockshin, L., Mueller, S., Louviere, J., Francis, L., & Osidacz, P. (2009). Development of a new method to measure how consumers choose wine. *The Australian and New Zealand Wine Industry Journal, 24*(2), 35–40.

Louviere, J., & Eagle, T. (2006). Confound it! That pesky little scale constant messes up our convenient assumptions. In *2006 Sawtooth software conference proceedings*, Sequim, WA.

Louviere, J. J. (2001). What if consumer experiments impact variances as well as means? Response variability as a behavioral phenomenon. *Journal of Consumer Research, 28*(3), 506–511.

Louviere, J., Hensher, D., & Swait, J. (2000). *Stated choice methods: Analysis and application*. Cambridge: Cambridge University Press.

Louviere, J., & Islam, T. (2008). A comparison of importance weights/measures derived from choice-based conjoint, constant sum scales and best-worst scaling. *Journal of Business Research, 61*(9), 903–911.

Louviere, J., & Meyer, R. J. (2007). Formal choice models of informal choices: what choice modelling research can (and can't) learn from behavioural theory. *Review of Marketing Research, 4*, 3–32.

Lunardo, R., & Guerinet, R. (2007). The influence of label on wine consumption: its effects on young consumers' perception of authenticity and purchasing behavior. In *105th EAAE seminar 'international marketing and international trade of quality food products'*, Bologna, Italy.

Magidson, J., & Vermunt, J. K. (2007). Removing the scale factor confound in multinominal logit choice models to obtain better estimates of preference. In *Paper presented at the sawtooth symposium conference proceedings*, Sequim (WA).

Mathios, A. D. (2000). The impact of mandatory disclosure laws on product choices: An analysis of the salad dressing market. *Journal of Law and Economics, 43*, 651–677.

Matsumoto, S. (2004). Consumers' responses to front vs. back package GM labels in Japan. *Journal of Agricultural and Food Industrial Organization, 2*, 1–23.

McCarthy, M., Brennan, M., Kelly, A. L., Ritson, C., de Boer, M., & Thompson, N. (2007). Who is at risk and what do they know? Segmenting a population on their food safety knowledge. *Food Quality and Preference, 18*(2), 205–217.

McCarthy, M., & Henson, S. (2005). Perceived risk and risk reduction strategies in the choice of beef by Irish consumers. *Food Quality and Preference, 16*(5), 435–445.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behaviour. In P. Zarembka (Ed.), *Frontiers in econometrics* (pp. 105–142). New York: Academic Press.

Mitchell, V.-W., & Greatorex, M. (1988). Consumer risk perception in the UK wine market. *European Journal of Marketing, 22*(9), 5–15.

Mitchell, V.-W., & Greatorex, M. (1989). Risk reducing strategies used in the purchase of wine in the UK. *European Journal of Marketing, 23*(9), 31–46.

Mueller, S. (2004). The German wine law from an information economics perspective. *International Journal of Wine Marketing, 16*, 72–96.

Mueller, S., & Lockshin, L. (2008). How important is wine packaging for consumers? On the reliability of measuring attribute importance with direct verbal versus indirect visual methods. In *4th International Conference of the Academy of Wine Business Research*, Siena, Italy.

Mueller, S., & Umberger, W. (2009). Myth busting: Who is the Australian cask wine consumer?. *The Australian and New Zealand Wine Industry Journal 24*(1), 48–54.

O'Connor, E., Cowan, C., Williams, G., O'Connell, J., & Boland, M. P. (2006). Irish consumer acceptance of a hypothetical second-generation GM yogurt product. *Food Quality and Preference, 17*(5), 400–411.

Olson, J. E. (1977). Price as an informational cue: Effects on product evaluations. In A. G. Woodside, J. N. Sheth, & Bennett (Eds.), *Consumer and industry buying behavior* (pp. 267–268). New York: North Holland Inc..

Olson, J. E., Thompson, K. J., & Clarke, T. K. (2003). Consumer self-confidence in wine purchases. *International Journal of Wine Marketing, 15*(3), 40–51.

Orth, U. R., & Malkewitz, K. (2008). Holistic packaging design and consumer brand impression. *Journal of Marketing, 72*, 64–81.

Orth, U., Wolf, M. M., & Dodd, T. H. (2005). Dimensions of wine region equity and their impact on consumer preferences. *Journal of Product Management, 12*(2), 88–97.

Overby, J. W., Gardial, S. F., & Woodruff, R. B. (2004). French versus America consumers' attachment of value to a product in a common consumption context: A cross – national comparison. *Journal of Academy of Marketing Science, 32*(4), 437–460.

Port, J. (2008). Adding value: Are we drinking Frankenstein wines? *The Age*, 11 November 2008 (p. 34). Melbourne.

Provencher, B., & Moore, R. (2006). A discussion of "Using angler characteristics and attitudinal data to identify environmental preference classes: A latent-class model". *Environmental and Resource Economics, 34*(1), 117–124.

Quester, P. G., & Smart, J. (1998). The influence of consumption situation and product involvement over consumer's use of product attribute. *Journal of Consumer Marketing, 15*(3), 220–238.

Rasmussen, M., & Lockshin, L. (1999). Wine choice behaviour: The effect of regional branding. *International Journal of Wine Marketing, 11*(1), 36–46.

Remaud, H., Mueller, S., Chvyl, P., & Lockshin, L. (2008). Do Australian wine consumers value organic wine. In *Proceedings of 4th international conference of the academy of wine business research*, Siena.

Rocchi, B., & Stefani, G. (2005). Consumers' perception of wine packaging: A case study. *International Journal of Wine Marketing, 18*(1), 33–44.

Roy Morgan (2007). *Single source data representative for Australian population*. <www.roymorgan.com> (January to December 2006).

Ruto, E., & Scarpa, R. (2008). Valuing animal genetic resources: A choice modeling application to indigenous cattle in Kenya. *Agricultural Economics, 38*(1), 89–98.

Scarpa, R., Thiene, M., & Tempesta, T. (2007). Latent class count models of total visitation demand: Days out hiking in the eastern Alps. *Environmental and Resource Economics, 38*(4), 447–460.

Selvanathan, E. A. (2004). Economic and demographic factors in Australian alcohol demand. *Applied Economics, 36*(21), 2405–2417.

Shaw, M., Keeghan, P., & Hall, J. (1999). Consumers judge wine by its label, study shows. *Australian and New Zealand Wine Industry Journal, 14*(1), 84–87.

Sogg, D. (2007). Bonny Doon to list ingredients on wine labels. *Wine Spectator*. <http://www.winespectator.com/Wine/Features/0,1197,4147,00.html> Accessed 17.04.08.

Solomon, G. E. A. (1990). Psychology of novice and expert wine talk. *American Journal of Psychology, 103*(4), 495–517.

Spawton, T. (1991a). The wine-marketing environment. *European Journal of Marketing, 25*(3), 12–18.

Spawton, T. (1991b). Wine and the marketing mix. *European Journal of Marketing, 25*(3), 19–31.

Street, D. J., & Burgess, L. (2007). *The construction of optimal stated choice experiments: Theory and methods*. Interscience: Wiley.

Swait, J. R. (1994). A structural equation model of latent segmentation and product choice for cross-sectional revealed preference choice data. *Journal of Retailing and Consumer Services, 1*, 77–89.

Swait, J., & Louviere, J. (1993). The role of the scale parameter in the estimation and comparison of multinominal logit models. *Journal of Marketing Research, 30*, 305–314.

Teratanavat, R., & Hooker, N. H. (2006). Consumer valuations and preference heterogeneity for a novel functional food. *Journal of Food Science, 71*(7), S533–S541.

Thomas, A. (2000). Elements influencing wine purchasing: A New Zealand view. *International Journal of Wine Marketing, 12*(2), 47–62.

Thomas, A., & Pickering, G. (2005). X-it: Gen-X and older wine drinker comparisons in New Zealand. *International Journal of Wine Marketing, 17*(2), 30–48.

Train, K. (1998). Recreation demand models with taste differences over people. *Land Economics, 74*, 185–194.

Tustin, M., & Lockshin, L. (2001). Region of origin: Does it really count? *Australian and New Zealand Wine Industry Journal, 16*, 139–143.

Underwood, S., & Klein, N. (2002). Packaging as brand communication: Effects of product pictures on consumer responses to the package and brand. *Journal of Marketing Theory and Practice, 10*(4), 58–68.

Vermunt, J. K., & Magidson, J. (2008). *LG-Syntax™ user's guide: Manual for latent GOLD® 4.5 Syntax module*. Belmont Massachusetts: Statistical Innovations Inc.

Wansink, B., & Chandon, P. (2006). Can "Low-Fat" nutrition labels lead to obesity? *Journal of Marketing Research, 63*, 605–617.

Wedel, M., & Kamakura, W. A. (2000). *Market segmentation: Conceptual and methodological foundations* (2nd ed.). Boston: Kluwer Academic.

Yeung, R. M. W., & Morris, J. (2001). Food safety risk. Consumer perception and purchase behaviour. *British Food Journal, 103*(3), 170–186.

Zeithamel, V. A. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing, 52*(3), 2–22.

The influence of shelf information on consumers' wine choice

L. Lockshin[a], S. Mueller[a], J. Louviere[b]

[a] Ehrenberg Bass Institute of Marketing Science, University of South Australia
Larry.Lockshin@unisa.edu.au; Simone.Mueller@unisa.edu.au

[b] Centre for the Study of Choice (CenSoC), University of Technology Sydney
Jordan.Louviere@uts.edu.au

Abstract

Prior research on consumer choice of wine has focused on information on the bottle itself, such as brand, region, grape variety and awards. We add to this stream of research by considering information on the shelf, such as short descriptions of the taste of the wine and ratings by independent agencies. Participants chose wines from two different simulated retail shelves, one containing photographs of real wine bottles and one containing graphics of simulated wine bottles. The greatest increase in choice probability was generated by star ratings followed by numerical ratings, and then by taste descriptions. Implications for retailers and future research are discussed.

Keywords: Wine choice, shelf information, wine ratings

Introduction

This article reports the effect of display information from a simulated retail shelf. While multimedia experiments aimed to forecast consumer responses to product information have been used for other categories such as cars or cameras (Urban, 1997), we develop and test a prototype of shelf information in a simulated wine retail environment. In this first application to wine choice we used a selection of wine display information that might induce consumers to trade up to higher price points. Some research has measured the effect of brand names, region, price, medals or awards using discrete choice experiments (Lockshin et al. 2006) and found some influence of brand, region and awards on prices chosen. We investigate the response of consumers to shelf display information using two different experiments involving sensory descriptions, star ratings by the retail store, and scores by wine critics in order to see if these risk reducing mechanisms have an effect on choice, including the price paid.

