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Project NWG 1103

Attitudes, Drivers of Consumption and Taste Preferences: a Focus on Chardonnay

Report Compilation

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PART 1. SUMMARY AND RECOMMENDATIONS

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Summary

This summary provides an overview of a series of reports on the 'Chardonnay Challenge' project, compiled within the current document. As such, it draws from all of the reports in making conclusions.

We have shown that there are a range of Australian Chardonnay wine styles that appeal to consumers and provided some guidance on flavours that are positively viewed. Overall, it was shown that 'taste' was not the reason for decline in sales of Chardonnay.

Data from two 'deception' experiments are presented, where we measured the influence of the perception of Chardonnay on taste preference ratings. Consumer responses showed that consumers do NOT rate the wines they taste lower when they are told that it is Chardonnay. This finding suggests that consumers do not currently hold general negative impressions of Australian Chardonnay.

Focus groups were conducted and qualitative results from that process showed a particularly negative perception of Chardonnay. The focus groups were made up of consumers of wine, but as it turned out, not Chardonnay. This was a required limitation of the work, since focus group recruitment needs to be performed agnostic of the key question – that is, we could not announce to potential participants that we were interested in Chardonnay and possibly bias their responses.

The negative perception of Chardonnay found in the focus groups was cross-checked with a quantitative survey using population sampling. The focus group results were not found to be representative of the population. The survey showed that consumers did NOT hold negative views about Chardonnay. A total of four focus groups were run, so it is unlikely that the sampling alone produced such different and negative opinions.

However, focus groups represent 'group' responses, and there is certainly clear negative information about Chardonnay known that may have influenced responses. That is, responses may have represented more about what participants thought they should say to appear knowledgeable to the group, rather than their own opinions. The negative responses about Chardonnay provided by the focus groups were consistent with what is well known and even promoted within the media, such as Chardonnay being 'uncool' because of what TV shows like 'Kath and Kim' have done to the image.

The incongruence between the group results from the focus groups and the individual responses from the survey suggest that individual responses are positive toward Chardonnay and group responses are negative.

The negative responses from the focus groups may come from the peer pressure associated with the focus group methodology as suggested above. The Australian media seems to have accepted that consumers have a negative perception of Chardonnay and this colours reports on the topic.

In an environment where consistent negative messages are associated with Chardonnay, consumers will report those views back when asked, at least in a group setting. Some pockets of the Australian wine Industry have accepted the negative Chardonnay messages and even been involved in perpetuating them - not through any malicious attempt to 'talk down' the prospects of Chardonnay, instead in an attempt to be pragmatic about what they accepted as true.

Detailed results from a survey specifically on Chardonnay are reported. In summary, the results unambiguously demonstrate that there are no systematic negative views of Australian Chardonnay. Further, attitudes towards Chardonnay have NOT changed over the last five years. This result requires some interpretation, as the commonly held viewpoint is that attitudes toward Chardonnay were extremely positive and have declined substantially in recent years.

We conducted a review of the literature and found that all of the information pointing to Chardonnay being considered a 'hero' in the past and being viewed less positively now, was not peer reviewed research, but rather based on opinion or similar forms of evidence. In fact, there was a paucity of empirical research on Chardonnay perception, and in the absence of such evidence less formal evidence dominates the formation of opinions.

The consumer data results present a clear case for Chardonnay being moderately liked by a broad range of consumers, and no evidence for strong negative views amongst any segments. We do not have attitudinal data measured in the past, but we have asked respondents to reflect on their views of Chardonnay in previous years. If this kind of quantitative population survey had been conducted in the past, it would have shown us that Chardonnay was not the 'hero' that we thought it was. In the absence of this information, and led only by less formal forms of evidence, the Australian wine Industry was understandably encouraged to plant and make more Chardonnay. This has created the kind of oversupply problem that has been reported elsewhere, and is explained in the literature review that we conducted.

Unfortunately, at the same time as the industry was creating an oversupply pressure, the competitor space was developing. Several other white wine styles became more available, in particular styles from the varieties Sauvignon Blanc and Pinot Gris/Grigio. The industry was 'blind sighted' by the success of these wines, because it was thought that Chardonnay was extremely well liked by a large range of consumers. In reality, our data reported here suggests that Chardonnay was moderately liked by a broad range of consumers. With this understanding, it is clear that many consumers would transition to drinking competitors as they become available and as they meet their preferences.

Again, if empirical data were available in say 2000 on attitudes and preference for Chardonnay, the industry would have been unlikely to move so quickly to plant further Chardonnay vines.

Our data measured using sensory, consumer, experimental, survey, qualitative focus group, and critical reviews of the literature have all pointed to an unambiguous interpretation: that the 'Chardonnay Challenge' has come about because the industry misinterpreted moderate interest in Chardonnay to be high interest. This misinterpretation was allowed through a lack of empirical information on Chardonnay attitudes. The industry was eager to plant vines and make wine, and the best available information was suggesting that Chardonnay was in high demand, loved by consumers and had excellent viticultural credentials.

The current report is aimed at recommending outcomes that will help mitigate the 'Chardonnay Challenge' happening again – to another well-performing Australian variety for instance. The best advice that we can provide, and we admit that it might be viewed as nepotistic given that we are researchers, is for the industry to fund more empirical varietal attitudinal research. At present, there is a focus on conducting this kind of work (like this very project) ***after*** sales decline, in an attempt to understand what 'went wrong'.

It is highly likely that phenomena like the 'Chardonnay Challenge' can be avoided in future if the Australian wine industry funds research to understand base attitudes and makes this available in a co-ordinated way. That is, advice is available to growers on ***what*** to plant, based on likely future demand. In reality, that advice will never be so singular that the one variety will always be recommended, as growing conditions, target markets, and other variables individual to companies will dictate different ideal varieties to plant.

Recommendations

There is an understandable tendency to fund research in areas where challenges already exist, but often the results of that research are not able to 'solve' the problem once it has started. The major learning out of this project has been that costly industry-wide effects can be caused from not having access to reliable baseline consumer attitudes data.

When Chardonnay became popular in Australia there was *some* Viticulture and Winemaking research undertaken, in order to understand this industry 'hero'. However, it is less intuitive to conclude that when a variety is performing well, we need baselines consumer attitude and taste preference research conducted. The current lack of research in this area is one of the biggest risks currently facing the Australian wine industry.

Based on the multi-discipline approach we undertook, we make the following recommendations:

- Baseline consumer attitude and taste preference research needs to be undertaken, particularly for high-

performing varieties that are (or will likely become in the short term) highly valuable to the industry.

- There is a need to re-balance the supply-demand ratio of Australian Chardonnay for domestic sales, and find other markets to sell Chardonnay internationally. Understanding markets such as China are important, but also risky given the inherent volatility of the political landscape, at least in China. Emerging markets like India may prove a more stable investment, and pre-emerging markets such as Ghana are currently not considered at all despite cultural changes of revolutionary scale toward drinking wine.
- The sensory and consumer work undertaken has highlighted styles that appeal to consumers and some styles that do not. This information could be used to inform a wine business on proportion of wine volume to produce in given styles. The Chemistry work has tentatively identified compounds responsible for key sensory attributes. This aids winemakers and future research on Australian Chardonnay.
- The fact that other varieties were able to 'usurp' Chardonnay's position in the shopping trolley suggests a strong demand for flavour innovations that winemakers were unable to supply through Chardonnay. Methods that allow potential flavour innovations cheaply would provide existing varieties with an ability to be more flexible to consumer needs, without the expensive requirement to replant vines.
- Australian Chardonnay currently enjoys a positive perception amongst domestic consumers. This is at odds with some messages conveyed by the media and even by the wine industry themselves. We found no reason to be pessimistic about Chardonnay, instead, these results could be used to communicate that Chardonnay is a well-liked variety, with many existing flavour styles that appeal to consumers and the potential to offer flavour innovations in the future.

PART 2: LITERATURE REVIEW

Authors: Dr Suren Samuelian & A/Prof Anthony Saliba

Summary

The Australian wine industry owes a large portion of its success to Chardonnay which has been, arguably, its backbone for more than two decades. It is the most planted white variety because of its solid viticultural properties and the ability to provide flexible wine styles. However, in recent years, it has been claimed that Chardonnay has become relatively unpopular. One explanation is that general opinion has shifted towards fresher, lighter bodied, more predictable wine styles such as Sauvignon Blanc. Many different theories have been advanced by publicists, key wine industry personnel, sales representatives, managers, and others to explain Chardonnay's declining popularity but to date an empirical explanation for the 'Chardonnay challenge' is still lacking. Several strategic proposals are suggested to address the consumer decline in interest, including a focus on evidence based research to inform future strategy.

An integrated approach is required if we are to reverse the trend away from Chardonnay and win back consumers in the domestic market. In addition to the influence of region, clone selection, advances in viticultural management and wine making, an understanding of consumer preferences and appropriate marketing are critical in order to meet the expectations of target groups.

However, given that little consumer sensory research has focused on Chardonnay, consumer sensory preference mapping is now critically needed in order to understand how the effect of taste and perception interact and how sales are affected. Such information will help the industry respond appropriately. In the absence of this research, there has been an understandable tendency to rely on personal opinions and well-considered analyses that have not always been based on reliable data. This may have led the industry to conclude, incorrectly, that consumer attitude toward Chardonnay has recoiled.

Rationale

Although not a specific deliverable in the NWGIC's 'Chardonnay Project', a preliminary review of research on preferences and attitudes toward Chardonnay provides a solid, informed basis on which to conduct further work in the Project. Accordingly, this review was completed as part of the Project. Ideally, work reviewed here would be peer reviewed, but given the relatively small amount of peer reviewed literature on Chardonnay attitudes, other forms of 'evidence' are also reviewed in order to build a better understanding of the current knowledge base. This is not an exhaustive review of consumer attitudes and taste preference for all wine, or even white

wine – instead the focus is specifically on Chardonnay research. However, given the paucity of research on Chardonnay, work on some related varieties is also reviewed where appropriate.

Development of Chardonnay Market

The Australian grape and wine industry has expanded steadily for the past two decades to become the seventh largest producer and the fourth largest exporter in the world (Scott, 2010) with Chardonnay being one of the most prominent varieties (Rowley 2012). Although introduced into Australia in 1832 by James Busby (Wall, 1986), commercial Chardonnay production did not begin until the early 1970's (Fig. 1).

Since then production has increased substantially to an annual crushing of between 300 and 400,000 tonnes since 2004. In 2011 Chardonnay production represented a quarter of all grapes processed in Australia and in the last fifteen years Chardonnay has become the prominent Australian white variety (Rowley 2012) accounting for the largest share of white grape production (between 30 and 50%) and between 17 and 27% of total grapes crushed (www.wineaustralia.com/australia/, former Australian Wine and Brandy Corporation). In terms of red grape production, the figures are similar for Shiraz, the premium Australian red variety, (Fig. 2).

As with many varietal wines, Chardonnay falls into a number of categories (e.g. basic, premium, iconic etc) and associated price points (Fig. 3). That presents a problem when attempting to gain information about a specific category since the information provided by most data collection agencies refers to the combination of all categories and so can be misleading. For example, sales of ultra premium and icon sector Chardonnays are up while there are declining sales in the remaining price brackets (Keys 2010, 2011).

Since the top-level sectors comprise a very small percentage of the total, a focus on overall sales would show Chardonnay sales are declining. In comparison, Chardonnay production has increased in the Californian Central Valley by approximately 10% every year since 1977 (Fig. 4; Correia et al., online access). There, the average price per ton has increased and decreased in a sinusoidal fashion over three successive cycles. The increase and decrease was approximately 45-50% for each of the cycles – 1979-1986, 1986-1994, 1994-2001 but the prices have remained low since 2001. In Australia, prices per tonne increased slightly from 2000 until 2004 but have generally been declining ever since (Fig. 5). Similar trends are also observed for all other mainstream varieties[1] with weighted average prices declining steadily since 2008. Detailed data on sales both in the domestic and export markets re lacking partly due to the fact that large retailers such as Woolworths and Coles are reluctant to release sales information.

[1] Mainstream varieties are considered Chardonnay, Shiraz, Cabernet Sauvignon, Merlot, Sauvignon Blanc, Riesling, Pinot Noir, Semillon, Chenin Blanc, Colombard,

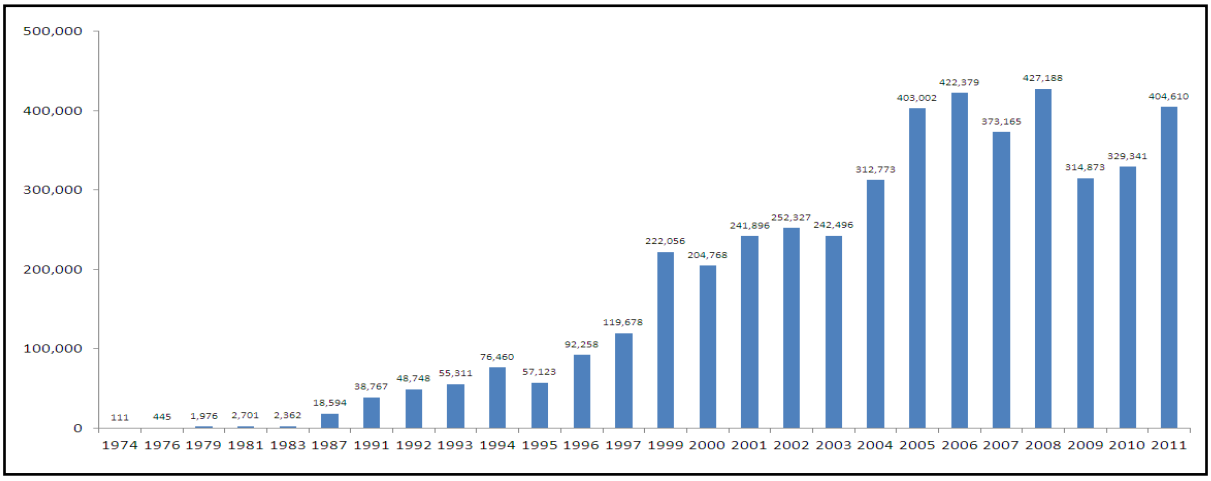
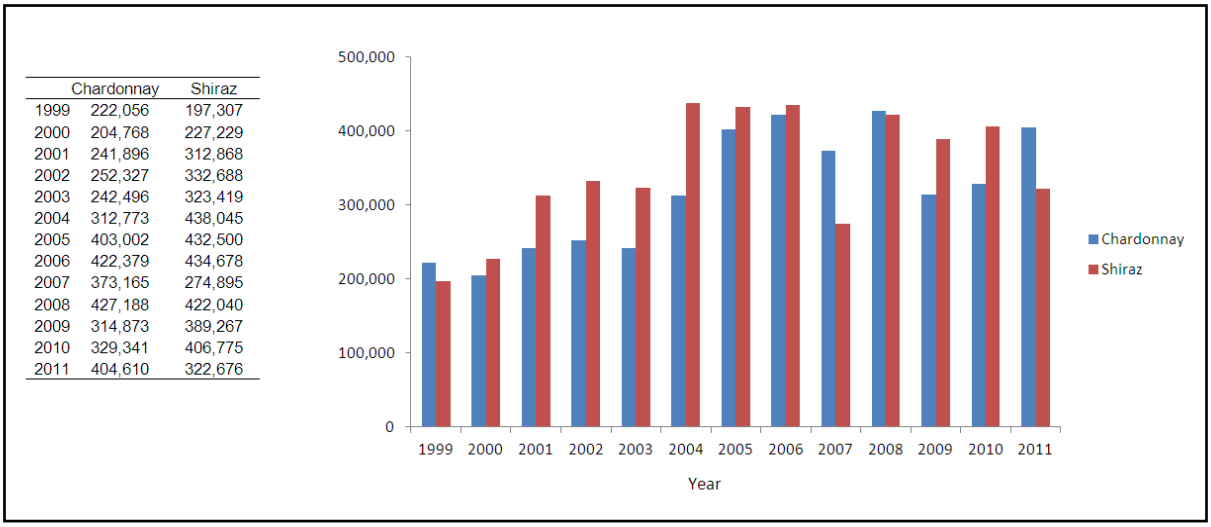