Literature review

Past research (EBI, 2007) observing wine shoppers in Australia found that the average time spent in front of a shelf in a retail outlet was less than a minute, and the total time browsing in the store was about four minutes. Involved shoppers spent up to 15 minutes buying wine, but these were the minority of wine buyers. Less involved wine consumers have been found to remember fewer wine regions or producers overall, with less well-known regions and producers not recalled (Dodd, 2005). Hence, ‘search’ attributes commonly available to a consumer on the shelf are of limited help for most wine purchasers to reduce their perceived purchase risk.

George A. Akerlof won the Nobel Prize for Economics in 2001 for his breakthrough findings on information asymmetry and its impact on market performance. He found that consumers would pay only a relatively low price when they perceive a purchase to be risky. According to Akerlof (1970) this price discount or ‘risk premium’ can be reduced if producers provide their trade partners with credible information, which reduces the perceived risk.

What information would be able to make a wine purchase decision for consumers less risky if information on the label is of limited help? Mitchell and Greatorex (1988) found that the taste of wine posed the greatest risk, followed by the risk of social unacceptability. A sensory description that provides information on the taste of the wine could be expected to reduce uncertainty and increase the likelihood of a wine being chosen. A wine consumer could look for advice on objective quality in the form of wine ratings from the store, wine critics’ scores, or medals from wine shows indicating that the wine was evaluated favourably by experts. In addition to reducing consumers’ perceived risk these accolades could also satisfy the aspirational need of exclusiveness or the social acceptance some consumers seek to fulfil with wine (Hall and Lockshin, 2000). Several studies (Deliza et al., 1996; Deliza and McFie, 1996; Guinard et al., 2001; Lange et al., 2002) have demonstrated that consumers can be strongly influenced in their taste evaluation by extrinsic attributes when tasting beverages such as wine or beer in an informed condition. Thus wine ratings, show medals and wine critics’ scores could have a combined utility to wine buyers by signalling higher objective quality and also by positively influencing how the wine will taste. While we would expect sensory descriptions, wine ratings, and wine critics' scores to have a positive influence on consumers' purchase decisions, little is known about their actual impact and relative importance on wine choice, especially in relation to price.

Method

We used two online choice experiments to measure the impact of display information on simulated retail shelves. One experiment used 21 Shiraz wines, selected from the New South Wales AC Nielsen top 100 sales data in the price range of $9 to $26, with a wide range of sensory properties and which covered both more and less well-known brands. Photographs of these wines were included in a shelf simulation showing five bottles at a time and their real market price. For a subset of six of the 21 wines we also included a short sensory description and/or rating scores on a simulated shelf talker (tag on the shelf below). Members of the an expert sensory panel characterised the wines, and based on this assessment a short sensory description was formulated for each wine in language understandable to consumers. On the 'shelf talker' below those wines selected as part of the design of the choice experiment we displayed three hypothetical ratings: one indicated to be from Kemenys retail store, one from Vintage Cellars retail store and one from Winestate magazine, with a maximum of 100 points each. The ratings were varied in both their average score (the low average was 85 points and the high one 90 points) and in the degree of agreement (variance) between the three scores (low and high agreement), resulting in four conditions (Table 1).

The presence or absence of the description or a set of rating scores was controlled by an experimental design that allowed us to independently measure the impact of the existence of the sensory description and the effect of wine critics' scores. In total 365 regular red wine consumers from New South Wales were asked to choose a wine for dinner at home with friends or family using these simulated shelves (appendix: Figure 2).

The second experiment used graphically simulated wine bottles that varied in six intrinsic wine attributes (brand, country of origin, region of origin, price, price discount and alcohol level) and four extrinsic attributes (label style, label colour, closure and medals). These results are not reported here (Lockshin et al., 2009), but the design allowed for the independent testing of the impact of each condition. With thousands of wines available in Australia only a relatively small group are rated by external wine experts. However, a retailer could develop its own quality rating system. To investigate the effect of such a retailer specific system we integrated a five star quality rating into the simulated wine bottle experiment's shelf talker. Before the experiment, respondents were informed about the definition of the quality ratings, from no stars to a maximum of five stars for an outstanding wine. Half of all wines in the experiment had no star rating (blank) while 12.5% showed either one, two, four or five stars as a quality rating. Three stars was not used in order to keep the levels to four. The star ratings were applied in an experimental design, independent of the other attributes, such as price. 1,233 regular red wine consumers from New South Wales were asked to choose wine from the simulated shelves for a dinner at home with friends and family.

Results and discussion

The impact of the presence of a sensory description was analysed by calculating how often a wine was chosen when it had a sensory description compared to when it had none. If a sensory description has a positive influence on choice then wines should be consistently chosen more often with a taste description than with no description. On average over all six wines, the presence of a taste description increased choice by 7.4%. As might be expected, the increase in choice was not the same for all six wines, but always was found to be positive and varied between 3.9% and 15.1% increase in choice. Since these increases in choice are frequency counts, statistical testing is not possible, however, the results of a multinomial logit model including the significance levels, which incorporates the descriptions and the ratings is provided in the appendix (Table 2).

Wine quality ratings are not widely used in the Australian wine retail market to assist consumer purchase, and there is not such a clear critic's influence on the Australian scene compared to markets such as the US, where Robert Parker or the Wine Spectator are very influential. Because there are a number of different sources of opinions in Australia, we were not only interested in the effect of lower or higher critic's scores but also in the effect of the degree of agreement among several critics. For a low wine rating where all three sources highly agreed with each other the impact was low as expected (1.9% increase in choice compared to no rating). Not surprisingly the condition in which all three rating sources agreed on a high rating had the highest impact, with an average increase in relative choice of 9.8%.

One could expect that disagreement between the three scores would signal to the consumers a higher risk. We found that the effect of disagreement differs for the low and high average rating conditions (Table 1). As expected, the wide variance on the high average rating scores had a somewhat lower impact on choice (7.2%) than those agreeing on the same high average (9.8%). Interestingly, if wine raters disagreed on the quality rating of the wines at the lower average level then consumers seem to be more influenced by the single high score of 95 and hardly consider the very low score (average increase of 5.9%).

Table 1: Relative impact of wine critic's point ratings with high and low average and different degrees of agreement between the critics (ratings are shown in brackets).

	Increase in choice (%)	
	Low average rating	High average rating
High agreement	**1.9%** Scores: (83, 85, 87)	**9.8%** Scores: (88, 90, 92)
Low agreement	**5.9%** Scores: (75, 85, 95)	**7.2%** Scores: (85, 90, 95)

At this stage we can conclude that high expert wine ratings indeed have a positive impact on consumer choice. For the greatest influence on consumer choice, retailers should consider picking the highest score available from different expert ratings and only show several ratings when they agree on a high value (e.g. above 90 points).

As shown in Figure 1, while a wine without any star was chosen 21% of the time, a wine that had a five star rating was chosen 38.6% of the times it appeared. Keeping all other attributes constant, the relative impact on choice from having no rating to a five star rating was thus 17.6%. This equates to about a 3.5% increase in relative choice per incremental star. Statistical testing within a multinomial logit model is provided in the appendix (Table 2). We see one star is not very different than no stars, but two to five stars have an incremental impact. The reasons for this should be tested in future research.

Choice models allow wine marketers to assess how consumers trade off attributes against each other. An attribute beneficial to consumers such as a quality rating could be compensated by an attribute that is less preferred such as a higher price. While adding a beneficial attribute at a constant price would increase the likelihood of the wine being chosen (i.e. more volume sold), a producer could consider raising the price by a certain amount. One might also assume that a wine that aims to achieve a five star rating is more expensive in its production than an average commercial wine with a lower rating. Taking into account the relative choice impact of price, where a decrease of choice by 10.7% was found for an increase from $7.99 to $22.99 as shown in Lockshin et al. (2009), a producer could potentially raise a wine's price by about $6 if the star rating is increased from four to five stars without decreasing sales. Similarly, an additional star from three to four might justify a price increase of about $4.

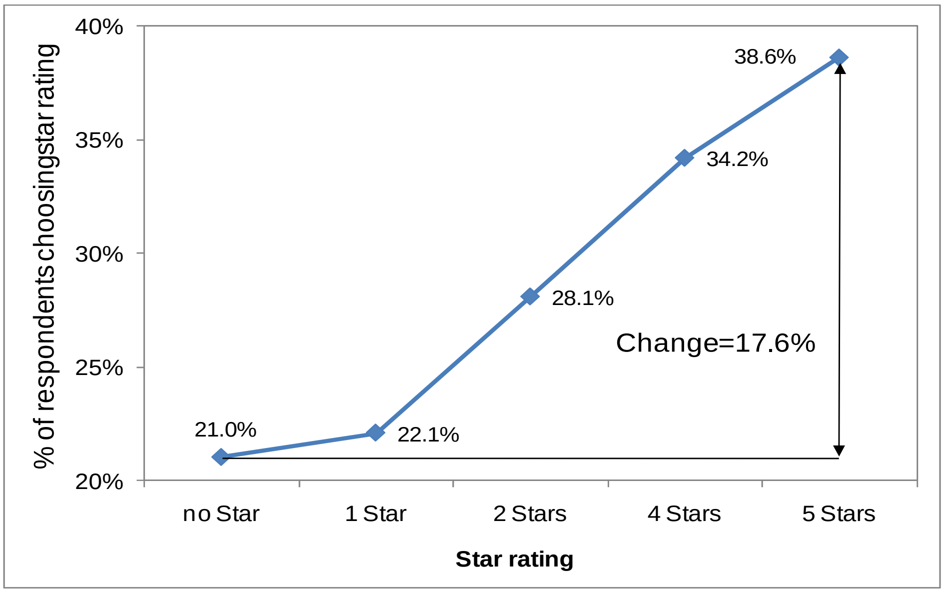


Figure 1: Impact of star ratings on relative choice.

Implications

We found a positive influence on wine choice for all information display types included in the retail shelf simulations. The effects found for the real bottle and the graphical simulated bottle experiments are not exactly comparable, but the overall effect of star ratings was the strongest with a 17.6% increase in choice between no star and five stars, an average of 3.5% per star. Quality ratings in the form of a star seem to be especially suitable as aids to decision making, presumably as they may be more intuitive and do not require extensive cognitive processing. The presence of sensory descriptions had an average effect of 7.4%, which was similar to the impact for wine show medals (no medal to Gold and Trophy) with 7.6% (Lockshin et al. 2009, Figure 4) and wine critics' scores (7- 10%).

In these experiments respondents were asked to choose a wine for a dinner with friends or family where there is some degree of social risk present. Results for other purchase occasions are likely to be different. For very special occasions like a formal dinner or giving wine as a gift we would expect medals and expert ratings to be even more important than measured here. On the other hand, they are likely to be less important for everyday consumption or for drinking wine by oneself.

Our results also present a snapshot in time. The effects of medals, stars and scores will be reduced if they are overused or wrongly used and lose their credibility. For quality signals to keep their value they must be used sparingly and consistently to signal high perceived quality. We expect that meaningful and understandable sensory descriptions will reduce purchase risk and if used wisely can induce consumers to trade up and try new wines, thus helping unknown brands to gain market share. More research is necessary to verify this effect.

From what we found in our experiments specific information to consumers at the retail outlet has a substantial effect on whether a wine will be selected for purchase. The wine industry often declares that consumers need to be better educated without specifying the suitable means to do so. There is hardly any more frequented location for consumer information than the retail shelf. Retailers in other product categories like Amazon have set examples on how referencing systems - 'if you like this – then try that' - can be highly successful in inducing consumers to try suitable new products, trading up and reducing consumers' perceived risk at the same time. Once we better understand the preference drivers of different consumer segments, then wineries and retailers can cross-reference their products for similarity and recommendations. This is just one potential form of consumer information.

We are not advocating putting control in the hands of a few wine critics. Instead we suggest that wineries provide retailers with as much suitable information as possible to be used for marketing their wines by the retailers. These could be pre-produced taste descriptions and information on medals, wine critics' judgements, and show awards won by the wine. The star ratings were one example, which showed that retailers could develop their own in-house rating and wine description system. These currently exist and are used by some retailers. In the long run the consumer will honour that system that is the most useful to him or her with greater patronage.

From a research prospective the relative impact of different promotional materials, neck hangers, environmental messages and even advertising movies (like in YouTube) can be tested with online retail shelf simulations. Our method can be adapted to single wine producers, wine regions or a national wine industry and can test consumers in any market where there are Internet panels.

References

Akerlof, G.A. (1970). The Market for "Lemons": Quality uncertainty and the market mechanism. Quarterly Journal of Economics, 84(3), 488-500.

Deliza, R. & MacFie H. J. H. (1996) The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: A review. *Journal of Sensory Studies*, 11**,** 103-128.

Deliza, R., MacFie H. J. H. & Hedderley D. (1996) Information Affects Consumer Assessment of Sweet and Bitter Solutions. *Journal of Food Science*, 61**,** 1080-1084.

Dodd, T. H., Laverie, D. A., Wilcox, J. f., & Duhan, D. F. (2005). Differential effects of experience, subjective knowledge, and objective knowledge on sources of information used in consumer wine purchasing. *Journal of Hospitality and Tourism Research, 29*, 3-19.

EBI Ehrenberg-Bass Institute for Marketing Science (2007), Understanding wine shoppers' purchase decision process and behaviour in store, unpublished research report.

Guinard, J.-X., Uotani B. & Schlich P. (2001) Internal and external mapping of preferences for commercial lager beers: comparison of hedonic ratings by consumers blind versus with knowledge of brand and price. *Food Quality and Preference,* 12**,** 243-255.

Hall, J. & Lockshin, L., (2000), "Using Means-End Chains for Analysing Occasions – Not Buyers", *Australasian Marketing Journal*, Vol. 8 (1), 45-54.

Hughson, A. L., & Boakes, R. A. (2002). The knowing nose: the role of knowledge in wine expertise. *Food Quality and Preference, 13*(7-8), 463-472.

Lange, C., Martin, C., Chabanet, C., Combris P. & Issanchou S. (2002) Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. *Food Quality and Preference*, 13**,** 597-608.

Lawless, H. T. (1984). Flavor description of white wine by 'expert' and nonexpert wine consumers. *Journal of Food Science, 40*, 120-123.

Lockshin, L., Mueller, S., Louviere, J., Francis, L., & Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, *The Australian and New Zealand Wine Industry Journal*, Vol. 24 (2), 35-40.

Lockshin, L., Jarvis, W., d'Hauteville, F., & Perrouty, J.-P. (2006). Using simulations from discrete choice experiments to measure consumer sensitivity to brand, region, price, and awards in wine choice. *Food Quality and Preference, 17*(3-4), 166-178.

Mitchell, V W and M Greatorex (1988), "Consumer risk perception in the UK wine market," *European Journal of Marketing*, 22 (9), 5-15.

Mueller, S. (2004), The German wine law from an information economics perspective, *International Journal of Wine Marketing*, 16, 72-86.

Mueller, S., Lockshin, L., Saltman, Y. & Blanford, J. (2009). Message on a bottle: the relative importance of wine back label information on choice, working paper University of South Australia.

Urban, G. L, Hauser, J. R., Qualls, W. J., Weinberg, B. D., Bohlmann, J. D. & Chicos, R. A. (1997), Information acceleration: validation and lessons from the field, *Journal of Marketing Research*, 34, 143-153.

Appendix

Figure 2: Simulated shelf of real wines with wine ratings and wine descriptions

Figure 3: Simulated shelf of graphical wines with quality star ratings

Table 2: Multinomial logit estimates and standard errors for selected levels in the two experiments

Attribute Level	**Estimate**	**S.E.**	**P value**	**Wald**	**P value Wald**
Experiment 1					
Sensory description	0.12	0.03	0.00	15.6	0.00
No sensory description	-0.12	*base level*			
No rating	-0.16	0.04	0.00	35.4	0.00
Low mean low variance	-0.18	0.06	0.00		
Low mean high variance	0.03	0.06	0.65		
High mean low variance	0.22	0.05	0.00		
High mean high variance	0.10	0.05	0.06		
Experiment 2					
No star	-0.13	0.02	0.00	123.8	0.00
1 star	-0.50	0.04	0.00		
2 stars	-0.12	0.03	0.00		
4 stars	0.23	0.03	0.00		
5 stars	0.51	*base level*			

The relative importance of extrinsic and intrinsic wine attributes:

Combining discrete choice and informed sensory consumer testing

S. Mueller[a], P. Osidacz[b] , L. Francis[b], L. Lockshin[a]

[a] Ehrenberg Bass Institute of Marketing Science, University of South Australia, Adelaide SA 5000, Australia.
Simone.Mueller@unisa.edu.au; Larry.Lockshin@unisa.edu.au

[b] The Australian Wine Research Institute, Glen Osmond SA 5064, Australia.
Patricia.Osidacz@awri.com.au; Leigh.Francis@awri.com.au

Abstract

In this study, an online choice task was combined with a separate informed sensory hedonic test to understand the interplay of wine sensory characteristics and extrinsic attributes such as packaging, price and brand awareness. This approach simulates the process of a consumer choosing a product from the shelf, tasting the product, and making a repurchase decision.

Twenty-one Australian Shiraz red wines were characterised by a trained sensory panel. Four hundred and twenty regular wine consumers chose a wine for a dinner with friends from simulated shelves of the wines represented by photographs in an online experiment. The same consumers evaluated liking and purchase intent in a central location sensory test, which included photos of each wine tasted.

Respondents' online choices are a measure of extrinsic wine attributes and were found to be highly related to a wine's AC Nielsen market share. Price was found to be a strong positive driver of informed liking, which did not relate to the sales volume, or to the choice in the online experiment. In contrast, the previous online choice was a strong predictor for purchase intent, confirming that extrinsic attributes substantially influence the re-purchase decision. For both liking and purchase intent a number of sensory characteristics were also positively (sweetness, fresh fruit aromas) and negatively (sherry-like and reductive aromas) related, confirming the influence of sensory characteristics on the repurchase decision.

Combining choice experiments and sensory tests which simulate consumers' purchase, tasting and repurchase decision process is the first step towards better pre-testing of new wines and predicting their market uptake.

Keywords: extrinsic vs. intrinsic cues, informed sensory testing, sensory characteristics, discrete choice experiment, repurchase.

Introduction

To which degree should a winery invest in its winemaking practices or in the packaging and promotion of its wines? Most previous wine research has either concentrated on intrinsic attributes (sensory characteristics) or extrinsic attributes such as price, region of origin, brand and packaging. Only a few studies have aimed to analyse the interplay of intrinsic and extrinsic product characteristics.

A first step in understanding the interplay of sensory and non-sensory cues is to measure *sensory expectations* generated from extrinsic cues, especially packaging. For instance Deliza *et al.* (2003) showed that labelling information, packaging colours and images influence consumers' sensory expectations for orange juice.

The psychological framework of *expectation disconfirmation* theory (Deliza and MacFie, 1996) goes one step further by relating sensory expectations to informed and/or blind sensory product tests. In the informed conditions consumers are either exposed to holistic product concepts or to single attributes. For wine, a number of studies have quantified a very strong combined effect of brand, price and/or origin on informed wine sensory liking and willingness to pay (Lange, 2000; Lange *et al.*, 2002; Yegge and Noble, 2000 and Priilaid, 2006; Szolnoki and Mueller, 2009). Other studies focused on the relative effect of only one attribute on informed wine evaluation (Marin et al, 2007 for closures; Siegrist and Cousin, 2009 for wine critic's rating scores; Combris *et al.*, 2009 and Wansink *et al.*, 2007 for region of origin; and Plassmann *et al.*, 2008 for price). In general, these studies agree that consumers' informed sensory liking of wine is strongly influenced by extrinsic cues.

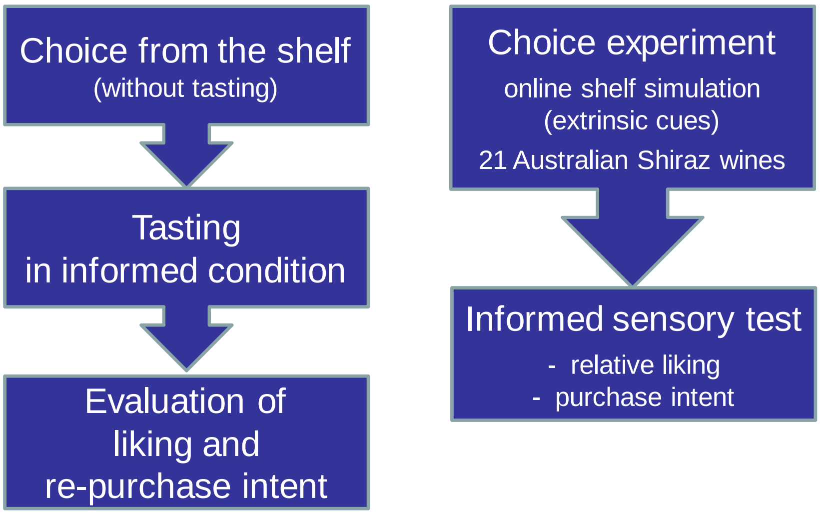
Adding to the existing knowledge of the degree of extrinsic influence, a neural imaging approach taken by Plassman *et al.* (2008) allowed first insights into the *neurological processes* of extrinsic cues on sensory evaluation. The authors showed that when tasting wine, price directly affected respondents' activity in the medial orbitofrontal cortex, an area that is connected with the pleasantness experienced during the experiential tasks. Higher prices increased respondents' neural activity in the brain area related to experienced pleasantness but not in the primary taste areas. This provides first insights into the processing of extrinsic cues such as price, which modulate the hedonic experience of sensory cues such as flavours.