Fig. 1. *Production of Chardonnay in Australia. Source: (www.wineaustralia.com/australia/)*



	Chardonnay	Shiraz
1999	222,056	197,307
2000	204,768	227,229
2001	241,896	312,868
2002	252,327	332,688
2003	242,496	323,419
2004	312,773	438,045
2005	403,002	432,500
2006	422,379	434,678
2007	373,165	274,895
2008	427,188	422,040
2009	314,873	389,267
2010	329,341	406,775
2011	404,610	322,676

Fig. 2. *Production of Chardonnay and Shiraz in Australia. Source: (www.wineaustralia.com/australia/)*

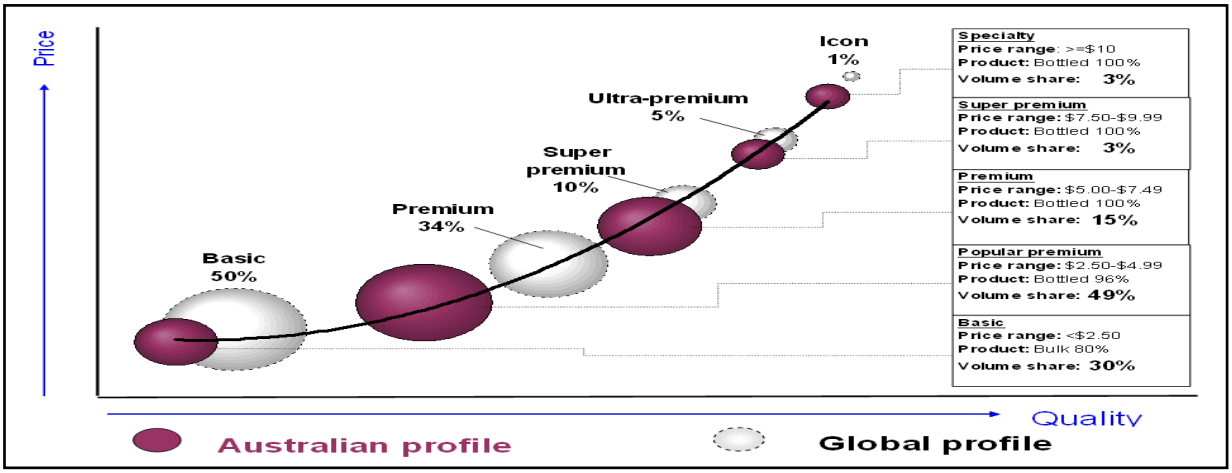


Fig. 3. *Global wine categories. Reproduced with permission from Jim Hardie, the National Wine and Grape Industry Centre.*

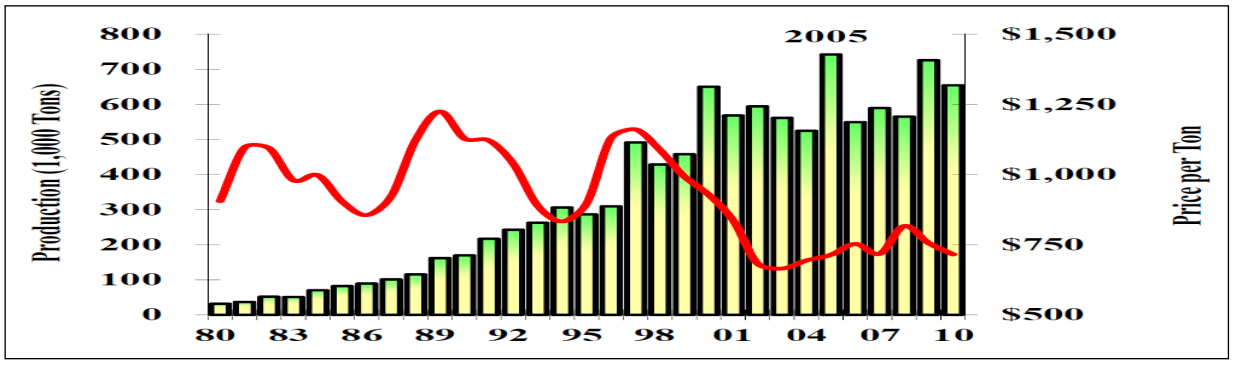
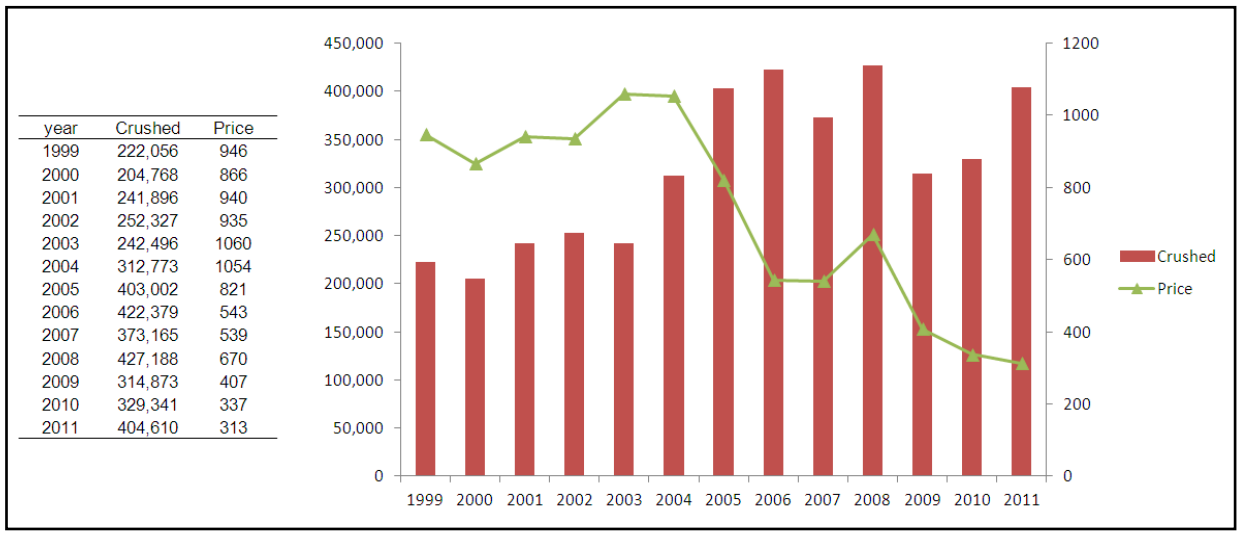


Fig. 4. *Production and weighted average price of Chardonnay in California. Reproduced with permission from Tony Correia, www.c-x.com*



year	Crushed	Price
1999	222,056	946
2000	204,768	866
2001	241,896	940
2002	252,327	935
2003	242,496	1060
2004	312,773	1054
2005	403,002	821
2006	422,379	543
2007	373,165	539
2008	427,188	670
2009	314,873	407
2010	329,341	337
2011	404,610	313

Fig. 5. *Production and weighted average price of Chardonnay in Australia. Source: (www.wineaustralia.com/australia/)*

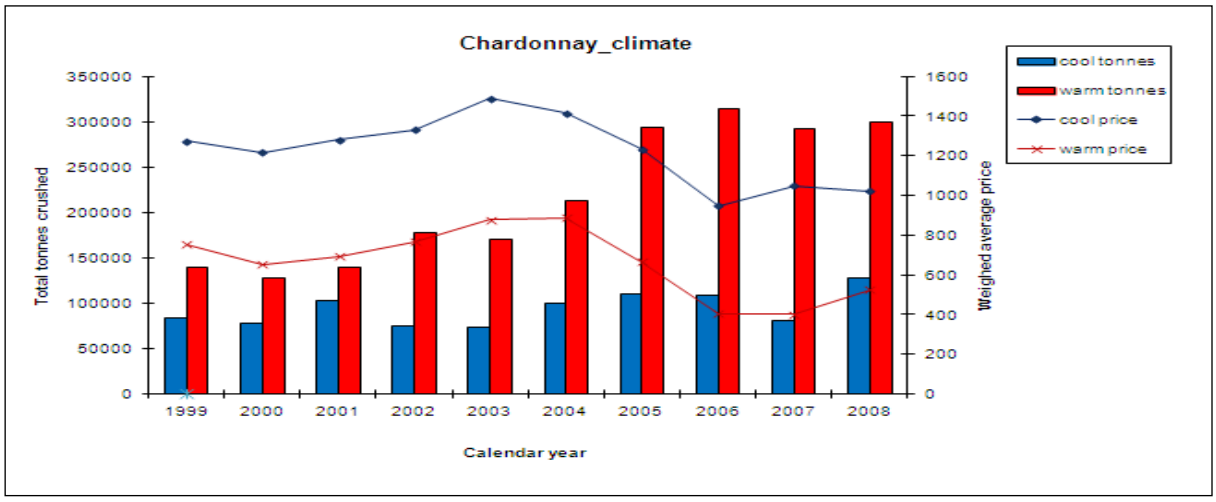


Fig. 6. *Production and weighted average price of Chardonnay in warm and cool climates. Source: (www.wineaustralia.com/australia/)*

Reasons for Chardonnay unpopularity in recent years

The reason for the relative decline in consumer interest in Chardonnay in recent years is not known. Different theories have been offered by publicists, winemakers, proprietors, managers, exporters, marketers, directors, consumers, and others, regarding the 'Chardonnay challenge' facing the industry but empirical data is virtually non-existent. Historically, Chardonnay production was concentrated in warm grape growing regions such as the Riverina and the Hunter Valley and the wines were characterised by generous fruit and oak flavours, moderate acidity, and relatively high alcohol levels (for review see Paterson, 2004).

General opinion is that although Australians continued to favour Australian Chardonnay they have moved towards more aromatic, crisp and refreshing white wines in recent years such as Sauvignon Blanc (and maybe Semillon and Pinot Grigio) as consumer preferences for oak-driven rich Chardonnay styles have declined (Curtin, Bellon, Bartowsky, Henschke et al, 2011; Keys 2010, 2011). The industry responded in a timely manner producing more Chardonnay styles (the so-called 'next-gen' Chardonnays, Curtin et al. 2011), that are fresher, lower in alcohol and oak but higher in fruit and acidity.

However, there are still a significant number of consumers who prefer the traditional, old-fashioned, full-bodied Chardonnay. The general view that consumers prefer lighter Chardonnay wines produced in cool climates is not supported by increasing production of such wines despite cooler climate wines having a higher weighted average price (Fig. 6).

An additional problem Chardonnay faces is that it has lost its social currency as it is produced in a vast number of viticultural regions leading to 'unclear' styles and/or flavour profiles whereas Sauvignon Blanc wines are more predictable ('Project Chardonnay. Top line strategy paper.' Wine Australia; Curtin et al. 2011).

Tony Keys has expressed the view that consumers, especially in the UK, are simply tired of Australian Chardonnay and so moved to Chardonnays from France (where it is also known as Chablis, White Burgundy, Champagne, Blanc-de-Blanc, Pouilly Fuissé etc, for a complete list see Robinson 1986, p. 119), Chile, South Africa and other New World countries (Keys 2010, 2011). The current global economic situation has also contributed to the decline in Chardonnay sales.

Morss in his document 'The US Wine Market – A Global Economist's Perspective' collected data from Martignetti's liquor store, the 7th largest distributor in USA, which offers more than 2,500 wine labels. The author concluded that it would be very difficult to get shelf space in the highly competitive US market and in order to do so, price and quality were essential. The current high in the Australian dollar makes Australian wines now more expensive to buy overseas while simultaneously making imported wines cheaper to buy in Australia. Hence, "price" is currently a problem. "Quality" too is an issue since ten years ago it

was difficult to find good wine for $10 but that is no longer the case. As a result, Australian "quality" wines compete with similar wines from other countries.

Addressing the Chardonnay challenge

In 2011, Wine Australia presented a document entitled 'Project Chardonnay: Top line strategy paper'. The scope of the project was to propose a broad strategic framework to address the challenges Chardonnay faces in the domestic market which then can be tailored to the export market. The vision of the project was to make Chardonnay the white wine of choice by giving it social currency.

According to the authors of the document, the first and most important strategic response is to understand what consumers are looking for, convey those messages to the grape and wine industry, and finally, share learning and ideas between participants. The focus is on consumers moderately involved with Chardonnay as they are the largest 'user group' and are also ready to consider alternative wine varieties.

Other strategic proposals suggested by the Project involve producing quality Chardonnay in all price brackets; exploring Chardonnay's flexibility to deliver the more crisp and refreshing styles that consumers demand (including unwooded and slightly oaked styles); provide multiple price points and styles to target consumers with varying budgets and tastes; and move towards organic/biodynamic production (although the proportion of such production is not specified).