Previous research studying the interplay of intrinsic and extrinsic product characteristics mostly utilised measures of liking (Lange *et al.*, 1999; Siegrist and Cousin, 2009), purchase intent (Guinard *et al.*, 2001; Szolnoki and Mueller, 2009) and willingness to pay (Combris *et al.*, 2009; Lange *et al.*, 2002, Stefani *et al.*, 2006). Research in marketing and sensory consumer research could not confirm liking and purchase to be valid predictors for consumers' true purchase behaviour (Garber *et al.*, 2003). Instead, letting consumers choose from different alternatives in discrete choice experiments was found to result in valid market predictions (Grunert *et al.*, 2009; Louviere *et al.*, 2000; Lusk and Schroeder, 2004).

Those sensory consumer studies, which utilised choice experiments, so far only included one sensory cue together with a larger set of extrinsic attributes (Solheim and Lawless, 1996; Veale and Quester, 2009; Enneking *et al.*, 2007; Raz *et al.*, 2008). A reason for this can be sought in the complexity caused by the interaction of several sensory attributes, which challenge the limits of a choice experiment. Sensory respondent fatigue from evaluating several stimuli is especially strong for red wine, caused by its tannin and alcohol content.

We avoid the limits arising from sensory fatigue by limiting the DCE to extrinsic characteristics. Choosing from different alternatives and thereby trading off different attributes reflects what consumers do when purchasing wine from the shelf, where they usually do not have to option to taste the wine. This scenario certainly represents the majority of wine purchases. After their purchase consumers almost always consume the wine in an informed condition (being aware of the brand, region, packaging and price of a wine). Then consumers evaluate the product based on the interplay of extrinsic and intrinsic cues and consider if they would repurchase the wine or not. We simulate this second step in a sensory test where respondents evaluate how much they like a wine and if they would purchase it or not, being informed about the wine they taste (see Figure 1).

Figure 1: Simulation of realistic wine purchase scenario (left) in experimental design of the study (right)



The contribution of this paper is threefold. We analyse the relative importance of intrinsic and extrinsic product cues to Australian wine consumers. Our approach allows to find specific sensory wine characteristics, which positively or negatively influence consumer liking and purchase intent of Shiraz wine. Finally, we validate all response measures (choice, liking and purchase intent) by relating them to actual AC Nielsen wine market shares.

Materials and Method

The methodological approach of this study simulates a purchase decision where a consumer first chooses a wine from the shelf without tasting it, and then evaluates how much s/he likes the wine and if s/he would repurchase it (see Figure 1). We aimed to replicate this process with a combination of a shelf simulation choice experiment and a subsequent informed consumer tasting.

Wines and their sensory properties

We selected 86 Australian Shiraz wines in the price range of $8-$26 from the New South Wales AC Nielsen Top 100 Shiraz sales data. Vintages from 2001-2006 represented the age of the wines as available in wine retail outlets in November 2007. We analysed the chemical composition and described the sensory properties of these wines by bench tasting with sensory experts. Out of these 86, we selected 21 wines that differed a wide range of sensory properties and had a variety of price points, sales volumes, label types and both more and less well-known brands and regions. The sensory characteristics (appearance, aroma and in-mouth attributes) of those 21 wines were characterised by a trained sensory descriptive panel (13 assessors) in triplicate. A basic chemical composition of the 21 wines and a detailed description of all 28 sensory attributes evaluated can be found in Mueller, Osidacz *et al.*

(2009). Figure 2 shows the first two components of the descriptive analysis, which demonstrate the wide sensory space covered by these wines.

Consumer sample

To qualify respondents had to be regular wine drinkers of legal drinking age (18 years) who had purchased a bottle of red wine in NSW in the last month for consumption at home or someone else's home. The sample of 420 respondents was provided in May 2008 by a sensory research company in North Sydney and is representative of Australian regular red wine consumers.

Choice task

Instead of asking consumers for their liking, we used an online choice task, which was previously shown to be more valid in predicting what consumers do in real market settings. Photographs of the 21 wines were included in a shelf simulation showing five bottles at a time and their real market price (see an example screen in Figure 3).

We asked consumers to choose the wine they would most likely (best) and least likely (worst) buy to have at home with friends or family tonight, which is one of the most common wine drinking occasions in Australia (Hall and Lockshin, 2000). Every respondent completed 16 choice sets of the online experiment at home. Because consumers could not taste the wines, their choices in the shelf simulation experiment reflect overall extrinsic product attributes. It should be emphasised that we did not control the extrinsic attributes by an experimental design to unbundle the separate effects of individual extrinsic cues. Instead, wines and their choices represent the combined effects of extrinsic cues. For the results of an experiment disentangling brand, region of origin, price, packaging and other attributes for Australian wine consumers, see Lockshin *et al.* (2009).

Informed consumer hedonic tasting

A few days after respondents completed the choice experiment they participated in a central location test in North Sydney. In an informed taste test every consumer evaluated five out of the 21 wines, resulting in 100 responses per wine. The allocation of the wines was controlled by an incomplete balanced block design. Respondents received a glass of wine (30 ml) together with an A4 photograph of the wine bottle and its price, identical to the online choice experiment. Respondents indicated their hedonic liking for each wine on a 9-point structured scale (dislike extremely to like extremely) relative to a standard wine representing intermediate intensity in most of its sensory properties. Finally respondents were asked to indicate their purchase intent for each wine (binary: yes or no).

Analysis

The analysis related the following different information and response measures of the 21 wines:

1) Market information: market price and market sales (AC Nielsen, 2007)
2) Sensory characteristics: intensity ratings by sensory panel from descriptive analysis
3) Choices (best and worst) in online shelf simulation
4) Relative hedonic liking in informed condition
5) Purchase intent in informed condition.

From the choice experiment we counted the number of times a wine was chosen as most and least liked across all respondents. From the most and least choices of each wine a ratio scale was derived by the square root of the ratio of most over least (Lee et all, 2008; Mueller, Francis and Lockshin 2009). The term *online choice* is in the following used synonymously for the mathematical expression Sqrt (most/least).

Each wine's actual market share was calculated from its volume sold relative to the total volume sold in NSW in 2007 over all 21 wines. Online choice, liking and purchase intent of a particular wine were related to its market share and market price with Pearson's correlation.

We related all data sets (price, sensory characteristics, choices, liking and purchase intent) with partial least square regression (PLS) with full cross validation and a jack-knifing procedure to test for significant attributes, using Unscrambler (Version 9.5, CAMO Software, Oslo, Norway). Two models, one explaining relative hedonic liking and the other purchase intention as the dependent variables, were estimated. We used price, sensory characteristics and online choices as the independent variables in both models. PLS regression is especially suitable for relating a large number of correlated independent variables (sensory attributes) to dependent variables, when only a small number of observations (21 wines) are available.

Results

Online choice

One aim was to see how valid the online choices were compared to the actual sales of real wines in the market. After deleting one outlier[1] we found that the wines online choice (combination measure of their best and worst choices, see above) was strongly related to their actual market shares according to AC Nielsen data. A significant and strong correlation of 0.564 ($p=0.013$) indicates that consumers choice based on extrinsic attributes, is a good approximation for what consumers purchase in reality (see Figure 4).

When relating online choices to price, an inverse quadratic relationship provides the best fit to the data ($R^2=0.26$, see Figure 5). Wines of medium price levels around $15 are more often chosen than less or more expensive wines. The same inverse U-shaped relationship between number of bottles sold across price points is representative for the overall Australian wine market (AC Nielsen, 2008). This indicates that our small sample of 21 wines forms a similar sales by price relationship as the actual wine market.

Hedonic liking

The first PLS model relates hedonic liking of the wines to their sensory properties, their online choice and price. The left side of Table 1 lists the PLS loadings for hedonic liking in descending order. The price of a wine was the strongest predictor for how much consumers like each wine, confirming previous findings by Plassman (2008), also see Figure 6. Next to price a number of sensory intrinsic attributes were found to be significant drivers of liking. Fresh fruit, dark fruit and oak/wood have a positive influence on consumer liking. Wines that were characterised by the sensory panel with relatively high sherry, medicinal and band-aid aromas were not well liked by consumers. The wine consumers chose in the choice task and the market share of a wine were not related to their liking.

---

[1] Wine S-06 has an extraordinary high market share of 23% of the total sales that is under-predicted by online choice. It is likely that the high sweetness level (see Figure 2) and its lowest price of all wines make this wine more attractive to consumers mainly drinking cask wine, who did not qualify for the study.

The relationship between these drivers is visualised in the first and second PLS principal components diagram (Figure 7). Price is located closest to the liking vector, indicating its strong relationship. Other positive drivers like fresh fruit and sweetness are located on the upper right quadrant. Negative sensory drivers can be found in both left quadrants.

Purchase intent

Purchase intent was strongly positively related to how often consumers had chosen a wine in the online experiment. While this is the strongest predictor, it was not found to be significant by the jack-knifing procedure, indicating that this effect was not consistent for all wines. Thus some wines' purchase intent values were more strongly influenced by the sensory attributes than others. Fresh fruit and fruity aftertaste were again positive drivers, whereas medicinal aromas related to the older wines decreased the likelihood of purchase (right side of Table 1).

The first and second PLS principal component in Figure 8 can be interpreted by a horizontal sensory axis (fresh fruit and fruity aftertaste as positive drivers versus medicinal aromas as negative drivers). Those attributes that are related to the key drivers are located in close proximity, such as dark fruit, chocolate, purple for the positive direction and sherry, brown and band-aid for the negative direction. The y-axis is strongly related to online-choice that reflects the extrinsic product attributes. The liking vector is spanned by both positive extrinsic and intrinsic attributes: online choice and fruity sensory aromas. Price was not a significant driver of purchase intent compared to online-choice. Purchase intent is only very weakly related to market share (Pearson's $r = 0.088$, $P = 0.713$)

Conclusion

The experimental approach used provides insight into the complex interactions of sensory and non-sensory influences on consumer responses. Consumers' wine choices in an online shelf simulation were well correlated with AC Nielsen market shares. This indicates that choice experiments without tastings have external validity and can closely predict how consumers choose in the real market.

Price and some sensory attributes were found to influence informed sensory liking. That price is a very strong quality and pleasurable experience heuristic confirms previous findings. The fact that liking is not related to online choice indicates that each is measuring a different construct and that one should be careful when drawing conclusions from sensory liking to actual choice in the market. Previous choice and several sensory attributes were key drivers of (re)purchase intent.

Our results suggest that extrinsic product attributes play a very strong, if not the strongest role, for consumer wine choice. Nevertheless wine makers have to make sure that negative sensory characteristics in older vintages and reductive aromas do not decrease the likelihood of a wine being re-purchased. On the other hand, fresh fruit and sweetness are sensory characteristics, which positively impact re-purchase.

Future research should also relate consumers' blind liking to choice and informed sensory evaluation. If respondents can taste all wines in several successive test sessions, differences between consumers in their reaction to sensory and non-sensory cues can be uncovered.