Such strategic proposals are somewhat vague in that they do not describe how such issues as determining the right balance between oak and fruit (for example) are to be achieved or whether winemakers should really be more focussed on producing a very consistent, distinctive Chardonnay style rather than attempting to make styles similar to Sauvignon Blanc.

It might be speculated that the considerable success of Australian Chardonnay, at least in the past, in the international arena is partly due to the controlled fermentation with selected yeast. However, this might also be one of the reasons for the recent decline in consumers' interest in countries such as the UK and the USA. Informative to this assertion is the Australian Wine Research Institute (AWRI) investigation of the attributes of wines produced with selected commercial yeast, 'non-conventional' yeast, and 'wild' yeast.

The team from the AWRI has developed a fermentation toolkit to help winemakers produce wine with the complexity required to lure consumers back to Chardonnay. It is reasonable to presume that the AWRI has evidence pointing to the 'complexity required', though this information may also be difficult to find for some wine producers who have not conducted their own taste preference work with Chardonnay.

It seems no single approach will ensure an increase in demand for Chardonnay. To win back consumers and assure continuous success in both the domestic and export markets the

importance of region, clone selection, advances in viticultural management and winemaking as well as appropriate marketing will all need to be considered in an integrated approach. The key however, is to better understand the expectations of target consumer groups since that will help identify desirable regional and clone characteristics and inform appropriate viticulture management/wine-making as well as provide a marketing focus.

Consumer attitudes and taste preference focussing on Chardonnay

If the word 'Chardonnay' is entered into Google Scholar or Web of Knowledge, there will be approximately 26,300 hits. While there is a large number of articles about Chardonnay, many only offer opinions on Chardonnay or if they use Chardonnay in research they do not report on any insights into the wine itself. It is clear there is a need for an increase in reported empirical research on consumer sensory and perceptual factors related to Chardonnay to inform decisions about Chardonnay production and marketing.

Consumer sensory research on other white varieties, e.g. Hunter Valley Semillon (Blackman & Saliba, 2009; Blackman, Saliba & Schmidtke. 2010) and New Zealand Sauvignon Blanc (Francis, Sefton & Williams. 1992; Parra, Greenb, Whiteb & Sherlockc. 2007), has also been reported, possibly more so than that on Chardonnay.

Yegge and Noble (2000) conducted a study in which 10 inexpensive commercial California Chardonnay wines, vintage 1997, were descriptively profiled by 14 trained judges and further rated by 126 novice and experienced Chardonnay wine consumers for acceptance and purchase intent. "Acceptance" was based on sensory factors such as aroma and flavour (using descriptors such as 'oak', 'butter', 'citrus', 'apple' etc) while purchase intent was based on non-sensory wine attributes such as price, growing region, label description, brand name and label design.

Five consumer segments with similar preferences for wine were identified with significant differences in acceptance and purchase intent observed between and within segments. The largest variation in consumers' flavour preference was observed between fruity and floral wines versus wines with low intensity of fruitiness but high in caramel, spice and oak aromas. Acceptance was scored significantly higher than purchase intent which suggested that purchase behaviour depended on more than mere liking of a product. In addition, labels significantly influenced the attitude towards several of the wines thereby demonstrating the importance of labelling.

A limitation of the study was that it did not specify how 'novice' and (especially) 'experienced' consumers were determined. Defining "experience" is important since, while a consumer who reports 25 years (for example) of wine drinking might be considered "experienced", they may be less knowl-edgeable than someone who has actively learnt about wine for far fewer years (Blackman *et al*. 2010). Knowledge of how classifications were assigned helps assess how generaliseable

research findings may be.

In other studies, Canadian Chardonnay was analysed for its sensory and compositional attributes by Cliff and Dever (1996) and, later, by Schlosser, Reynolds, King and Cliff (2005). In the first study, sixteen Chardonnay wines from 1993 and twenty-five Chardonnay wines from 1988-1993 from British Columbia (B.C.) were profiled. Wine, wineries and vintage differences were analysed. The sixteen 1993 vintage wines were obtained from 12 wineries and the twenty-five 1988-93 vintage wines were obtained from 6 of those 12 wineries.

Wine styles were able to be discriminated as some wineries produced fruity and floral wines while others were more yellow, oaky, buttery and astringent. Chemical analyses involved titratable acidity (TA), pH, absorbance, phenol and alcohol content. Ten "experienced" judges evaluated colour, aroma and flavour of all wines. Correlates with the attributes fruit, sweetness and perfume, as well as complex, yellow, oak and alcohol were found in the 1993 wines. Astringent and vegetal characteristics were found to be negatively correlated with fruit and sweetness as were perceived acidity, complexity, yellow and alcohol.

The older vintages were generally found to be more yellow and oaky with more diacetyl flavours while the 1993 wines were fruitier. The authors attributed the differences to the influence of both aging and the cooler weather conditions experienced by some wineries. Chardonnay wines from Chablis, Maconnais and Napa have also been associated with fruitiness, specifically ripe apple, melon and pineapple characters (Robinson 1986).

Amongst the disadvantages of the Cliff and Dever (1996) study were that several different vintages were investigated leading to possible confounding effects. Further, bottle age was not taken into account and the oldest wines were omitted from some of the analyses. In terms of the work's relevance to this review, it is unclear how consumer attitudes or preferences relate to the results as only experienced assessors were used.

Schlosser *et al*. (2005) analysed twenty-four Chardonnay wines from the Niagara Peninsula, one of the three distinct Ontario viticultural appellations, as well as a Chardonnay from California, Australia and France for their chemical and sensory attributes. Wines were selected from 13 producers and vintages ranged from 1993 to 1998. A panel of 14 judges from Brock University Cool Climate Oenology and Viticulture Institute participated in the descriptive analyses of the wines. Descriptive terms for aroma (oak, butter, citrus, apple, melon, grassy, earthy), flavour (oak, butter, toast, citrus, melon, grassy), taste (perceived acidity, bitterness) and mouthfeel (astringency, body) were agreed to be used. A randomized design was used to evaluate the 27 wines.

Chemical analyses involved titratable acidity (TA), pH, ethanol and total phenol concentration, as well as wine colour intensity. Wines from grapes matured under cool climate conditions have been shown to have higher acid and phenolic composition and lower pH, and that was also found to be the case for the Chardonnay wines analysed in this study.

Sensory analyses suggested that the three attributes of "melon", "citrus" and "colour" significantly differentiated the wines with respect to origin. Butter aroma and flavour, body and colour, melon and apple aroma, melon flavour and acidity, citrus aroma and flavour were found to be positively correlated. Acidity and fruit attributes were negatively correlated with oak aging and barrel fermentation.

The general outcome of the study was that regional differences in topography, climate and soil have limited impact on the distinctive sensory characteristics of Chardonnay wines from the Niagara Peninsula. The findings were consistent with those of Noble and Ohkubo (1989) who found that Chardonnay wines from California exhibited limited regional differentiation.

That result might, however, be more attributable to the Chardonnay winemaking process of that period which included barrel fermentation, malolactic fermentation and barrel aging (Arnold and Noble, 1979; Cottrell and McLellan, 1986; Sefton *et al*. 1993; Cliff and Dever 1996) rather than a lack of influence of topography, climate and/or soil. As with other studies, Schlosser *et al*. (2005) used only experienced judges without defining "experience".

Closer to home, the Australian Wine Research Institute undertook a study in 2010 involving eight oaked and four un-oaked commercial Chardonnays chosen for their chemical composition and sensory attributes (Francis, Osidacz, Bramley, King *et al*, 2010). The selected wines were within the Aus$8-20 price range and had less than 4 g/L residual sugar. An expert panel separated the unwooded Chardonnay widely across a three-dimensional principal component analyses map.

In another experiment, 203 Sydney-based regular white wine drinkers evaluated 14 wines including eight Riesling, two Pinot Gris and four Chardonnay, two oaked and two unwooded, for liking (Francis, Osidacz, Bramley, King et al, 2010). Three consumer clusters with different preferences were identified. Cluster 1 comprised 41% of the total sample tested with people in that Cluster preferring a Chardonnay that exhibited high levels of oak flavour, hotness, butter, viscosity, fruit aftertaste and yellow colour. In contrast, Cluster 3 (36%) people preferred sweet wines with fruity aromas such as citrus and pineapple while Cluster 2 (22%) members liked mainly Riesling wines with strong citrus flavour and higher acidity. The two Pinot Gris wines were equally well-liked by consumers with a preference for bitter, cheesy and astringent wines.

The authors concluded that phenolics, even at low level, have a negative influence on a considerable number of consumers and that the consumer clusters identified in this study were reproducible and real. As such results suggest, opportunities exist for different market niches. We cannot comment further here because detailed data was not presented, information about gender, age and other characteristics of the consumers who evaluated the wine was not reported and data specific to Chardonnay was limited.

In another study King and colleagues (2012)

conducted a survey in which regular white wine consumers were segmented based on self-reported liking and knowledge of white wine styles. The study was based on the top white varieties sold in Australia and represented a wide range of styles and flavours – Chardonnay, Riesling, and Sauvignon Blanc from both Australia and New Zealand. A sample of 150 respondents, equally distributed between male and female consumers and age categories, were recruited from the Adelaide metropolitan district (South Australia). The participants were regular white wine purchasers (AU$ 10-20) and had no tertiary wine education and were not employed in the wine industry.

It was found that the grape variety, region/country, brand name and recommendation by friends were the major drivers for decision making while technical comments on the back label, cork closure and alcohol levels were the least important. The consumers were segmented into three categories – 'white wine likers' (40%), 'Chardonnay wine dislikers' (35%), and 'Riesling wine likers' (25%). The majority of the 'white wine likers' had low to moderate wine knowledge as well as wine involvement, and were interested in expert opinions and awards. This segment consumed predominantly Chardonnay, followed by Riesling and smaller levels of Sauvignon Blanc.

'Chardonnay wine dislikers' were significantly more likely to be female than male and included the highest number of young respondents. They possessed low wine knowledge and considered recommendations by friends as the most important driver when purchasing wine. Vintage, alcohol level and ratings, reviews and awards were least important for this segment. Sauvignon Blanc was consumed at the highest levels followed by Riesling. A large percentage (81%) of these respondents did not consume Chardonnay. 'Riesling wine likers' had high wine knowledge and wine involvement and consumed mostly Riesling and Chardonnay.

The authors concluded that consumers with higher wine knowledge preferred Riesling and Chardonnay, while consumers with lower knowledge consumed mostly Sauvignon Blanc. This emphasised the importance of wine knowledge for consumers' decisions. Such information might prompt appropriate marketing campaigns as well as production of wine styles targeting specific demographic groups.

The major limitation of the study was that price was not included as a purchase driver even though it has been well-established that it is one of the most important factors influencing purchase decisions (Mueller et al, 2010; Quester and Smart, 1998). In addition, the respondents were sampled from metropolitan South Australia which might limit the generalisation of results. Another limitation of the study was the use of self-reports of liking, with no sensory testing undertaken.

In a similar study Lattey and colleagues (2005) investigated the relationship between consumer acceptability and 'expert' wine judgements and quantitative sensory profiling data. A set of ten

Rieslings (1993 to 2003 vintages) and ten unwooded Chardonnays (2001 to 2003 vintages) were characterised by a trained panel and 72 regular white wine consumers.

Two major conclusions were drawn from this study. First there was no significant correlation between the expert judges and consumer liking for either of the varieties; and second it was found that many of the consumers preferred the strongly fruited wines of each variety while the more developed wines with lower intensity aromas were liked by only a few participants. This study indicated that quality scores do not reflect consumer liking, suggesting that producers should target wine styles with view of consumer preferences rather than expert ratings alone.

Wine taints such as cork taint, oxidised flavour or bitterness can be recognised by some consumers even at low concentrations and have a strong negative effect on consumer perceptions and purchase intent (Towey & Waterhouse, 1996; Spillman, Iland & Sefton. 1998). To further elaborate on those findings Spillman, Sefton and Gawel (2004) examined the influence of volatile compounds derived from oak barrels during maturation, on the aroma of a Chardonnay wine.

The wine was matured in 24 oak barrels over 55 weeks and its compositional and aromatic properties analysed. A panel consisting of fifteen staff and post-graduate students from the Australian Wine Research Institute and the Department of Horticulture, Viticulture and Oenology, University of Adelaide, evaluated the sensory attributes of the wine. The following descriptors were agreed upon by the panellists – coconut, pencil shavings, caramel, vanilla, allspice, smoky, butter, cashew nut, green apple, and cinnamon. Oak toasting was negatively correlated with 'green apple' characters. 'Butter' and 'caramel' aromas were found to be strongly correlated with malolactic fermentation.

Bleibaum, Lattey, and Francis (2005) interviewed approximately 300 consumers from the United States and 400 from Australia primarily by means of an attitude and usage questionnaire. They concluded that closure type was an important purchase intent driver along with price, variety and region. Participants preferred natural cork to synthetic cork with screwcaps having a negative impact on purchase intent particularly for wines over $15.

For Australian consumers price was of primary importance followed by closure type, region and variety. Unfortunately, no further information on this study was available as it was conducted by the Tragon Consumer Marketing Group (www.tragon.com). As is usual for consumer attitudes work, the fact that it was conducted more than seven years ago is now a limitation that needs to be taken into account. Attitude toward screwcaps and subsequent perceptions of quality is one relationship that has changed rapidly. The following study also demonstrates previous attitudes against screwcaps.

Martin, Jorgensen, Kennedy and Ferrier (2007) and Martin and Durham (2007) studied the impact of three types of bottle closures – screwcap, synthetic and natural cork – on consumer perceptions. Consumers were

selected from Portland, Oregon from a pool of 2000 subjects based on availability. They were interviewed through a screening questionnaire for age, gender, wine knowledge and frequency of drinking 19 common beverages such as fruit juice, dairy beverages, coffee, tea and alcoholic beverages including wine. The majority of the participants were aged between 24 and 55 with females slightly outnumbering males in all tests. Chardonnay from the vintage 2000 was bottled for 33 months before evaluation.

In the first experiment "regular" wine consumers (i.e. drank wine 2-3 times a month) could not detect differences between wine bottled with the three closure types when closure information was unknown and were no more skilled in detecting a difference than "infrequent" wine consumers (i.e. drank wine once a month or less). The authors concluded that liking, quality, purchase intent and price expectation were rated in a significantly different way when consumers were informed about the closure type. At the time of these studies knowledge about the type of closure strongly influenced liking, quality rating and expected price because wine was perceived to be of a lower quality when closed with synthetic cork and even more so when closed with a screwcap.