Combining online choice and informed tasting, especially following blind sensory hedonic tests, could be an approach to avoid situations where new products that may be highly liked in consumer hedonic tests fail in the market.

Acknowledgement

The authors wish to thank Brooke Travis and Belinda Bramley from the Australian Wine Research Institute (AWRI) sensory team, the AWRI sensory panellists, and the Australian wine companies, which provided wines for the study. The project was supported by Australia's grape growers and winemakers through their investment body the Grape and Wine Research and Development Corporation (GWRDC), with matching funds from the Australian Government.

References

AC Nielsen. (2008). Scanner data for red wine retail sales in New South Wales, Australia, January - December 2007.

Combris, P., Bazoche, P., Giraud-Héraud, E., & Issanchou, S. (2009). Food choices: What do we learn from combining sensory and economic experiments? *Food Quality and Preference, 20*(8), 550-557.

Deliza, R., MacFie, H., and Hedderley, D. (2003). Use of computer-generated images and conjoint analysis to investigate sensory expectations. *Journal of Sensory Studies, 18*(6), 465-486.

Deliza, R., & MacFie, H. J. H. (1996). The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: A review. *Journal of Sensory Studies, 11*(2), 103-128.

Enneking, U., Neumann, C., & Henneberg, S. (2007). How important intrinsic and extrinsic product attributes affect purchase decision. *Food Quality and Preference, 18*(1), 133-138.

Garber, L. L., Hyatt, E. M., & Starr, R. G. (2003). Measuring consumer response to food products. *Food Quality and Preference, 14*(1), 3-15.

Grunert, K. G., Juhl, H. J., Esbjerg, L., Jensen, B. B., Bech-Larsen, T., Brunsø, K., et al. (2009). Comparing methods for measuring consumer willingness to pay for a basic and an improved ready made soup product. *Food Quality and Preference, 20*(8), 607-619.

Guinard, J.-X., Uotani B. & Schlich P. (2001) Internal and external mapping of preferences for commercial lager beers: comparison of hedonic ratings by consumers blind versus with knowledge of brand and price. *Food Quality and Preference,* 12**,** 243-255.

Hall, J. & Lockshin, L., (2000), "Using Means-End Chains for Analysing Occasions – Not Buyers", *Australasian Marketing Journal,* Vol. 8 (1), 45-54.

Lange, C., Martin, C., Chabanet, C., Combris, P., & Issanchou, S. (2002). Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. *Food Quality and Preference, 13*(7-8), 597-608.

Lange, C. (2000). *Etude de l'effet des caracteristiques sensorielles, des attentes induites par l'information et du prix sur l'acceptabilite et le comportement d'achat du consommateur.* Universite de Bourgogne.

Lange, C., Rousseau, F. and Issanchou, S. (1999), Expectation, liking and purchase behaviour under economical constraint, *Food Quality and Preference* 10, 31-39.

Lee, J. A., Soutar, G., & Louviere, J. J. (2008). The best-worst scaling approach: an alternative to Schwartz's Values Survey. *Journal of Personality Assessment, 90*(4), 335-347.

Lockshin, L., Mueller, S., Louviere, J., Francis, L., & Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, *The Australian and New Zealand Wine Industry Journal*, Vol. 24 (2), 35-40.

Louviere, J. Hensher, D. and Swait, J. (2000), *Stated Choice Methods: Analysis and Application*, Cambridge University Press, Cambridge.

Lusk, J. L., & Schroeder, T. C. (2004). Are choice experiments incentive compatible? A test with quality differentiated beef steaks. *American Journal of Agricultural Economics, 86*(2), 467-482.

Marin, A. B., Jorgensen, E. M., Kennedy, J. A., & Ferrier, J. (2007). Effects of bottle closure type on consumer perceptions of wine quality. *American Journal of Enology and Viticulture, 58*(2), 182-191.

Mueller, S., Francis, I. L., & Lockshin, L. (2009). Comparison of best-worst and hedonic scaling for the measurement of consumer wine preferences. *Australian Journal of Grape and Wine Research, 15*(3), 205-215.

Mueller, S., Osidacz, P., Francis, I. L., and Lockshin, L. (2009), Combining discrete choice and informed sensory testing of extrinsic and intrinsic wine attributes: Can it predict real world market share?, manuscript submitted to *Food Quality and Preference*.

Plassman, H., O'Doherty, J., Shiv, B. and Rangel, A. (2008), Marketing actions can modulate neural representations of experienced pleasantness, *PNAS* 105 (3), 1050-1054.

Priilaid, D. A. (2006). Wine's placebo effect: How the extrinsic cues of visual assessments mask the intrinsic quality of South African red wine. *International Journal of Wine Marketing, 18*(1), 17-32.

Raz, C., Piper, D., Haller, R., Nicod, H., Dusart, N., & Giboreau, A. (2008). From sensory marketing to sensory design: How to drive formulation using consumers' input? *Food Quality and Preference, 19*(8), 719-726.

Siegrist, M., & Cousin, M. E. (2009). Expectations influence sensory experience in a wine tasting. *Appetite, 52*(3), 762-765.

Solheim, R., & Lawless, H. T. (1996). Consumer purchase probability affected by attitude towards low-fat foods, liking, private body consciousness and information on fat and price. *Food Quality and Preference, 7*(2), 137-143.

Stefani, G., Romano, D. and Cavicchi, A. (2006), Consumer expectations, liking and willingness to pay for specialty food: Do sensory characteristics tell the whole story?, *Food Quality and Preference*, 17, 53-62.

Szolnoki, G., & Mueller, S. (2009). On the bottle or inside the bottle? The relative influence of wine packaging on hedonic liking and purchase intent, Poster. In, *8th Pangborn Sensory Science Symposium*. Florence.

Veale, R., & Quester, P. (2009). Do consumer expectations match experience? Predicting the influence of price and country of origin on perceptions of product quality. *International Business Review, 18*(2), 134-144.

Wansink, B., Payne, C. R., & North, J. (2007). Fine as North Dakota wine: Sensory expectations and the intake of companion foods. *Physiology and Behavior, 90*(5), 712-716.

Yegge, J., & Noble, A. (2000). The identification of sensory and non-sensory attributes of California chardonnay wines that influence acceptance and purchase intend for differing segments of consumers. In, *Proceedings of the ASEV 50th Anniversary Annual Meeting*. Seattle, Washington, June 19-23: American Society for Enology and Viticulture.

Appendix

Figure 2: Biplot of principal components 1 and 2 for mean scores of sensory descriptive analysis data. Vectors for the sensory attributes and points for the 21 wines (coded by A-T and vintage) are shown .

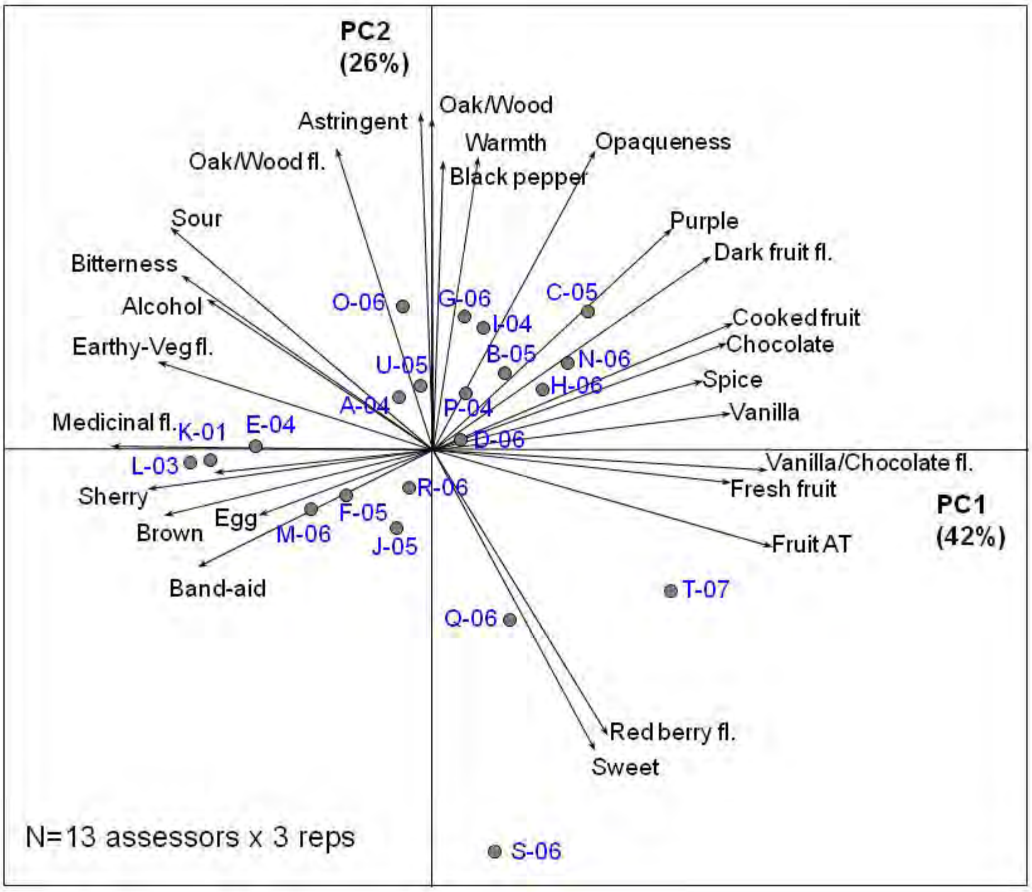


Figure 3: Screenshot of the online DCE shelf simulation

Figure 4: Relationship between online choice and market share (n = 20 wines)

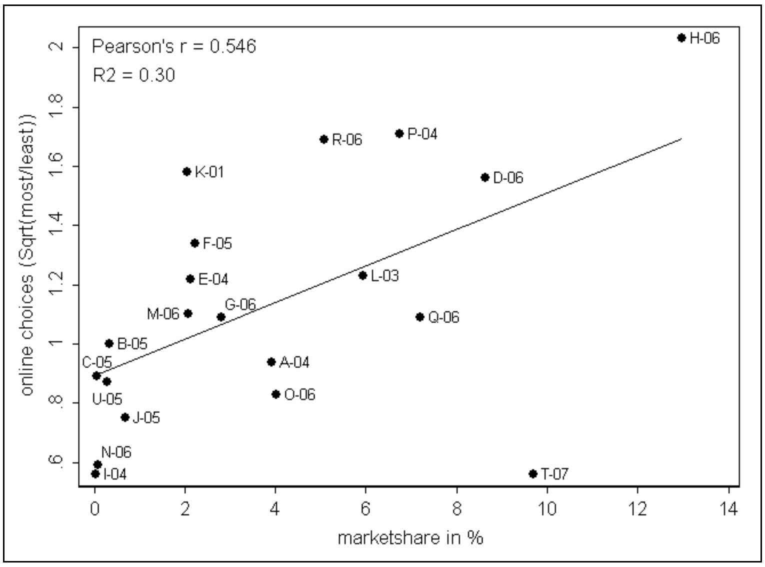


Figure 5: Relationship between online choice and price (n = 21 wines)

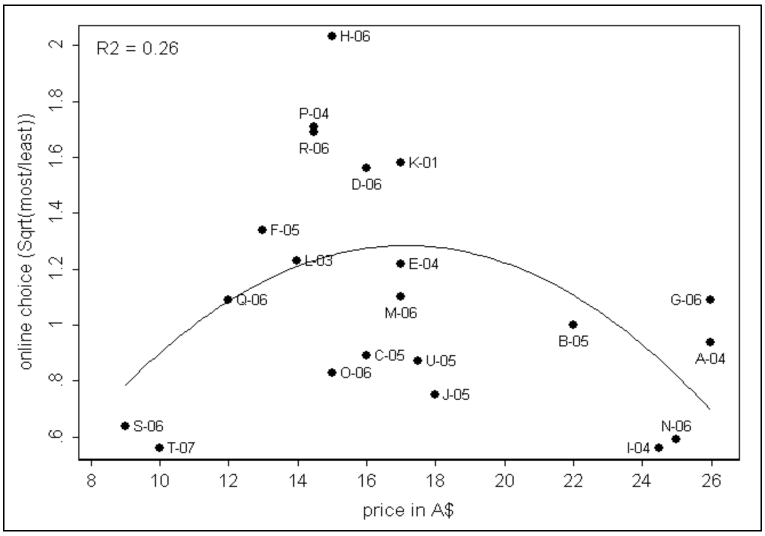


Figure 6: Relationship between hedonic liking and price (n = 21 wines)

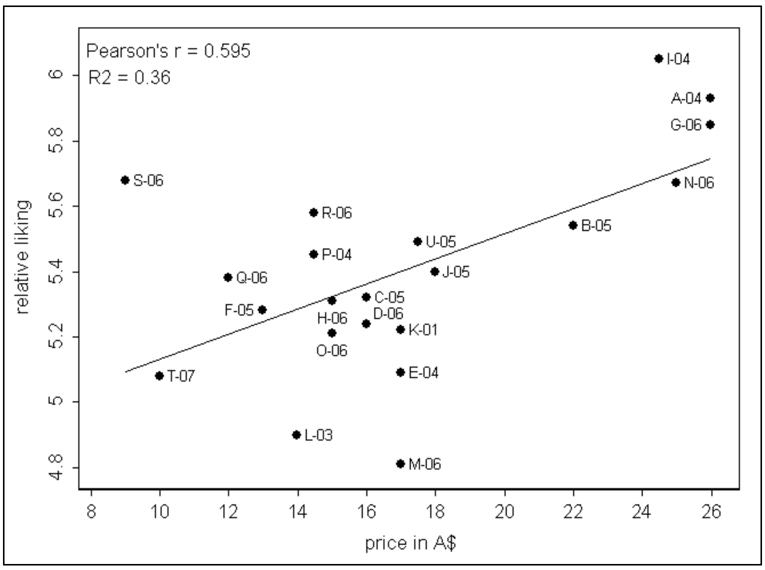


Figure 7: PLS model of relative liking shown as a biplot of components 1 and 2, using sensory attributes, online choice, price and market share, with wines identified as circle symbols.

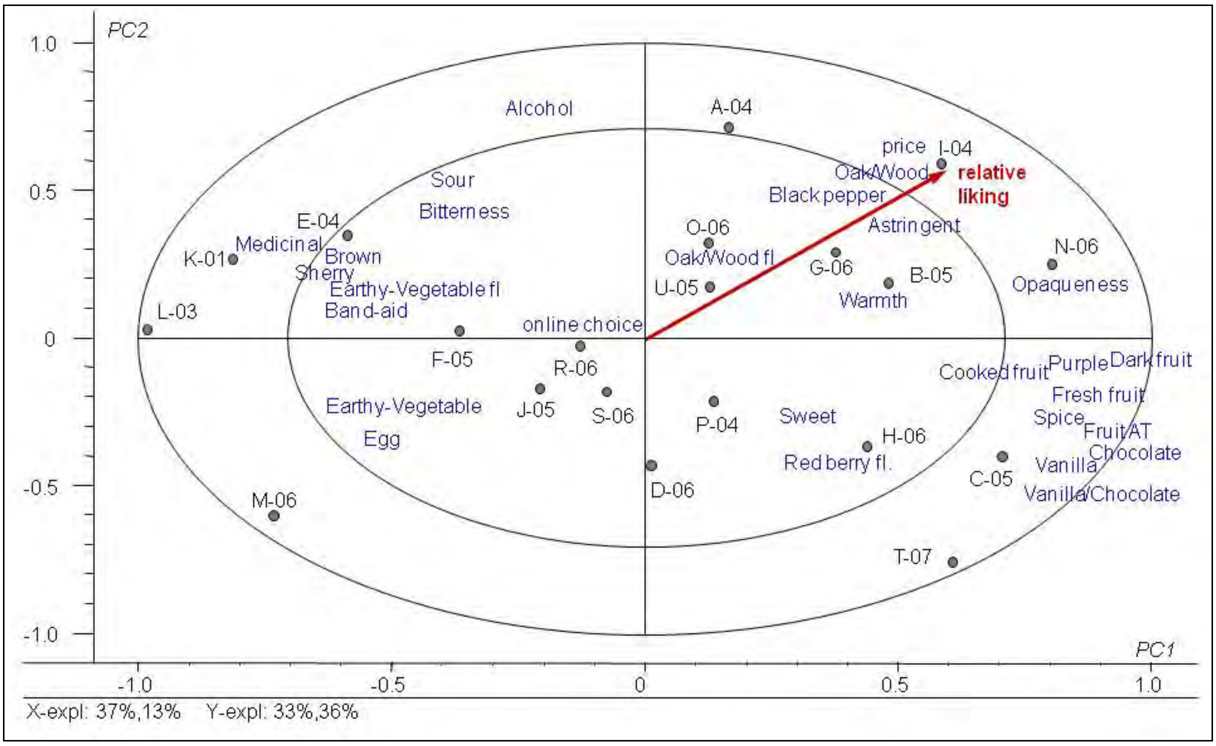


Figure 8: PLS model of purchase intent shown as a biplot of components 1 and 2, for mean liking scores using sensory attributes, online choice, price and market share, with wines identified as circle symbols.

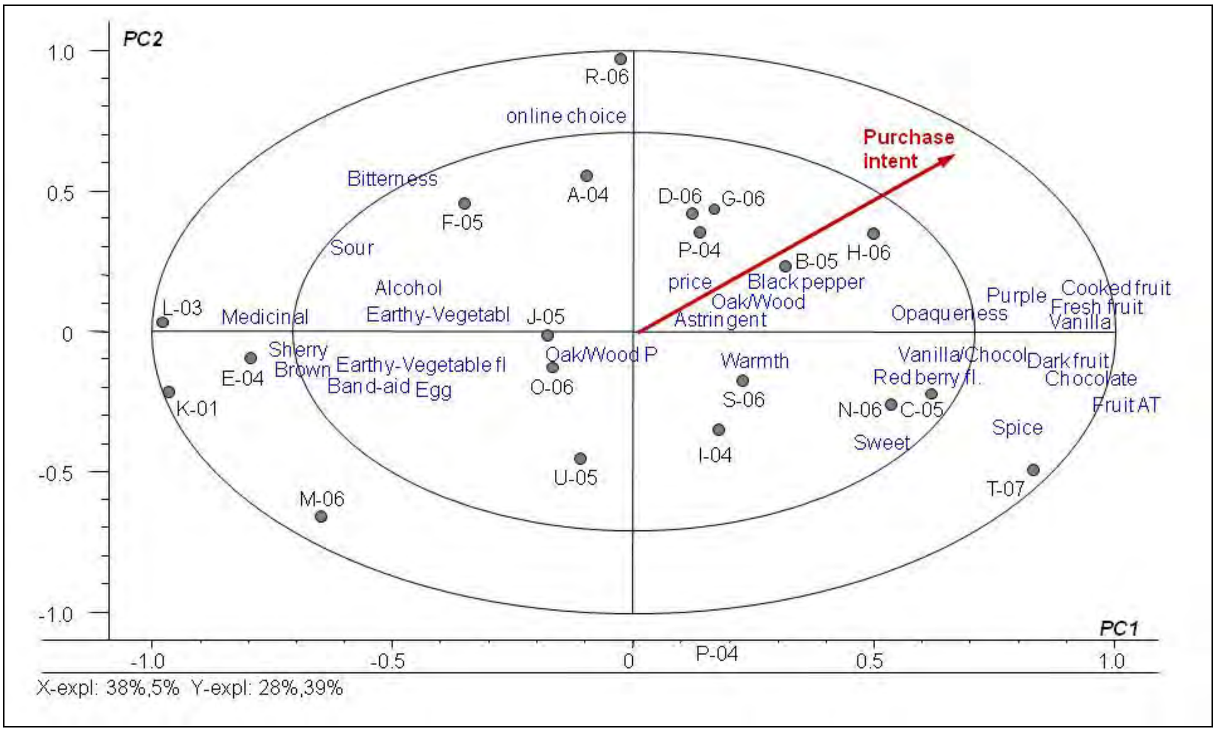


Table 1: Partial least squares regression coefficients of the hedonic liking and purchase intent data for the 20 wines modelled using the sensory attributes, online choice and price (sorted in descending order)

Hedonic Liking			**Purchase Intent**		
Variable	Coefficient	Sign.	Variable	Coefficient	Sign.
Price	0.55	*	Online choice	0.47	
Sweet	0.26	*	Bitterness	0.26	
Fresh fruit	0.22	*	Fresh fruit	0.16	*
Oak/Wood	0.11		Price	0.16	
Alcohol	0.09		Sweet	0.10	
Fruit AT	0.09		Oak/Wood	0.09	
Band-aid	0.09		Earthy-Vegetable	0.06	
Bitterness	0.08		Cooked fruit	0.05	
Opaqueness	0.08		Fruit AT	0.05	*
Dark fruit	0.07		Alcohol	0.03	
Sour	0.05		Purple	0.02	
Purple	0.04		Chocolate	0.02	
Online choice	0.04		Dark fruit	0.02	
Red berries	0.01		Warmth	0.01	
Black pepper	0.01		Red berries	0.01	
Cooked fruit	-0.02		Sour	0.00	
Oak/Wood fl.	-0.04		Vanilla/Chocolate fl.	0.00	
Brown	-0.04		Black pepper	-0.02	
Astringent	-0.07		Opaqueness	-0.02	
Spice	-0.09		Vanilla	-0.02	
Earthy-Vegetable fl.	-0.14		Band-aid	-0.04	
Chocolate	-0.15		Brown	-0.07	
Warmth	-0.17		Spice	-0.07	
Sherry	-0.17	*	Oak/Wood fl.	-0.10	
Medicinal	-0.17		Sherry	-0.16	
Vanilla	-0.17		Astringent	-0.18	
Egg	-0.18		Earthy-Vegetable fl.	-0.18	
Earthy-Vegetable	-0.18		Egg	-0.19	
Vanilla/Chocolate fl.	-0.19		Medicinal	-0.23	*

* significant driver according to Martens' uncertainty test jack-knifing procedure.