Conclusion

Consumer interest in Chardonnay has declined in recent years, accompanied by a drop in sales. This change is of considerable concern to Australian winegrowers as Chardonnay is the most prominent white variety in the country.

Explanations for the decline in consumer interest range from a loss of social currency to a change in consumer taste towards more aromatic, crisp and refreshing wines and even the influence of closure type on purchase intent. The majority of research we reviewed was not necessarily published in peer reviewed journals and in some cases conclusions were based on unsystematic observation or opinion. While some empirical research was found, most was conducted overseas using a variety of vintages, fermentation techniques, regions, aroma/taste descriptors and unspecified levels of "experienced" consumers. The applicability of such work to the Australian market is limited.

In the absence of a sufficient body of peer reviewed research, it is understandable why the Australian wine industry has relied on more informal sources of information. However, some of the empirical data is incongruent with much of that claimed from informal sources, highlighting the danger of relying on informal sources of information. Key to addressing the Chardonnay challenge is a better understanding of how Australian consumers perceive Australian Chardonnay. That understanding can best be achieved through research that includes quantification of claims using large and representative samples.

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PART 3: CONSUMER PERCEPTIONS OF CHARDONNAY – FOCUS GROUPS AND SURVEY COMPARISON

Authors: A/Prof Johan Bruwer, Ms Jasmine B. Thomas, and A/Prof Anthony Saliba

Background

The significance of the Chardonnay grape variety to the Australian wine industry is reflected in its position relative to other grape varieties, with the latest vineyard planting statistics indicating 28,037 hectares are planted with Chardonnay (18% of the national vineyard size) and that Chardonnay accounts for 45% of all white grape vineyard planting (ABS, 2011[2]). Chardonnay has been a mainstream variety and arguably the backbone of the Australian wine industry for almost three decades. The flavour styles in Australia are diverse, with many regions able to claim excellence.

Much research in Australia has placed Chardonnay in a position of strength as an earner of both money and reputation. Despite its position as a kingpin grape variety in the Australian wine industry, in recent years, Chardonnay wine sales have been rapidly declining domestically and many growers are considering removing, or have already removed, the variety.

No single reason for the decline in consumer interest is known. While there is no shortage of opinion, and granted, some may be correct, it is important to understand the contribution of consumer perception and taste preference (both separately and interactively), so that a solution can be offered beyond just removing Chardonnay altogether. It is also important to evaluate the Australian public's attitudes toward wine and the wine industry in general, to assess whether the turn against Chardonnay is linked to a general trend away from drinking Australian wine, or wine in general within the domestic market.

With this in mind, a multi-stage research project has been executed. A series of four focus groups were conducted to determine consumer perceptions toward Chardonnay wine and any appealing marketing opportunities.

[22] Australian Bureau of Statistics (2011), *Australian Wine and Grape Industry*, Report Cat. No. 6302.0, Canberra: Australia.

The qualitative focus group findings also informed the development of a survey of 2024 Australian regular wine consumers (Chardonnay Attitudes Questionnaire). The current report has two aims: 1) to describe the qualitative (focus group method) part of Stage 2 of the overall project, and 2) to triangulate results with the quantitative and nationally representative findings of the survey. A detailed description of the methods of the focus groups and survey can be located in Appendix A and B.

Research objectives

To determine consumer perceptions of Chardonnay, more specifically:

1. Current perception of Chardonnay as a wine of choice
2. Source of current perception, any events that caused recent changes
3. Stickiness' of the current perception
4. Suggestions on how to change any negative perceptions

Results and discussion

Current Perceptions of Chardonnay

This section reports the key findings of the focus groups and relates them, where possible, to the survey results of the Chardonnay Attitudes Questionnaire. Chardonnay was not a highly regarded grape variety in any of the four focus groups conducted, with few of the participants consuming it on a regular basis. Key reasons why participants claimed they did not choose to drink Chardonnay were:

- Dislike of the taste/flavour
- Dislike of its feel on the palate, often being referred to as ‘clinging’, ‘heavy’ ‘overwhelming’ or ‘lingering’
- As a result, the flavour remains on the palate too long
- Because of its ‘weight’ it is difficult to drink more than one or two glasses
- Concerns about its darker yellow colour, even likened to that of urine by some
- Claims that it was more likely to cause headache/illness than other wines
- Perceptions that it was out-dated, not reflecting current tastes, and an ‘old person’s wine’
- Perceptions that it is generally a down-market, low quality wine, often available in casks.

It is likely that many of these perceptions have been brought about by experiences with the heavily oaked Chardonnays that were common some years ago as many of the participants had not drunk a bottle of Chardonnay for some considerable time. While participants generally understood the terms ‘wooded’ and ‘unwooded’ in relation to Chardonnay, because of their reluctance to try the wine, there was negligible comment that would suggest an appreciation of the difference in flavours and textures between the two styles.

The Survey quantified consumer preference for Chardonnay in a number of ways. Firstly, participants were asked directly if they like Chardonnay. The vast majority of participants indicated that they like Chardonnay (74.5%). Secondly, preference was determined indirectly by asking participants what percentage of their normal volume consumption of white wine over the last 12 months is accounted for by various varieties (Table 3).

Table 3: Consumption of White Wine Varieties – Survey Participants

Variety	**Mean** (%)	**SD**	**SE**
Sauvignon Blanc	24.0	26.0	0.6
Chardonnay	23.4	25.2	0.6
Sparkling	15.3	22.3	0.5
Riesling	9.1	16.3	0.4
Chardonnay blends	6.3	11.4	0.3
Semillon	5.9	10.4	0.2
Pinot Gris/Grigio	5.4	10.9	0.2
Savagnin	2.0	7.0	0.2
Viogneir	1.5	4.1	0.1

The focus group data would lead us to believe that participants would consume much more Sauvignon Blanc than Chardonnay. However, participants indicated that Sauvignon Blanc (24.0%) and Chardonnay (23.4%) account for approximately the same amount of consumers white wine consumption.

The focus group findings suggest that consumers dislike the taste of Chardonnay and that they believe it is more likely than other wine varieties to cause headaches/illness. Adverse reactions to wine, such as headaches and illness, are generally associated with allergies. As such, the survey asked participants to respond on a five-point likert scale (strongly disagree = 1, indifferent = 3, and strongly agree = 5) to two items in order to quantify these findings: *I limit or avoid drinking Chardonnay because I have an allergy to it*, and *I drink Chardonnay because I like the taste*. Calculation of mean scores did not indicate a dislike of the taste of Chardonnay (M = 3.5, SD = 1.2). They also indicated that participants do not limit or avoid consumption of Chardonnay because of allergic reactions (M = 1.5, SD = 0.9).

Similar to the findings of the focus group, the participants indicated that they believe Chardonnay is characterised by lingering flavour (M = 4.7, SD = 1.3), yellow colour (M = 4.5, SD = 1.5), but were indifferent to the notion of it having a heavy mouthfeel (M = 3.6, SD = 1.6), as shown in Figure 1 (strongly disagree = 1, indifferent = 4, and strongly agree = 7). However, as stated above, 74.5% of respondents indicated that they like Chardonnay and as such agreement with these three items does not necessarily indicate that consumers view them negatively.

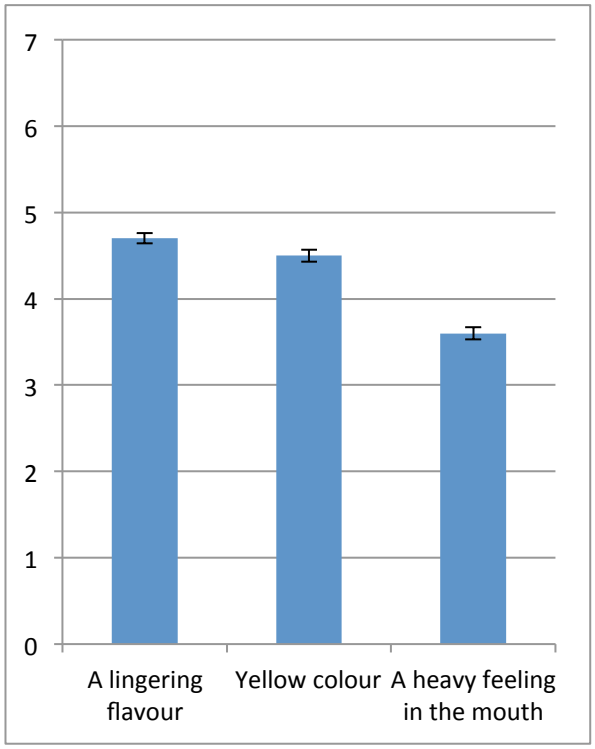


Figure 1: *'I believe that Chardonnay is characterised by...' - Mean and 2*SE*

The focus group findings suggest that consumers perceive Chardonnay as outdated and not reflecting current tastes. As Figure 2 demonstrates, the survey participants indicated that they perceive Chardonnay as a popular wine (M = 4.0, SD = 1.5) but that they are somewhat indifferent to the notion of Chardonnay being a fashionable variety (M = 3.9, SD = 1.5) (strongly disagree = 1, indifferent = 4, and strongly agree = 7). The focus group findings also suggest that consumers perceive Chardonnay as a low quality wine that is predominantly liked by older consumers.

However, the survey data suggests that consumers perceive Chardonnay as a high quality wine (M = 4.8, SD = 1.3). Participants also demonstrated some level of agreement with the notion of Chardonnay being an older consumers' variety. Finally, the focus group findings suggest that consumers perceive Chardonnay as a 'down-market' variety. Participants in the survey were asked to indicate how much they expect to pay for Chardonnay as compared to other white wine varieties on a seven-point likert scale (much less = 1, the same = 4, much more = 7). The results indicate that consumers expect to pay the same for Chardonnay products as they do for other white wine varieties (M = 4.0, SD = 0.9).

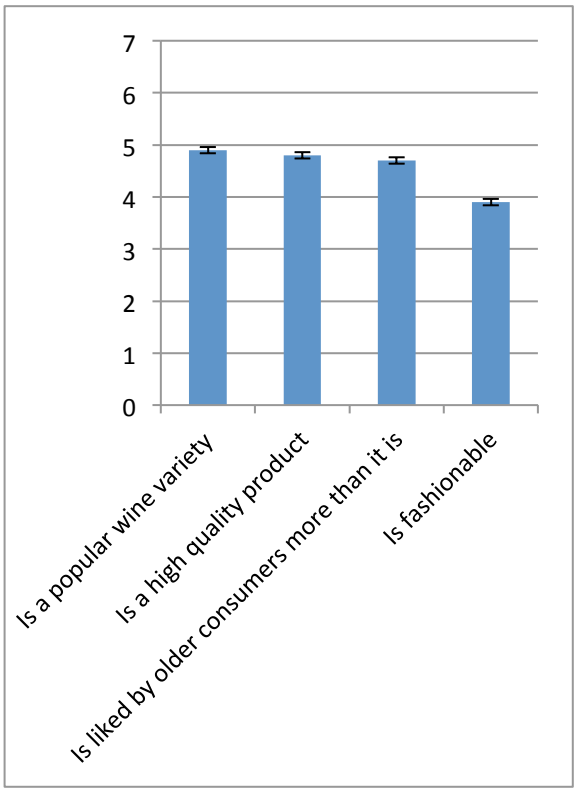


Figure 2: *'Compared to other white wine varieties, Chardonnay...' - Mean and 2*SE*

Many of the participants in the focus groups, females in particular, but also males to a lesser extent, indicated that they drank and enjoyed sparkling wine. Yet there was no real

appreciation that Chardonnay comprises at least one of the ingredients of many sparkling wines. The Chardonnay Attitudes Questionnaire indicated that 31% of consumers are unaware that Chardonnay is used in sparkling wines. This lack of knowledge regarding the use of Chardonnay in Sparkling products can potentially be regarded as a positive. It may be the case that some consumers would perceive Chardonnay in a higher regard were they aware of its use within Sparkling products, **provided** that it is packaged and marketed in the correct way.

Perceptions of Chardonnay as Compared to Other White Wine Varieties

Unlike Chardonnay, Sauvignon Blanc was held in high esteem by most of the white wine drinkers in the focus groups. It was preferred for the following reasons/features:

- Crispness
- Fruitiness
- Its feel in the mouth
- The taste does not linger long
- It is easy to drink, particularly in summer.

Before being told that the focus of the discussions was Chardonnay, participants in each of the groups were asked to rank four white wines from the same producer and of equal quality - a Riesling, Sauvignon Blanc, Chardonnay, and Pinot Gris/Grigio - from the highest to the lowest expected price point. While being mentioned at no point in any of the four groups as being actively consumed, the Pinot Gris/Grigio was considered by three of the four groups as being the most expensive. Rationale included it being more unique, not much being available and being harder to grow. The older male group considered the Riesling to be the most expensive.

Views varied as to where Sauvignon Blanc was placed - some thought it should be towards the top end of the price spectrum due to it being so popular, while others saw it towards the lower end because so much of it is available. However, Chardonnay was consistently placed towards the bottom end of the price spectrum, due primarily to the perceived lack of demand and the lack of interest by participants towards drinking it, remembering that the focus group was made up of mainly non-Chardonnay drinkers.

As mentioned in the previous section, consumers didn't expect a difference in price between Chardonnay and other white wine varieties in the survey results. The findings of the focus groups suggest a pervasive positive perception towards Sauvignon Blanc and a negative perception towards Chardonnay. Participants in the survey were asked to indicate whether they had a positive or negative perception of various white wine varieties on a seven-point likert scale (negative = 1, neutral = 4, and positive = 7). As Figure 3 shows, participants indicated neutral perceptions for the majority of varieties. However, participants indicated relatively positive perceptions toward three of the varieties; Sauvignon Blanc (M = 5.2, SD = 1.5), Sparkling (M = 5.0, SD = 1.7), and Chardonnay (M = 4.8, SD = 1.8).