Wine packaging and labelling - do they impact market price?

A hedonic price analysis of US scanner data

Simone Mueller[a], Gergely Szolnoki[b]

[a] Ehrenberg-Bass Institute for Marketing Science, University of South Australia, Adelaide, simone.mueller@unisa.edu.au

[b] Geisenheim Research Center, Section of Economics and Market Research, Germany, szolnoki@fa-gm.de

Abstract

Despite previous research has confirmed that wine packaging and labelling influence sensory wine evaluation, product associations and consumer choice, it is still unknown if they have an impact on the market price of wine. We report results from a hedonic price analysis of red wine scanner data from two US markets. While region of origin has the strongest impact on market price we also find significant price premiums and discounts for different label styles, label colours, bottle forms, closures and the presence or absence of front label information. Our findings give marketers valuable strategic insights on how to package and label wines to match consumer expectations for different price tiers.

Keywords: hedonic price analysis, scanner data, wine packaging, labelling information

Introduction and Literature Review

Many wine characteristics, such as region of origin, grape variety and brand reputation can only be changed in the very long term by most wine producers to react to consumer demand and market conditions. On the contrary, attributes such as the packaging and labelling of a wine are in the short term control of a winery and have attracted growing research interest over the last years.

Packaging design of food products in general and wine specifically was shown to influence consumers' sensory expectation and taste evaluation (Deliza and MacFie, 1996; Lange et al., 2002; Szolnoki, 2007). Orth and Malkewitz (2008) report five distinct holistic packaging design styles for which consumers have different product associations. Consumers' liking of a wine was found to be influenced by the label design and labelling information (Szolnoki, 2007). Also when actually choosing wine, consumers were found to react to label style, label colour and labelling information (Lockshin *et al*., 2009; Mueller et al., 2009; Mueller *et al.*, 2010).

Prior research analysing individual responses found that different consumers like different packaging and label information (Mueller *et al.*, 2010; Lockshin *et al.*, 2009; Szolnoki, 2007; Szolnoki and Mueller, 2009). Whereas such preference heterogeneity can be observed on the individual level, it is possible that these differences cancel each other out over the total market. For instance, if one segment prefers a traditional label style this effect on demand and price could be offset by another segment preferring chateau-style labels (Lockshin *et al.*, 2009), resulting in a similar demand for both label styles on the aggregate level. Accordingly, it is uncertain if the previously observed impact of wine packaging and labelling on individual consumer preferences indeed translates into different market prices.

A range of economic hedonic pricing studies have shown price premiums or discounts relative to the average market price for different wine characteristics . Most of them have concentrated on extrinsic attributes such as region and country of origin (Nerlove, 1995; Oczkowski, 1994), grape variety (Steiner, 2004; Schamel and Anderson, 2003), wine type (Ling and Lockshin, 2003), vintage (Schamel and Anderson, 2003; Oczkowski, 1994) and producer characteristics (Nerlove, 1995; Oczkowski, 1994; Ling and Lockshin, 2003). Some have also studied how price is impacted by wine critic scores (Oczkowski, 2001; Combris *et al.*, 1997, Landon and Smith 1997, Bentzen and Smith, 2008) or expert sensory evaluations (Nerlove, 1995, Combris et al. 1997, Combris et al. 2000). Only Costanigro *et al.* (2007) analysed if the availability of label information was related to wine prices listed in a wine magazine. No prior study explored the relationship between wine packaging and market price.

Our study aims to answer two research questions:

1) Do different wine packaging or labelling characteristics achieve a price premium on the market?
2) What is the relative importance of wine packaging and labelling in explaining price relative to other extrinsic characteristics such as origin and grape variety?

Data

Most of the previous hedonic price studies used recommended prices in wine guides or magazines that only partially reflect the true market price. Also, many studies completely disregarded the commercially relevant lower price tier. No study has previously analysed real market prices from transactions over a longer time period that also account for promotional prices.

For our analysis we used scanner data from AC Nielsen, comprising market transactions between August 2007 and July 2008 from two major metropolitan US markets, Chicago (IL) and Tampa (FL). The data set contains units of four weeks of sales for n=1,166 stock keeping units (SKU) of red wine (750ml bottles) sold in both markets in grocery, liquor and drug stores. We calculated a unit weighted average price from promotional and non-promotional prices over the total one year time period that represents our dependent variable. Descriptive statistics in Table 1 show that our data set covers a wide range of the market spectrum, including wines that differ in their price, store availability and sales frequency.

Table 1: Descriptive statistics for n=1,166 red wine SKU (August 2007 - July 2008)

	mean	median	stdev	min	max
Price	$15.42	$11.76	$11.89	$3.40	$166.85
Availability [0% ;100%]	25.9	18.3	22	1	96.8
Units sold	7,586	1,744	15,891	5	188,669
Sales volume	$77,833	$26,459	$145,923	$36	$1,602,893

Based on each SKU's identification, provided by ACN, with country of origin, grape variety, brand and wine name, photographs for each wine showing the total bottle and the front label were accessed from the internet. Label style categories were developed based on existing packaging style categories (Orth and Malkewitz, 2008) and from our own qualitative work. We asked eight regular wine consumers, who differed in their gender, age and wine involvement, to sort 500 wine labels into categories they perceived to be distinct. From this all packaging and information variables were specified for each SKU by two independent coders using objective coding books.

The Model and Estimation

Following conventional hedonic models, the price of a good is a linear function of its utility-generating characteristics for which implicit prices are predicted. Any qualitative and quantitative variable that affects consumer utility can be included in the model.

(1) *price = f (availability, origin, grape variety, packaging, front label information)*

We formulate a model (equation 1) assuming that consumers' utility is affected by its availability (linear and quadratic term), its origin (27 nested coded dummy variables for country and region), its grape variety (9 categories), its packaging, and front label information. Each wine's packaging is defined by its label style (8 cat.), label colour (5 cat.), bottle form (3 cat.) and closure (2 cat.). Six binary variables are used to quantify the presence or absence of front label information: brand name, country of origin, region of origin, grape variety, additional wine specific information and other general information. All categorical variables are effects coded which also allows us to calculate an implicit price for the reference category that is not confounded with the constant, representing the average price (grand mean).

Wine expert ratings are not available for the majority of commercial wines and vary with vintage, which is not specified in our data set because older vintages get continuously replaced on the shelves with younger ones. Unlike many other hedonic wine price studies we could not include a quality rating variable in our model. While this potentially might decrease the explained variance of our model, it is very likely to reflect the real market conditions. Most food and drug stores in the US only rarely display wine critic's scores and are more frequently found only in specialty liquor stores.

While the theoretical model described in formula (1) limits the type of explanatory variables, it does not restrict the functional form to be estimated. A large variety of different functional forms have been reported in the empirical hedonic wine pricing literature. The results from applying a RESET-test to ten different empirical model specifications[1] led us to prefer the reciprocal square root model specification $p^{-0.5}$ (Ramsey $F_{3,1107}=0.97$, $p=0.41$). While residuals are not completely normally distributed (Shapiro-Wilk $z=4.61$, $p<0.01$) we cannot reject the hypothesis that the residuals have a homogeneous variance (Breusch-Pagan test $\chi^2=3.03$, $p=0.082$). The reciprocal square root model has also previously been chosen to be the optimal specification by Costanigro *et al.* (2007) and Landon and Smith (1997).

When interpreting the following results, it should be considered that because the dependent variable price was transformed to $p^{-0.5}$, price premiums have a negative coefficient while price discounts have a positive sign.

Results

We estimated a base model without packaging and front label information variables and a full model including all variables specified in (1). According to Table 2 packaging and front label information significantly improve the model and contribute 7% to the explained variance (Adj. R^2). Significantly different average prices between domestic and imported wines led us to also separately estimate a US and an import model, including only US and imported wines (Schamel and Anderson, 2003). These separate models considerably improve the model fit for the US model and more strongly discriminate price differentials for origin and grape variety, but we do not have space to report these here. For both the US and import model, packaging and front label information improve the explained price variance by 8% and 12% respectively.

Table 2: Explained variance of models with and without packaging and information variables

Adj. R^2	**Total model** n=1,166	**US model** n=630	**Import model** n=536
no packaging variables	49%	53%	35%
including packaging & information	56%	61%	47%
contribution of packaging & information	7%	8%	12%

Table 3 presents the estimated coefficients and implicit prices (in US$) for packaging and information characteristics for the total model. Results from the separated domestic and import models are very similar in and deviate only slightly.

Because all categorical packaging variables were effects coded, coefficients and price estimates are interpreted relative to the constant, which reflects the average price over all wines (grand mean). Accordingly we find that red wine in Burgundy bottles is sold at $1.41 above average while Bordeaux bottles attract a discount of $1.31. Other bottle types such as the amphora style do not have a significant impact on price. The estimates for closure result in a $0.97 discount for screw cap and $1.07 premium for cork, confirming that wine consumers in the US do not yet accept screw cap closures (Caputo, 2008). The estimates for all six label colour categories are significant at $p=0.05$. Black and crème/grey labels realise a positive price premium of $2.03 and $0.96, while other colours and multi colour labels are more represented in the lower price tiers and accordingly attract a price discount of $1.56 and

[1] We tested the ladder of power, including p^2, $p^{1.5}$, linear, log linear, $p^{0.5}$, Box-Cox, $p^{-0.5}$, p^{-1}, $p^{-1.5}$ and p^{-2}.

$1.05. White labels, which are the most frequent in the sample, are not priced significantly different from the average.