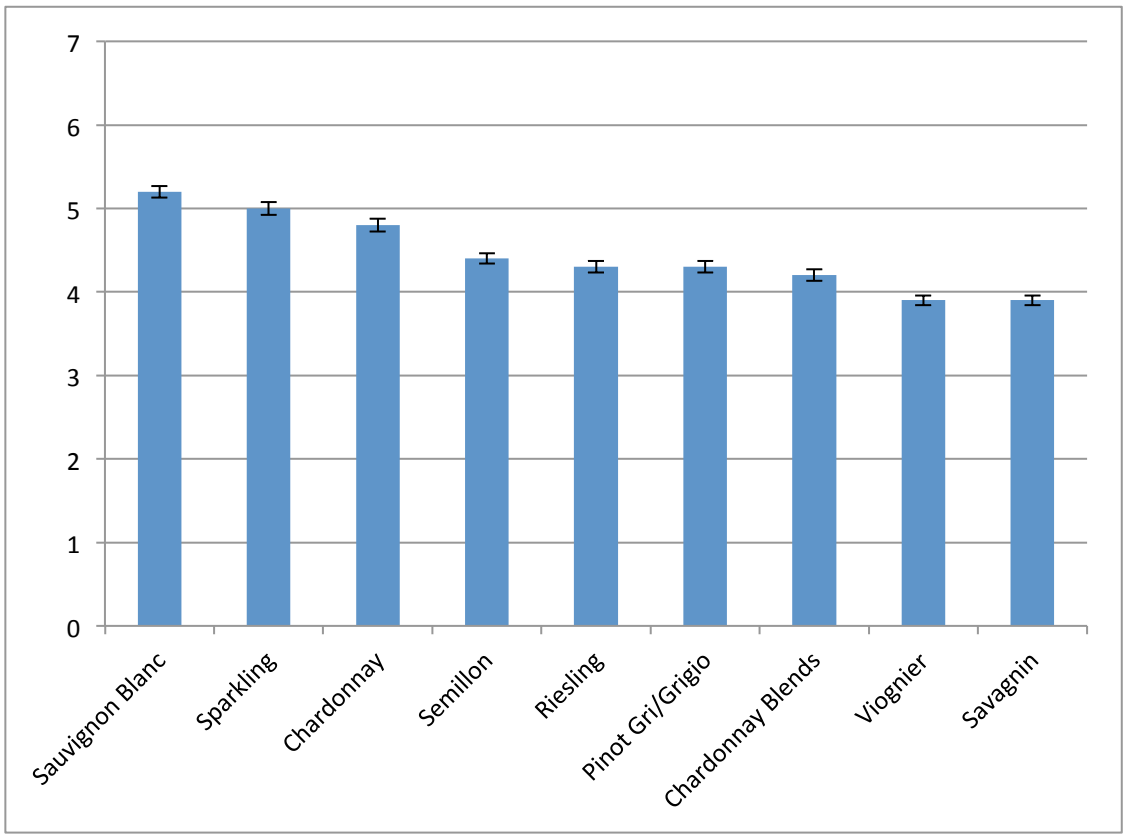


***Figure 3**: Attitudes toward white wine varieties - Survey Participants - Mean and 2*SE*

Suggestions on Improving Perceptions of Chardonnay

One of the issues discussed in the focus groups was that of packaging - both bottle size and construction of the bottle (glass versus PET). At the time, most had a strong preference for glass bottles, although a number saw the benefit of PET bottles for smaller sized wine sales. There was also a reasonable degree of interest in being able to purchase bottles of wine which would serve only one person (375 ml and 187 ml). Some mention was made of packaging in cans but it was not considered appropriate for wine, particularly reds.

A number of suggestions were made over the four groups to increase both the public acceptance and consumption of Chardonnay, with some of the ideas leading into others. The more relevant ones, which warrant further consideration, are as follows:

- Put bubbles in it
- Make a mixer drink like Hock Lime and Lemon which was popular many years ago
- Add fruit juice
- Make a punch or drink similar to a 'Sangria'
- Link it with events such as 'The Big Day Out' in order to encourage younger people

to drink it

- Have brighter packaging
- Blend Chardonnay with one or more other white wine varieties to change the (perceived) taste/flavour
- Provide consumers with better information on the types of meals Chardonnay can be served with
- Have more places provide tastings of the wine, and
- Undertake a national advertising and promotion campaign.

Some of these issues can be combined. For example, some could essentially be summarised as using Chardonnay as the base for a drink (or more appropriately a range of drinks) that would appeal to a relatively large market. The drinks could be carbonated. Those additions would make the drink lighter and fresher and lower in alcohol.

Interestingly the younger males considered that they would drink that kind of beverage regularly, particularly at external events such as the Big Day Out, concerts and picnics. Furthermore, they would happily consume them out of either something similar to a beer bottle (possibly PET) or a can similar to a soft drink.

The older males are likely to appreciate something which is less alcoholic for their wives/partners, and which can be easily transported; and the younger women suggested they would take a six-pack of some wines or drinks to a party rather than full-sized bottles of wine.

In none of the groups had blending Chardonnay been discussed before it was raised by the Moderator. Generally the view was that a blended wine was likely to taste better than 100% Chardonnay, provided it avoided the strong smell and yellow colour of Chardonnay and resulted in a clean, crisp, easy-drinking wine. Ideally Chardonnay should be excluded from the name of any blended wine, so negative the reputation thought the focus group participants.

As a result of the strong desire of many of the participants to consume New Zealand Sauvignon Blanc, it was decided to investigate the attitudes towards drinking imported wine. Essentially New Zealand was considered part of Australia, and no-one had any qualms about drinking wine from there rather than from Australia. If anything the opposite was the situation, namely that New Zealand Sauvignon Blancs were generally preferred to the same variety produced in Australia and that parochialism, if it existed, did not weigh up against that.

All groups mentioned that an advertising and promotion campaign should be conducted to assist in re-establishing the Chardonnay brand and that it needed a well recognised and credible person to be the 'Face of Chardonnay'. Four high profile Australian personalities were suggested to them, namely Jennifer Hawkins, Delta Goodrem, Shane Warne and Hugh Jackman. Of the four, they selected Hugh Jackman on the basis that he would appeal to the female audience, but would be the most likely to also appeal to

males.

The younger males tended to drink beer and spirits while out, and red wine at other times, but rarely white wine. Drinking wine, and white wine in particular, was seen by the younger male participants as the domain of females and regarded as effeminate. Hence the suggestion that they would be influenced by an advertisement by someone like Jackman, provided it was quirky/funny, is potentially a significant breakthrough. In the words of two of the participants:-

"I think my female friends would be saying: "If Hugh Jackman drinks it, you can too!"

"If you were trying to get us to buy it, then you'd have Hugh Jackman because he's a bloke. If you are trying to say 'Blokes drink Chardonnay' then that's who you'd have."

Survey participants were asked to indicate their level of agreement with various statements starting with: 'I could be more likely to consume Chardonnay if it were...' (strongly disagree = 1, indifferent = 4, and strongly agree = 7). Figure 4 indicates that participants were indifferent to plastic (or PET as described in the focus group findings) packaging (M = 4.0, SD = 2.0) and to whether or not the Chardonnay they consume is domestically produced or imported (M = 4.1, SD = 1.9). In contrast to the focus group findings, the results showed that participants would not be more likely to consume Chardonnay based on the other five factors listed.

Similarly, the participants indicated that Chardonnay did not need to be mixed with something (M = 2.4, SD = 1.7) or carbonated (M = 2.8, SD = 1.7) for them to consume it, again on the seven-point likert scale from strongly disagree to strongly agree. Finally, although the focus group findings suggested that blended Chardonnay would be preferable for consumers, the survey findings show that consumers have a more positive perception of Chardonnay than of Chardonnay blends (see Figure 3 above).

Conclusion and Recommendations

It should be recognised that the views expressed in the focus groups represent the opinions of a small number of people and cannot necessarily be extrapolated to reflect the views of the entire population. However, this does not mean that they are invalid, as other consumers may also hold the same opinions. The key is to determine how representative these opinions are of the overall population of wine consumers in Australia.

Individual members of a focus group may be influenced by the opinions of others in the group, especially members with strong opinions, and thus the discussion may not equally represent the range of opinions in the group, let alone be generalisable to a wider target group such as Australian wine consumers. The role of a moderator is to limit such bias within a group. It is for this reason that the qualitative findings of the focus groups have been triangulated with the quantitative findings of the nationally representative Chardonnay Attitudes Questionnaire.

Based upon the focus group data alone, the following recommendations could be made. As

mentioned above, it is important to consider where these recommendations are not supported by the survey data. For the ease of the reader, any aspects of the recommendations below that are not supported by the survey data, and have been previously discussed, are italicised.

The reader can refer to the results section above for further information of the survey data associated with each italicised aspect, as well as to the comprehensive report focusing on the findings of the survey. The budget allocated by the Australian wine industry to increase the consumption of Chardonnay is unknown. Hence, while the following recommendations are made, implementation of some may not be possible.

Recommendation 1:

> Provide more opportunities for consumers to taste Chardonnay wines.

The *current dislike of Chardonnay* seems to be largely based on negative experiences consumers have had, possibly many years ago, and perhaps also compounded by word-of-mouth and peer pressure. *Images portrayed on the 'Kath and Kim' television series have damaged Chardonnay's image*[3].

There seems to be little recognition that Chardonnays have changed significantly over the past decade and are often now quite different to the oaked, darkish yellow coloured wines that are still at the forefront of many consumers' minds. While unlikely to purchase a bottle, many participants indicated that they would try Chardonnay if it was presented to them to taste. If they enjoyed the taste, they would then consider future purchase.

This may be a matter for both the industry and individual wine companies to work with liquor stores to provide Chardonnay samples for tasting on a regular basis. Furthermore, restaurants could be given some encouragement (possibly an industry-wide incentive) to include more Chardonnays on their wine lists and sell them by the glass.

Recommendation 2:

> Develop an advertising campaign for Chardonnay should there be sufficient budget for both the production and achieving good coverage on prime-time television and in other above-the-line media.

Any advertisement needs to be attention-grabbing and humorous. Furthermore it is needs to be presented in a manner that can overcome the perception that is effeminate for males to drink white wine (and in particular Chardonnay). The actor Hugh Jackman is considered an ideal spokesperson to promote Chardonnay to both genders. Dependent on budget, any television campaign should be supported by advertisements in the print media.

[3] The Chardonnay Attitudes Questionnaire results indicate that consumers disagree with the statement 'My attitudes toward Chardonnay have been influenced by T.V. and film, such as Kath and Kim' (M = 2.6, SD = 1.7), utilising the seven-point likert scale from strongly disagree to strongly agree previously mentioned.

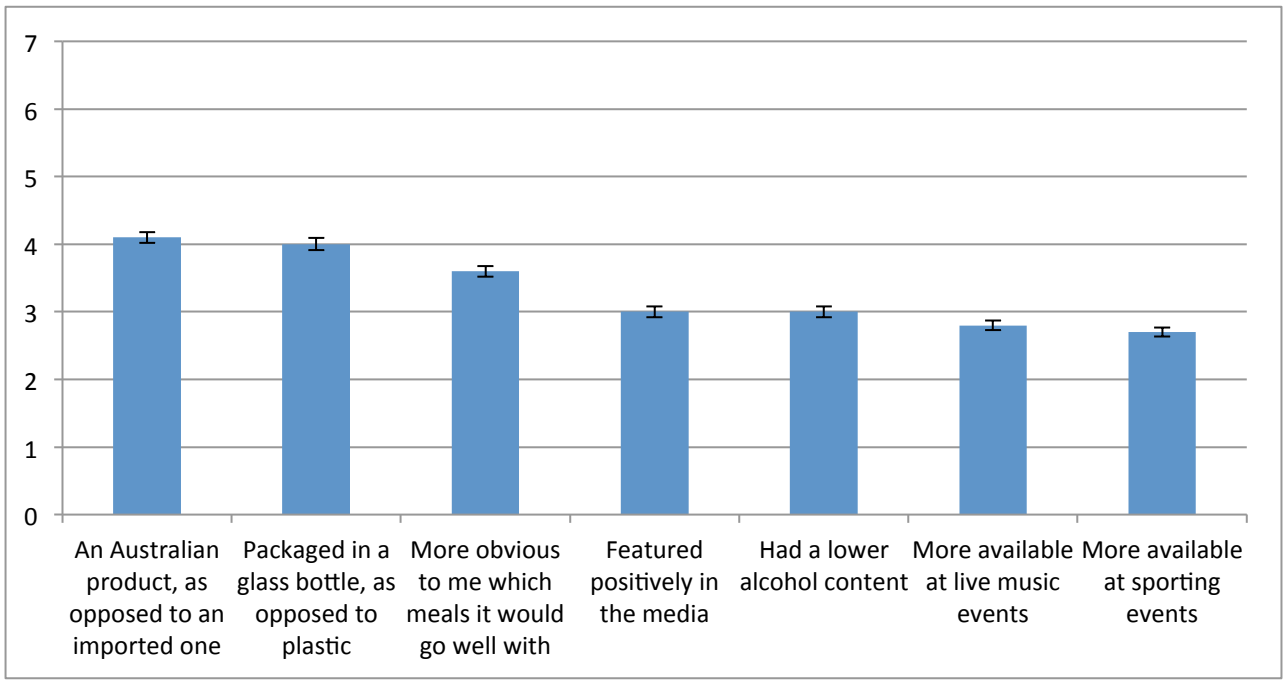


Figure 4: *'I could be more likely to consume Chardonnay if it were...' - Mean and 2*SE*

A less expensive option, if television is out of the question based on cost (or possibly even an additional approach if it was not going to add significantly to production), may be to develop a series of interesting/quirky clips which can progressively be released onto social media such as YouTube. Such short videos often become 'viral' due to their entertainment value, with people on-forwarding to their friends. It is possible that this would have an impact notwithstanding that the younger participants said that they did not base their wine drinking decisions on social media. Furthermore, it may achieve free airtime on television, for example, Channel 9 displays the top five YouTube videos of the day each morning.

Recommendation 3:

Investigate producing a range of sparkling drinks that use Chardonnay as a base, but include additives such as fruit juices and/or soft drinks.

The resulting drinks would avoid the perceived deficiencies of Chardonnay, be *lower in alcohol* than Chardonnay, and are likely to increase overall consumption of the variety without undue impact on sales of bottled wine. The resulting product(s) could be sold in either *smaller bottles/PET packaging* or cans similar to soft drinks. This concept (both flavours and packaging) should be tested with sensory panels at an early stage of development (and possibly again after any refinement).

One caveat to this suggestion is the possibility that by blending Chardonnay, those consumers who have a negative impression of Chardonnay will have that view reinforced (ie: if Chardonnay needs to be blended with X to make it drinkable, then I'm right in assuming it is not a great stand-alone drink).

Recommendation 4:

> Should Recommendation 3 be accepted, *look for events to link the product with and/or sponsor*.