Table 3: Results for packaging and front label information variables for total model (n=1,166)

	Coef. (x 10^2)	t	P>|t|	price estimate ($)	confidence interval low ($)	confidence interval high ($)
Bottle_bordeaux	1.17	4.56	0.00	-1.31	-0.89	-1.59
Bottle_burgundy	-1.10	-2.79	0.01	1.41	2.94	0.35
Bottle_other *	-0.07			0.08		
Closure_screw cap	0.85	3.00	0.00	-0.97	-0.40	-1.35
Closure_cork *	-0.85			1.07		
Colour_creme/grey	-0.76	-2.11	0.04	0.96	2.26	0.05
Colour_black	-1.53	-3.05	0.00	2.03	4.15	0.59
Colour_monochrome	1.40	4.20	0.00	-1.56	-1.00	-1.92
Colour_multi colour	0.92	2.32	0.02	-1.05	-0.20	-1.61
Colour_white *	-0.03			-0.38		
Label_clean uni colour	-1.13	-2.12	0.03	1.46	3.51	0.09
Label_clean highlight	1.32	3.79	0.00	-1.47	-0.85	-1.87
Label_chateau basic	-0.26	-0.57	0.57	0.31	1.72	-0.64
Label_chateau highlight	1.38	3.27	0.00	-1.54	-0.75	-2.05
Label_delicate elegant	-0.47	-0.85	0.40	0.58	2.39	-0.62
Label_animal graphic	1.19	2.66	0.01	-1.34	-0.43	-1.93
Label_artwork graphic	0.46	1.24	0.22	-0.54	0.38	-1.17
Label_nondescript *	-2.49			3.50		
Info_country	-0.40	-1.69	0.09	0.50	1.29	-0.07
Info_region	-0.51	-2.38	0.02	0.63	1.38	0.09
Info_grape	0.81	2.75	0.01	-0.93	-0.32	-1.34
Info_other	-1.26	-5.30	0.00	1.64	2.70	0.87
Info_additional	-2.32	-4.77	0.00	3.22	5.70	1.54
constant	25.52	40.42	0.00	15.35	16.96	13.96

* reference category of effects coded categorical variables (t-statistics and confidence interval unavailable)

Five of eight label styles have implicit prices that are different from zero. Nondescript and clean uni-colour labels are overrepresented in higher price tiers and achieve a price premium of $3.50 and $1.46 respectively. An interesting effect can be observed for both pairs of chateau and clean labels, where each version with a coloured or golden highlight attracts a price discount relative to its un-highlighted counterpart. This is an interesting result as gold and coloured accents are often thought to achieve a price premium in the market. Possibly, this effect might have been over-used and lost its credibility. Not surprisingly, graphical animal labels, also called critter labels, attract a price discount, confirming that they are mainly positioned in the lower price tiers (Port, 2008). Wine prices for delicate elegant and artwork graphic label styles were not found to differ from the average. Some of the label styles and label colours for which we found a price premium also concur with findings from a choice experiment with Australian wine consumers (Lockshin *et al.*, 2009).

Estimates for all front label information variables represent the implicit price for the presence of information. The results seem to follow a general rule – the more the better (or the more information the higher the price), with the exception of grape variety which has a negative implicit price. When estimating separate domestic and import models this negative effect can only be observed for US wines but not for imported wines. This suggests that generic European wines such as Bordeaux and Chianti, not stating a grape variety, do not suffer a price discount. Why is this different for US wines? One would expect that US 'red blends' that do not state a specific grape variety would attract a price discount. While we can indeed observe a small price discount for red blends in the lower price tiers, this effect is more than compensated by a number of icon wines such as 'Opus One' that are positioned in the maximum price tier >$50.

The observed price premium for wines indicating a country and region of origin on the front label is congruent with expectations. The substantive price premiums gained by other information is surprising. Story or history information on the front label resulted in a price premium of $1.64 while additional wine specific information, such as estate grown, single vineyard, reserve or old vine attracted a premium of $3.22.

From the maximum price difference for each attribute relative to the sum of the price differences over all attributes (not presented here) we calculated the attribute importance for all three models (Table 4). While we cannot discuss detailed differences between the US and import model, it becomes clear that origin has the largest impact on wine prices. This is not surprising as regional reputation is very inelastic, it takes time to evolve and change (Schamel and Anderson, 2003). Packaging characteristics follow as second most important for all models, with label style for the total and US model and label colour for imported wines. While grape variety is third most important in the US it is only next to last for imported wines, largely caused by European origins that do not state grape varieties on the front label. Label information is the fourth most important attribute in our study, contributing between 8% and 11% of explained price differences.

Table 4: Attribute importance (measured as relative share of price differences)

	Total model	rank	US model	rank	Import model	rank
Origin	59%	1	34%	1	40%	1
Label style	10%	2	21%	2	10%	5
Label information	8%	3	9%	4	11%	4
Grape variety	8%	4	14%	3	9%	6
Label colour	7%	5	8%	6	14%	2
Bottle form	5%	6	5%	7	12%	3
Closure	4%	7	9%	5	4%	7

Conclusion

Analysing scanner data of red wine sales in two metropolitan US markets we found a significant impact of packaging and front label information on wine prices. For the first research question it can be concluded that a large number of packaging and label information could be identified that achieve a significant price premium and discount on the market for red wines in the US.

While region of origin attracts the highest differences in implicit prices (34% to 59%), packaging can be related to between 26% (total model) and 42% (US model) of predicted price differences, while label information is linked to between 8% and 11% of total price differentials. Accordingly, for the second research question it can be concluded that wine packaging is related to price differences that are almost as high as for origin, while labelling information has the smallest impact.

These findings were derived from real market transactions covering all market price tiers and reflect reliable and valid results. Our findings of price premiums and discounts for certain packaging and labelling attributes have a high relevance for strategic marketing and can be utilised in the short term to package and label wines for different price tiers.

At this stage it is unclear to what degree those price premiums and discounts we found are related to stable consumer perceptions and how uniform they are in different international markets and for other wine categories like white wine. Unlike regional differences that do not change in the short term, producers can adapt their packaging rapidly. Therefore it is likely that price premiums will be eroded by offering more wines with those packaging characteristics, which recently attracted a price premium. Further research is necessary to address these questions.

Acknowledgements

This project was supported by Australia’s grapegrowers and winemakers through their investment body the Grape and Wine Research Development Corporation with matching funding from the Australian Government. Gergely Szolnoki’s research visit in Adelaide was supported by the Geisenheim Research Center and funding from the School of Marketing at the University of South Australia.

References

Bentzen, J. & Smith, V. (2008). Do expert ratings or economic models explain champagne prices?. *International Journal of Wine Business Research*, 20(3), 203-243.

Caputo, T. (2008), How to break into the U.S. market, Meininger’s Wine Business International, 2/2008, p. 34-35.

Combris, P., Lecocq, S., & Visser, M. (1997). Estimation of a Hedonic Price Equation for Bordeaux Wine: Does Quality Matter?. *The Economic Journal*, 107 (2), 390-402.

Combris, P., Lecocq, S., & Visser, M. (2000). Estimation of a Hedonic Price Equation for Burgundy Wine. *Applied Economics*, 32 (8), 961-967.

Costanigro, M., McCluskey J. J., & Mittelhammer, R. C. (2007). Segmenting the Wine Market Bades on Price: Hedonic Regression when Different Prices mean Different Products. *Journal of Agricultural Economics*, Vol. 58 (3), 454-466.

Deliza, R., & MacFie, H. J. H. (1996). The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: A review. *Journal of Sensory Studies*, 11(2), 103-128.

Landon, S., & Smith, C.E. (1997). The Use of Quality and Reputation Indicators by Consumers: The Case of Bordeaux Wine. *Journal of Consumer Policy*, 20 (3), 289-323.

Lange, C., Martin, C., Chabanet, C., Combris, P., & Issanchou, S. (2002). Impact of the information provided to consumers on their willingness to pay for Champagne: comparison with hedonic scores. *Food Quality and Preference*, 13(7-8), 597-608.

Ling, B., & Lockshin, L. (2003). Components of wine prices for Australian wine: how winery reputation, wine quality, region, vintage, and winery size contribute to the price of varietal wines. *Australasian Marketing Journal*, Vol. 11 (3), 19-32.

Lockshin, L., Mueller, S., Louviere, J., Francis, L., & Osidacz, P. (2009), Development of a new method to measure how consumers choose wine, *The Australian and New Zealand Wine Industry Journal*, Vol. 24 (2), 35-40.

Mueller, S., Lockshin, L. & Louviere, J. (2010), What you see may not be what you get: Asking consumers what matters may not reflect what they choose, *Marketing Letters*, Vol. 21, forthcoming.

Mueller, S., Lockshin, L., Louviere, J., Francis, L., & Osidacz, P. (2009), How does shelf information influence consumers' wine choice?. *The Australian and New Zealand Wine Industry Journal*, Vol. 24 (3), 50-56.

Mueller, S., & Szolnoki, G. (2009), Conjoint analysis: Modelling consumer heterogeneity with latent class regression, Poster, 8th Pangborn Sensory Science Symposium, Florence, 26-30 July 2009.

Nerlove, M. (1995). Hedonic Price Functions and Measurement of Preferences - The Case of Swedish Wine Consumers. *European Economic Review*, 39 (1), 1697-1716.

Oczkowski, E. (1994). A Hedonic Price Function for Australian Premium Table Wine. *Australian Journal of Agricultural Economics*, 38 (2), 93-110.

Oczkowski, E. (2001). Hedonic Wine Price Functions and Measurement Error. *The Economic Record*, 77 (239), Dec. 2001, 374-382.

Orth, R. U., & Malkewitz, K. (2008). Holistic Package Design and Consumer Brand Impressions. *Journal of Marketing*, 72, 64–81.

Port, J. (2008), Sting in the tail, The Age, July 22, 2008.

Steiner, B. (2004). French Wines on the Decline? Econometric Evidence from Britain. *Journal of Agricultural Economics*, Vol. 55 (2), July 2004, 267-288

Schamel, G., & Anderson, K. (2003). Wine Quality and Varietal, Regional and Winery Reputations: Hedonic Prices for Australia and New Zealand. *The Economic Record*, 79 (246), Sept. 2003, 357-369.

Szolnoki, G. (2007). Die Messung des Einflusses der äußeren Produktgestaltung auf die Kaufbereitschaft – Dargestellt am Beispiel Weißwein. Geisenheimer Berichte, Geisenheim, Band 61.

Szolnoki, G. & Mueller, S. (2009), On the bottle or inside the bottle? The relative influence of wine packaging on hedonic liking and purchase intent, Poster, 8th Pangborn Sensory Science Symposium, Florence, 26-30 July 2009.

APPENDIX 2 – IP STATEMENT

There is no specific intellectual property developed from this research project.

All the methods developed were based on publicly available research in economics, marketing, psychology, and sensory science. The combinations used in this research were new, but all methods are provided in published articles.

APPENDIX 3 – STAFF LIST

The following staff from the three research organisations was involved in the project:

University of South Australia

Prof. Larry Lockshin

Dr Simone Mueller

The Australian Wine Research Institute

Dr Leigh Francis

Patricia Osidacz

Belinda Bramley

Brooke Travis

Centre for the Study of Choice (CenSoC)

Prof. Jordan Louviere

Dr David Pihlens

Maria Lambides

Edward Wei

David Hackman

Scott Gillespie

Industry Advisory Board

Mark Allgrove (then Constellation)

Ric Anderson (d'Arenberg)

Kathy Barber (Fosters)

Edouard Beaslay (Pernod-Ricard)

Ian Hollick (Hollick Wines)

Fiona Keen (Pernod-Ricard)

Miriam Leenders (then Constellation)

Libby Nutt (Casella)

Lawrie Standford (AWBC)