The Big Day Out, staged in Australian (Adelaide, Gold Coast, Melbourne, Perth, and Sydney) and New Zealand (Auckland), would be one possibility, but no doubt further investigation would identify many other events which may be appropriate. It is expected that generally they would be outdoor events involved in this strategy where it is often preferable to consume lighter, more refreshing drinks than wine.

Recommendation 5:

> The suggestion of *blending Chardonnay* with other white wine varieties is perhaps an issue to be considered by individual producers rather than an industry body.

There may be an industry role in encouraging a group of wine producers to establish a blending/branding program to promote a wine which is different - perhaps in a similar vein to the way in which a number of McLaren Vale producers have grouped together to produce and market a set of Cadenzia wines based on Grenache (which was also out of favour twenty years ago) as the dominant variety. An appropriate name would need to be developed for the project/wine.

Recommendation 6:

> *Brighter packaging*, which seems to appeal to the younger demographic.

Style of packaging is again usually in the domain of the individual producer. However, should this recommendation be adopted, it would be worthwhile all participating organisations adopting a consistent and distinguished packaging arrangement with bright labels and possibly a unique bottle (which of course is all cost dependent, so the suggestion may need the support of some very large producers initially).

Recommendation 7:

> Chardonnay producers should be encouraged by the industry bodies (i.e. WFA) to *provide suggestions on which foods their wines are best served with*.

This should be relatively easy for individual businesses to implement. Suggestions could be included on any back label of bottles; they could be included with tasting notes on company websites; and (at greater expense) tags for bottle necks or brochures (for handing out when wine is sold) can be produced.

Appendix A

FOCUS GROUP METHODOLOGY

Participants

In order to achieve a 'balanced view' of participants' perception of Chardonnay, it was decided to recruit consumers who drank wine regularly (at least once a month). There was no requirement that they had to be consuming Chardonnay. A series of 4 focus groups were conducted in Adelaide comprising:

- Females aged 18 to 34 who regularly consume wine;
- Males aged 18 to 34 who regularly consume wine.
- Females aged 35 or older who regularly consume wine; and
- Males aged 35 or older who regularly consume wine.

Table 1: Demographic Characteristics of the Focus Group Participants

Characteristic	**Males**	**Females**	**Total**
Education Level:	**%**	**%**	**%**
No post-secondary qualification	20.0	41.2	29.7
Undergraduate post-secondary qualification	60.0	47.0	54.1
Postgraduate qualification	20.0	11.8	16.2
Annual Household Income Level:	**%**	**%**	**%**
≤ $29,999 per year	-	5.9	2.8
$30,000 - $49,999 per year	10.0	23.5	16.2
$50,000 - $74,999 per year	20.0	11.8	16.2
$75,000 - $99,999 per year	20.0	11.8	16.2
$100,000 - $149,999 per year	30.0	23.5	27.0
$150,000 - $199,999 per year	10.0	17.6	13.5
$200,000 + per year	10.0	5.9	8.1
Marital Status:	**%**	**%**	**%**
Married	75.0	29.4	54.1
Single	20.0	47.0	32.4
Divorced, separated, widowed	5.0	23.6	13.5
Number of Persons in Household:	**Means**	**Means**	**Means**
Persons under 18 years old	0.65	0.35	0.51
Persons ≥18 years old	2.80	2.24	2.54
Persons ≥18 years old who drink wine	2.30	1.94	2.14
Persons in household (total size)	3.45	2.59	3.05

Adelaide is regarded as a venue representative of the Australian domestic market. For context purposes, Table 1 shows the demographic and socio-economic characteristics of the focus group participants.

Given that the median annual household income[4] level in South Australia is $44,820 the participants were from high-income households (±85% earning more than $45,000 per year), highly educated (70% have a post-secondary qualification), and from small-size households (mean = 3 persons) with very few dependent children living in the household. The majority had a married status although the 35+year female age group had a high incidence of single person households. The fact that 2.14 persons on average in households in which 2.54 legal drinking age persons reside drank wine, underlines not only the social nature of wine consumption, but also its role as a lifestyle product of consumption.

As for the differences between males and females, they were fairly pronounced with noticeably more males (75%) than females (29%) from households in which they are in a married relationship. As a consequence, more females (47%) than males denoted their marital status as single and were thus from smaller households of 2.59 persons in comparison with males (3.45 persons).

In the case of the socioeconomic characteristics of education and income, males were markedly higher than females. Whereas 80% of males were in possession of a postsecondary qualification the corresponding figure for females was 59%. This also manifested in the annual household income levels with 90% of males earning in excess of $50,000 per year compared with 70% of females.

Materials

Each of the 4 focus group discussions followed the topics outlined in the moderator's guide

(see Appendix C). In broad terms these were:

- Drinking preferences
- Wine packaging
- Price perceptions
- Purchasing behaviours
- Importance of origin (country and region)
- Perceptions of Chardonnay wine (why they like or dislike Chardonnay)
- Significance of oak flavours in Chardonnay wine
- Steps to encourage consumption of Chardonnay wine
- Image of Chardonnay: Male vs. Female drink
- Influence on (and of) partners and significant others
- Opinion about blended Chardonnay wine
- Advertising and promotion of Chardonnay wine

4 Australian Bureau of Statistics (2011). *Average Weekly Earnings*. Report Cat. No. 6302.0, Canberra: Australia.

- How and why their impressions of Sauvignon Blanc were formed

Procedure

Twelve participants were recruited for each group, with a view of having at least 10 attend each discussion. Once recruited, participants were sent a letter confirming their attendance and details of date, time and location, and they were then phoned on the evening before their respective group discussion to remind them of their commitment. The true purpose of the research was not revealed upfront to the participants and no tasting of wine took place during the focus group sessions.

Appendix B

SURVEY METHODOLOGY

Participants

A 'population sample' was recruited to be representative of Australian consumers. Participants were recruited through the market research company Research Now and were required to be at least 18 years of age and to consume wine at least once per fortnight. In order to achieve a 'balanced view' of participants' perception of Chardonnay, there was no requirement that participants consume Chardonnay. Table 2 shows the demographic characteristics of the sample.

Approximately half of the sample (53.5%) selected 'married' as their marital status. The second most frequently selected marital status was 'single' (17.5%). Five of the seven marital status categories were evenly distributed, however, female participants were more prominent than males within the 'divorced' (females 67.9%, males 32.1%) and 'widowed' (females 77.8%, males 22.2%) categories.

The age categories were representative of the ABS national figures and were relatively evenly distributed by gender. The sample was also nationally representative of each state and territory, with the exception of the NT. According to the ABS, the NT accounts for 1% of the Australian population. However, only 0.2% of participants within the present study were from the NT.

Materials

An online questionnaire was developed, informed by the findings of the focus groups conducted to address Output B: Report of how the 'Chardonnay challenge' came about. The questionnaire had five sections. Section one aimed to characterise the sample in terms of demographic information, section two contained screening questions, section three asked about participant wine consumption and purchasing in general, whilst section four asked about chardonnay specific consumption and purchasing. Finally, section five aimed to assess participant attitudes towards chardonnay, directly relating to the four research objectives listed above.

Procedure

As mentioned above, the market research company Research Now recruited participants. An invitation to complete the online questionnaire was sent to existing registered Research Now panelist matching the sampling

criteria of the present study. Firstly, participants received an information statement outlining the nature of the questionnaire and what will be required of them, how the data collected will be utilised, that participant responses are anonymous, and that participation is voluntary.

The information statement also contained the contact details of the principle investigator and appropriate ethics committee, in the event that participants had any concerns or questions. Participants were required to read the information statement before accessing the questionnaire, as such, informed consent was inferred by the participant having read the information statement and continuing on to complete the questionnaire. Participants then completed the five sections of the online questionnaire.

Table 2: Demographic Characteristics of the Chardonnay Attitudes Questionnaire Participants

Characteristic	**Males (%)**	**Females (%)**	**Total (%)**
Education:			
High School	45.1	54.9	24.1
TAFE certificate/diploma	48.2	51.8	32.0
Bachelor's degree	48.3	51.7	31.7
Master's degree	54.0	46.0	10.0
Doctoral	85.7	14.3	1.0
Other	37.5	62.5	1.2
Annual Household Income:			
≤ $30,000	47.3	52.7	12.7
$30,001 - $50,000	46.3	53.7	18.2
$50,001 - $75,000	50.3	49.7	18.3
$75,001 - $100,000	50.9	49.1	21.3
$100,001 - $200,000	47.0	53.0	25.9
>$200,000	46.6	53.4	3.6
Marital Status:			
Single	52.3	47.7	17.5
In a relationship	47.2	52.8	7.9
De Facto	41.9	58.1	10.7
Married	51.8	48.2	53.5
Separated	42.3	57.7	1.3
Divorced	32.1	67.9	6.9
Widowed	22.2	77.8	2.2

Table 2 Continued			
Characteristic	**Males (%)**	**Females (%)**	**Total (%)**
Age Category:			
18-24	50.0	50.0	10.8
25-34	39.7	60.3	18.3
35-44	47.3	52.7	19.8
45-54	40.9	59.1	18.7
55-64	53.7	46.3	14.6
65+	60.7	39.3	17.8
State of Permanent Residence:			
NSW	45.3	54.7	33.9
VIC	45.0	55.0	26
QLD	52.8	47.2	19.7
SA	60.5	39.5	8.3
WA	47.7	52.3	8.6
NT	80.0	20.0	0.2
TAS	48.9	51.1	2.2
ACT	47.6	52.4	1.0

Appendix C

MODERATOR'S GUIDE

1. Have participants complete short Quantitative Survey - 5-7 Mins

2. Participants to introduce themselves and speak briefly about their wine consumption behaviours where, when, how much - 10 Mins

3. What type(s) of wines do participants drink (20 Mins):
   a) By style (red, white, rose, bubbles)
   b) By variety
   c) Of white varieties what is liked/disliked about the major types (Sav Blanc, Semillon, Chardonnay, Riesling, Pinot Gris)
   d) What influences the style/variety being drunk? Are different wines drunk with food than without food? Are there 'occasions' for different varieties?
   e) What is the ideal 'bottle size' to encourage purchase of wine? Would participants pay proportionately more for smaller bottles?
   f) What are your views on wine in PET or plastic packaging?

g) Explore price perceptions – say Riesling, Sav Blanc and Chardonnay all from the same maker.

4. Where do you mainly consume wine:
   a) At bars/restaurants or at home or friends?
   b) Of the wine you drink at home or at friends, where do you usually purchase it?
   c) Why do you use that hotel/bottle shop/cellar door to buy your wines?
   d) How many bottles would you usually purchase on each visit?
   e) How important are the staff at the venue in helping you determine what to buy?

5. Discussion of Chardonnay (25 Mins)
   f) What are participants' perceptions of Chardonnay?
   g) Do any drink Chardonnay regularly?
   h) For regular consumers, what is it about Chardonnay they like? Is there anything they dislike?
   i) For non-regular consumers, why do they prefer other wines? What do they dislike about Chardonnay?
   j) How important/significant is the use of Oak (toastiness) of Chardonnay?

6. What steps should a wine producer take to encourage people to drink more Chardonnay? (5-10 Mins)

** The following topics/issues were added to various groups based on comments made either in that discussion or as a result of a build up of comments throughout the series of Groups:

- Reasons why Participants particularly favour Sauvignon Blanc
- Attitudes to Chardonnay being blended with other white grape varieties
- The impact of the Country of Origin on the purchasing decision
- The impact of Social Media as an Influencer of Preferences (Younger Groups only)
- Is wine perceived as a Male or Female drink (or neutral)? (Younger Groups only)
- The ability (or otherwise) of Females to influence their Partners' drinking habits (Younger Groups only)
- The Preferred 'Face of Chardonnay' for an Advertising Campaign (Young Male Group only)
- First impressions of Sauvignon Blanc (Young Male Group only)

PART 4: CHANGE IN CONSUMER ATTITUDES TOWARD WINE BETWEEN 2007 AND 2012

Authors: Dr Suren Samuelian and A/Prof Anthony Saliba

Summary

In 2007 we conducted a population survey in Australia, with questions on consumption and attitudes toward Australian wine and the Wine Industry. In 2011 we repeated parts of that same survey, again with a population sample in Australia. This provided an opportunity to compare changes between 2007 and 2011. Changes in consumption pattern and attitude over a 4 year period are informative. However, the four years between 2007 and 2011 mark an especially important period for the Australian wine Industry.

Firstly, there was a decline in sales and price per bottle paid for Chardonnay. Since the over-arching project focuses on that decline, this activity is an important baseline. Secondly, attitudes toward over-consumption have changed, in this author's opinion, more than at any other time in the last 25 years. To what extent that attitudinal change has also influenced 'normal' consumption is of interest. Thirdly, various claims were made around 2007 in regards how demand for wines in categories such as 'organic wine' would change over the following years. This report provides insights into all of these questions.

Method

In 2007, a population sample of 1,229 completed a questionnaire on wine consumption and attitudes. The nature of population samples is that attempts are made to balance responses by postcode, sex, age and income, based on known ABS data. In this way, the sample is an accurate approximation of the Australian community in 2007. In 2011, some parts of the questionnaire were re-administered to a different population sample, this time of 2000 participants.

The reason for the over-sampling was that the two samples were then 'matched'. That is, the two samples were aligned in terms of important demographic variables - age, gender and income, so that responses from the two samples could be directly compared, and results indicated changes between 2007 and 2011. The matching was achieved by 'blind' deletion of responses from the 2011 sample (hence the oversampling). The end total number of participants in each year was 1,086.

Results

The results are presented in graphical format, with some explanation and interpretation below each Figure. The major change since

2007 was an increase in the frequency of wine consumption in the categories 'several times a week' and 'once a week', with a reduction in less frequent consumption (see Figure 1). Figure 2 shows more clearly the increase in regularity of consumption. Regular drinkers are defined as respondents who reported consuming wine once per week, or more often, whereas infrequent drinkers were defined as those who consumed less than once per week.

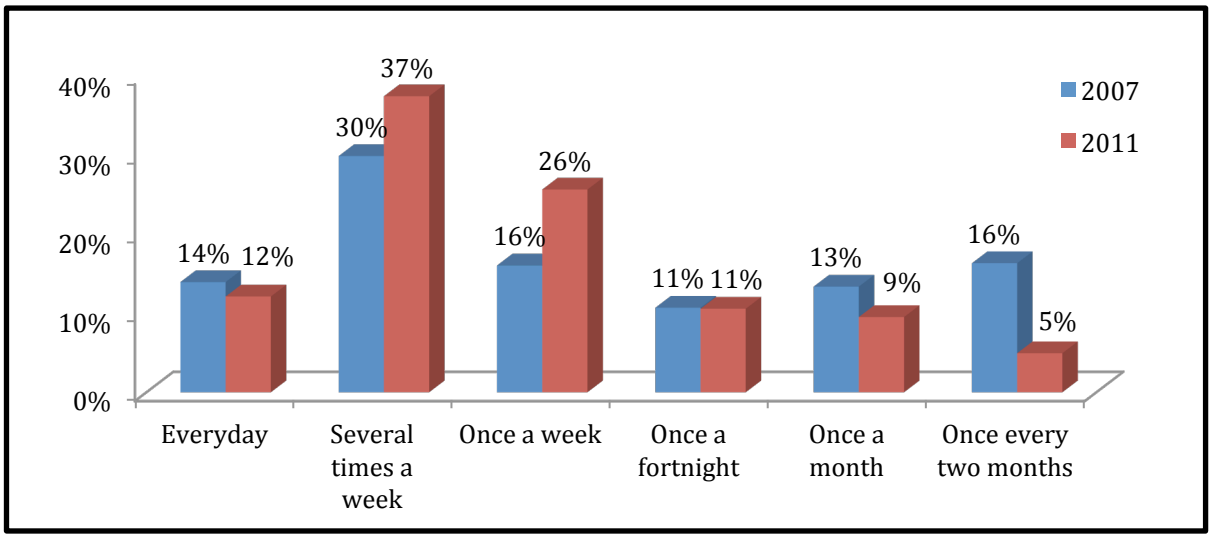


Figure 1: Frequency of wine consumption

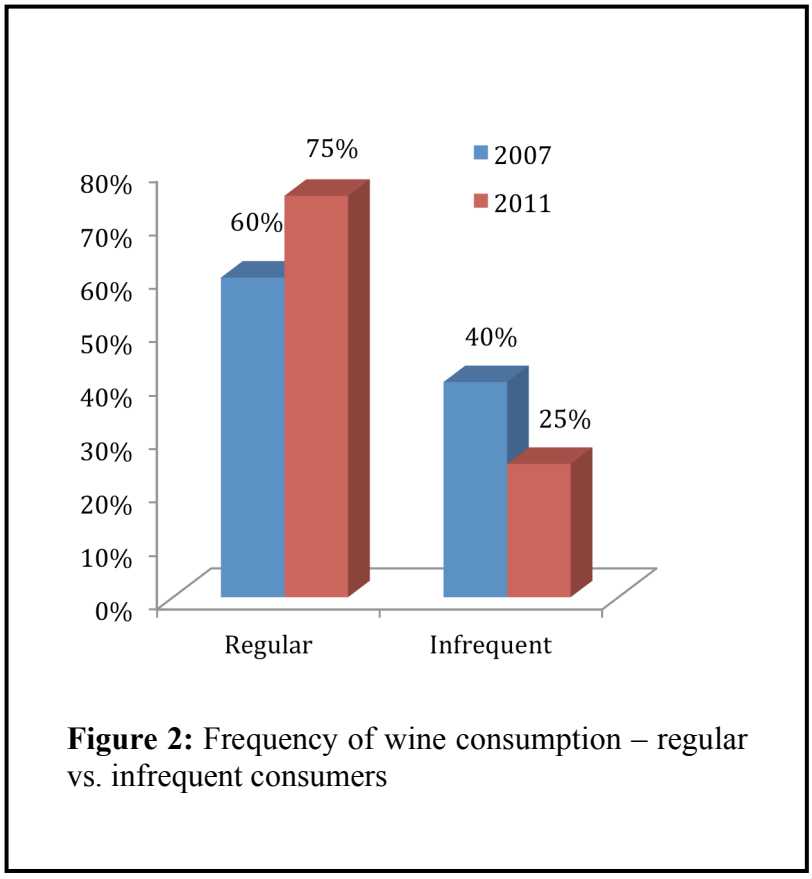


Figure 2: Frequency of wine consumption – regular vs. infrequent consumers

Although we do not have consumption data from both years, consumption data collected in 2011, compared to that reported elsewhere, did not suggest an increase in consumption from earlier years. This suggests that Figures 1 and 2 are characterised by more frequent consumption of smaller amounts. Such behaviour may conform to the kind of healthy drinking messages that have become more common since 2007.

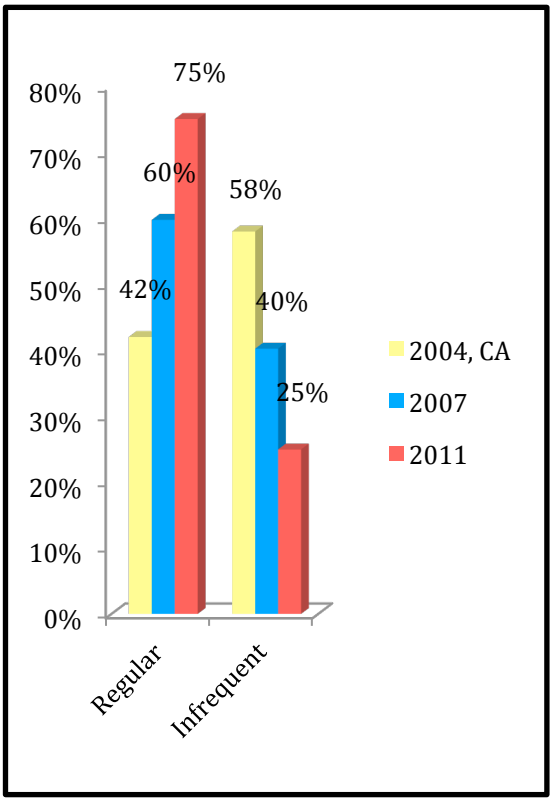


Figure 3: Frequency of wine consumption – regular vs. infrequent consumers. Results are presented for respondents from California from 2004 and from Australia from 2007 and 2011. Source: http://ccwinegrowers.com/Symposium%20Files/WMCFresno%20presentatio.htm

Figure 3 is a replication of Figure 2 and includes data from a study conducted by Merrill Research in California in 2004. Their study was balanced for gender and income, and shows the trend of increasing transition from infrequent to regular wine drinking starting in 2004. Although the data collection methods were similar across the Californian study and ours, the samples were not matched so results should be interpreted with caution.

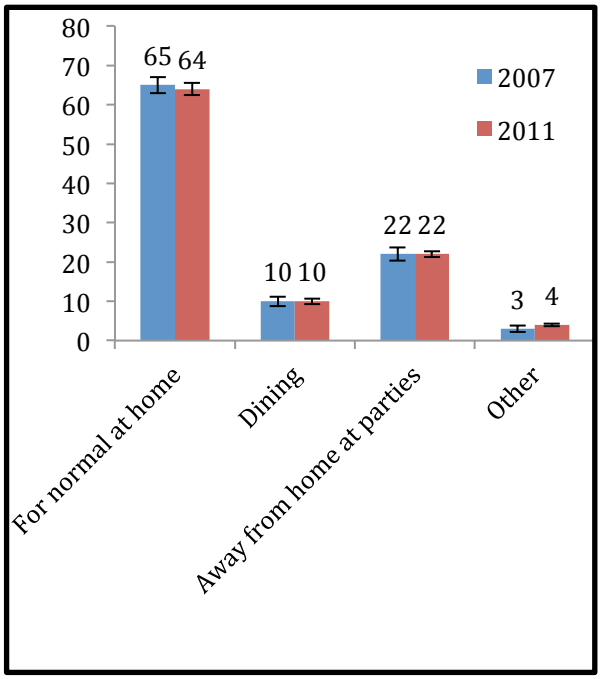


Figure 4: Wine consumption for different occasions

There appears to be little change related to consumption occasion (Figure 4). Figure 5 shows a number of things. Firstly, it shows that there were more male regular drinkers in 2007 than females, and in 2011 the disproportion increased.

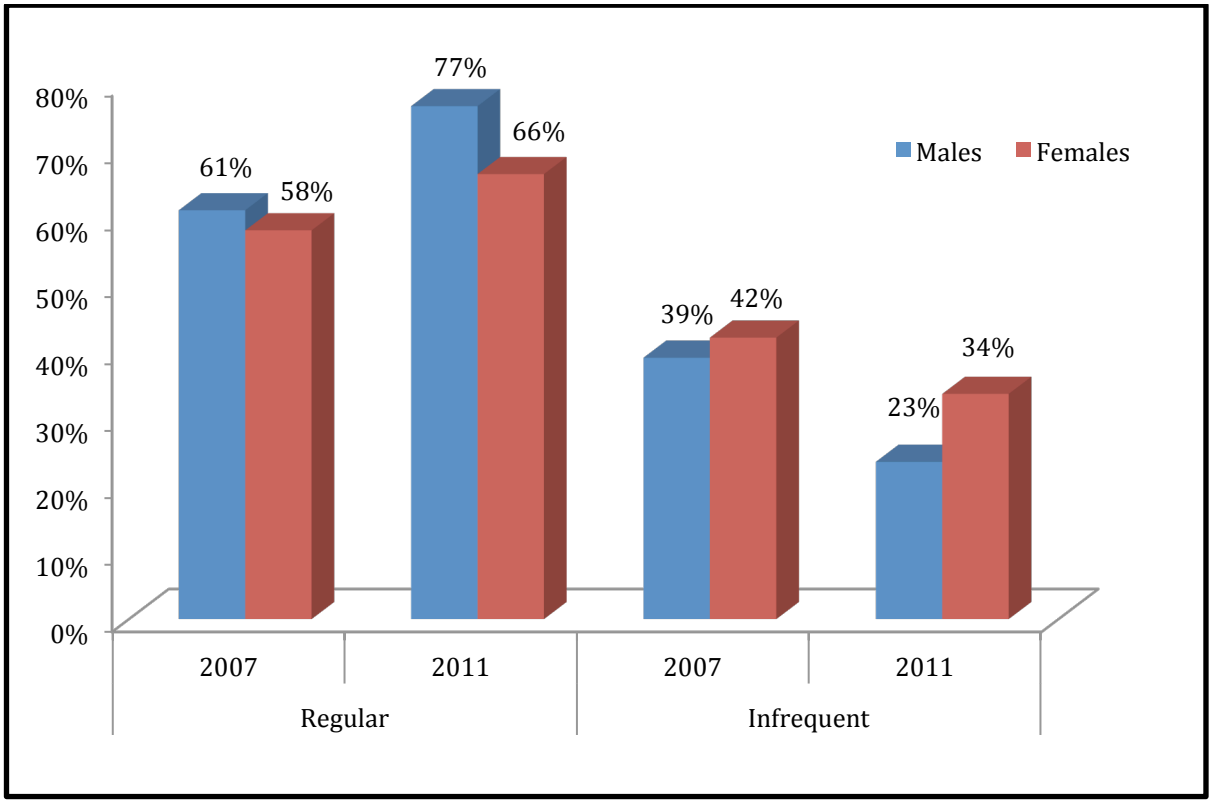


Figure 5: Frequency of wine consumption by gender

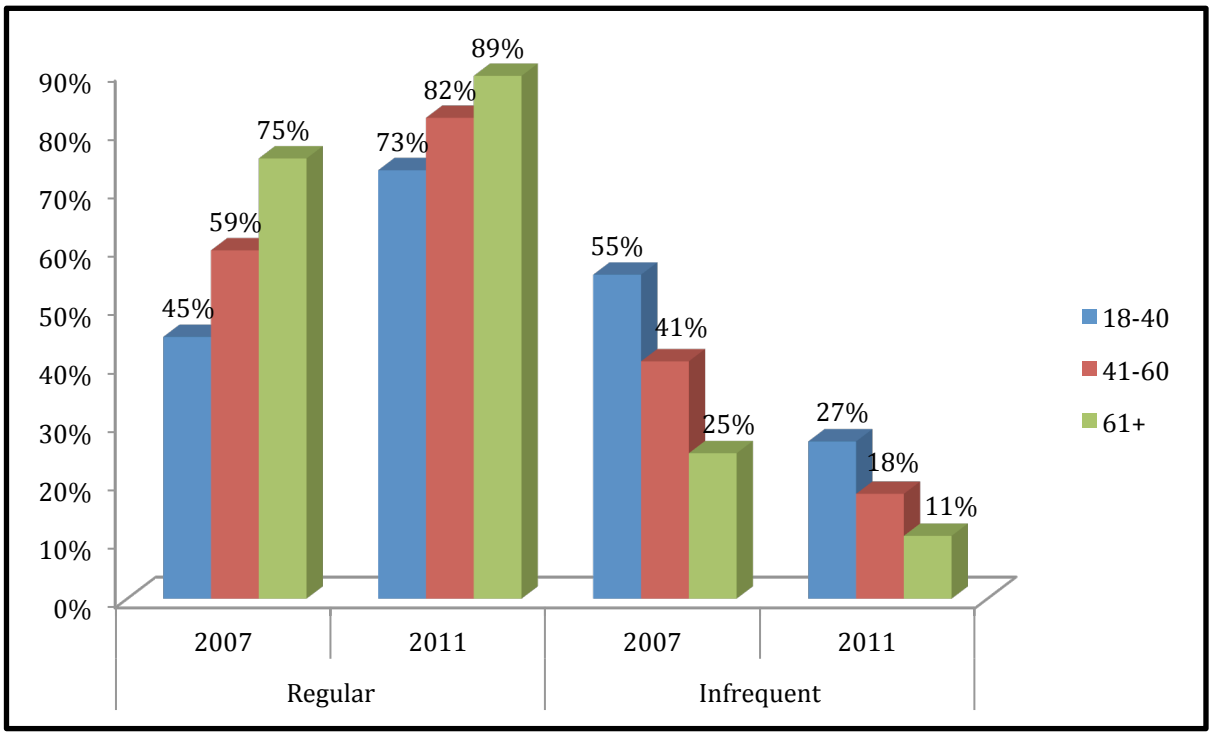


Figure 6: Frequency of wine consumption by age

Secondly, and what logically follows, is that in 2007 there were more female infrequent drinkers than males, and again that proportional difference increased in 2011. The differences shown in Figure 2 therefore seem at least partly explained by large changes in drinking frequency for males and females.

Following a similar pattern to previous graphs, again we see that the proportion of regular drinkers has increased for all age categories, and decreased for infrequent drinkers in all age categories, between 2007 and 2011. Interpreting these results, along with data above, both age and sex categories seem to have mediated drinking patterns in similar ways.

This broad and consistent change suggests that the Australian community broadly have changed their drinking behaviour to be more consistent with healthy drinking advice, which is to limit consumption to a smaller number of standard drinks per day. This may have lead to more frequent consumption, and such a pattern should be taken into account when considering innovations (e.g. smaller serving sizes).

There was a decrease in the number of consumers who 'never' returned wine in 2007 as compared to 2011, and an increase in the number of people who sometimes (i.e. rarely) returned wine. The Australian wine show system, advances in technology, transfer and extension strongly suggest that the number of Australian wines with 'faults' or 'taints' has reduced between 2007 and 2011, so clearly this result does not suggest that the number of Australian wines with faults has increased since 2007.

Instead, this question addressed how prepared consumers were to return wine because it did not meet their expectation, or indeed, in their view, it contained a fault. This is an important change in Australian community attitudes. Where a wine is not enjoyed, whether through fault or another cause, it is preferable that consumers return the product and allow the supplier to rectify the situation, rather than simply avoiding that wine and perhaps associated brands in the future.

Many wine producers are making more overt attempts to encourage 'return' behaviour (e.g. 'no questions asked refund', contact details for complaints on bottles, etc), so that feedback can be captured and the consumer may be retained. This undertaking may have contributed to the number of people prepared to return wine. It also seems at least somewhat likely that Australian consumers have also increased their wine knowledge, leading to the confidence required to return wine. The category of 'often' was also measured, but is not presented here because responses in this category were negligible.

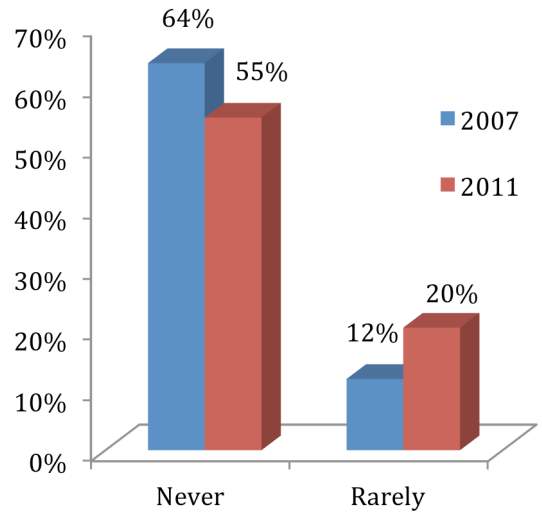


Figure 7: How often do you return wine on the basis of a fault or taint

Figure 8 suggests that the change in willingness to return wine shown in Figure 7 has been driven by all three age categories, but is most pronounced in the younger age group.

Significant differences can be seen for all wine styles between 2007 and 2011, with a consistent increase in amount paid for each style (Figure 9). This is surprising, as some data elsewhere suggests that prices being paid have decreased. However, where consumers reduce their overall volume of consumption, some researchers have shown that there is a corresponding increase in willingness to pay per item, as a kind of compensation strategy, and to utilise their 'available budget'. Attitudes toward drinking less volume may have encouraged consumers to pay more per bottle. This possible trend is useful for businesses to consider when deciding on how much wine from each wine category to produce (ie: basic, premium, super premium, etc.). Future trends may see Australian consumers more interested in higher categories.

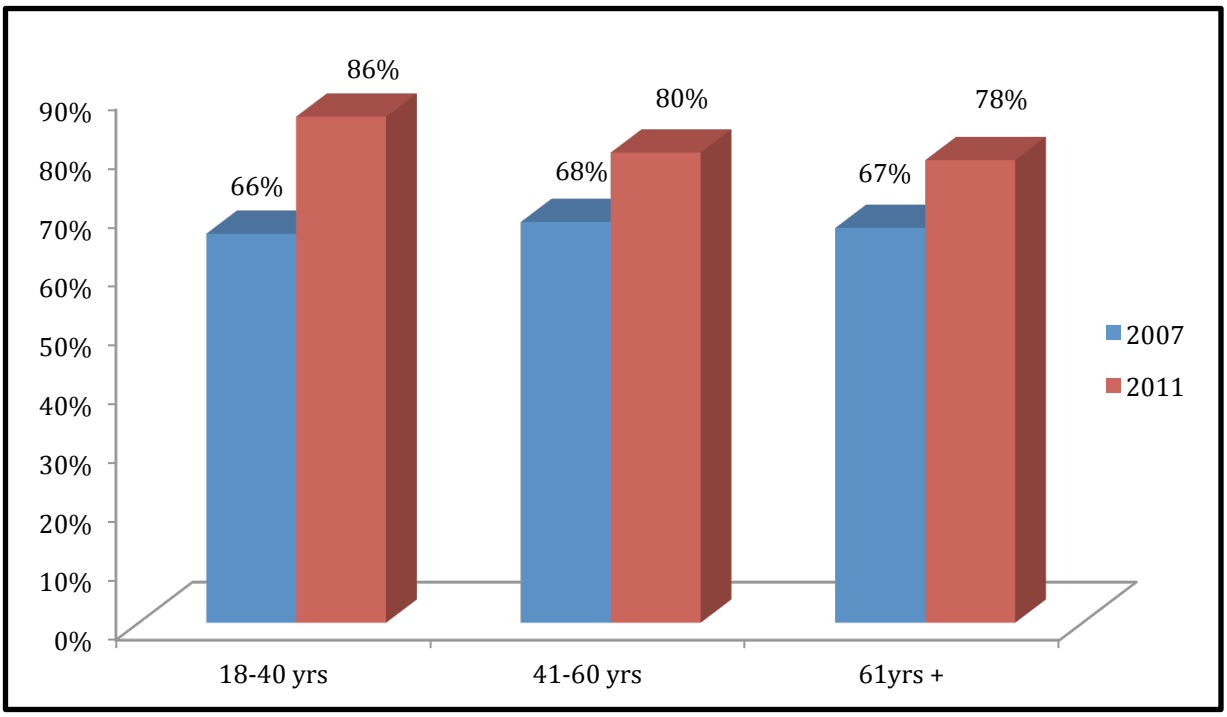


Figure 8: How often wine is returned on the basis of fault or taint, by age category

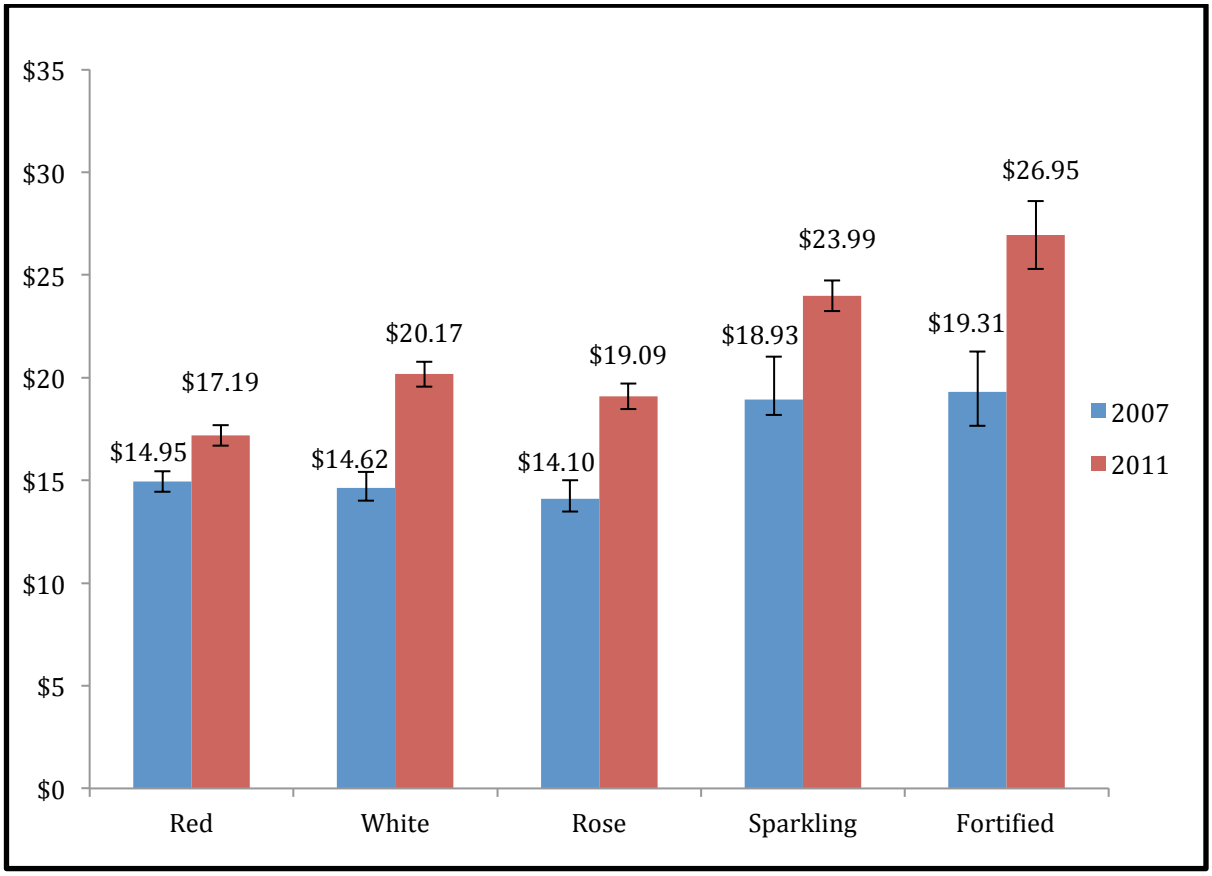


Figure 9: Mean price paid per bottle for different styles

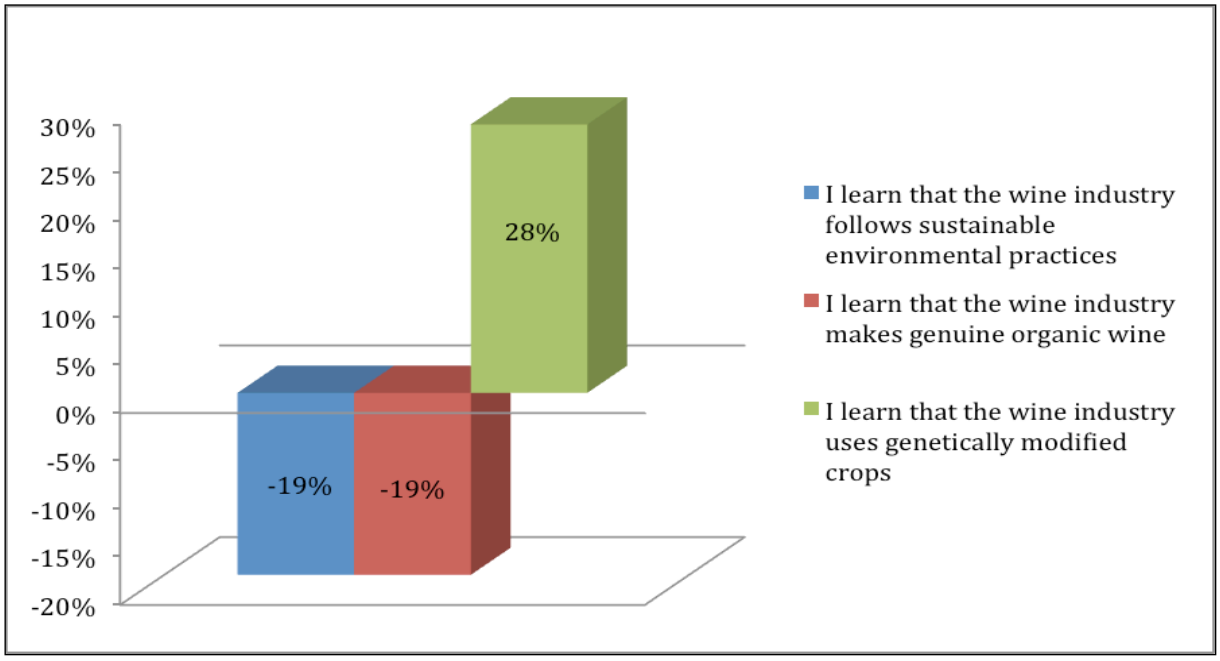


Figure 10: Percentage difference in attitude toward sustainable practice, organic wine and genetically modified crops (2001 subtracted from 2007).

Findings above (Figure 10) show that environmental practices followed to produce wine concerned buyers around 20% less in 2011. Attitudes toward organic wine also changed, whereby respondents were less concerned about whether the wine they drank was organic or not in 2011. In addition, willingness to consume wine produced from genetically modified crops increased by 28% in 2011 from the 2007 survey. Overall, results indicate less concern about how wine is produced.

These results can be considered as broad attitudinal changes, as age, gender, education and household income did not significantly account for the differences. These findings are important for winery owners to consider when planning production changes to address consumer attitudes. There appears little evidence to warrant a large number of Australian companies changing current practices to align with the three areas.

Figure 11 shows mean differences between 2007 and 2011 for drinking motives. Differences are calculated by subtracting mean values in 2007 from values in 2011, therefore values in Figure 11 indicate how much motives have changed since 2007. That is, values above 0 indicate increases since 2007 while values below 7 indicate decreases since 2007.

Some increase in motives for drinking wine have occurred, but the particularly interesting finding here is that motives for drinking beer have changed substantially more than wine for 'reduce anxiety' and 'peer pressure'. This suggests that the marketing of beer around reducing life stressors has been highly successful.

Alcohol is used by some to transition from 'work' to 'play', and it appears that for drivers of consumption like this, marketing campaigns have successfully positioned beer as more suitable than wine. It is unclear whether this is problematic for the wine industry.

While it is important to understand the nature of how beer cannibalises the potential wine drinking market, there are some motives for drinking that the wine industry might be better avoiding than encouraging. The large increase in 'peer pressure' as a motive to drink beer is partly explained by the larger number of younger consumers who consume beer. However, the large increase is nonetheless interesting, as it shows a stronger pull to consume now than in 2007.

Figure 12 shows that the willingness to pay more per bottle to get something extra has decreased slightly since 2007, however this effect was not statistically significant. Indeed, mean values for each income category are numerically close across both years – and there is no significant difference for willingness to pay across income categories. This result is important because the wine industry world-wide is currently considering what innovations can be developed to leverage increased profits. Whether it is 'organic wine' or other offerings, it is concerning that Australian consumers appear unwilling to pay more, at least based on income. It appears that if there ARE segments willing to pay more for certain innovations, they are more complicated to identify than based on mere income.

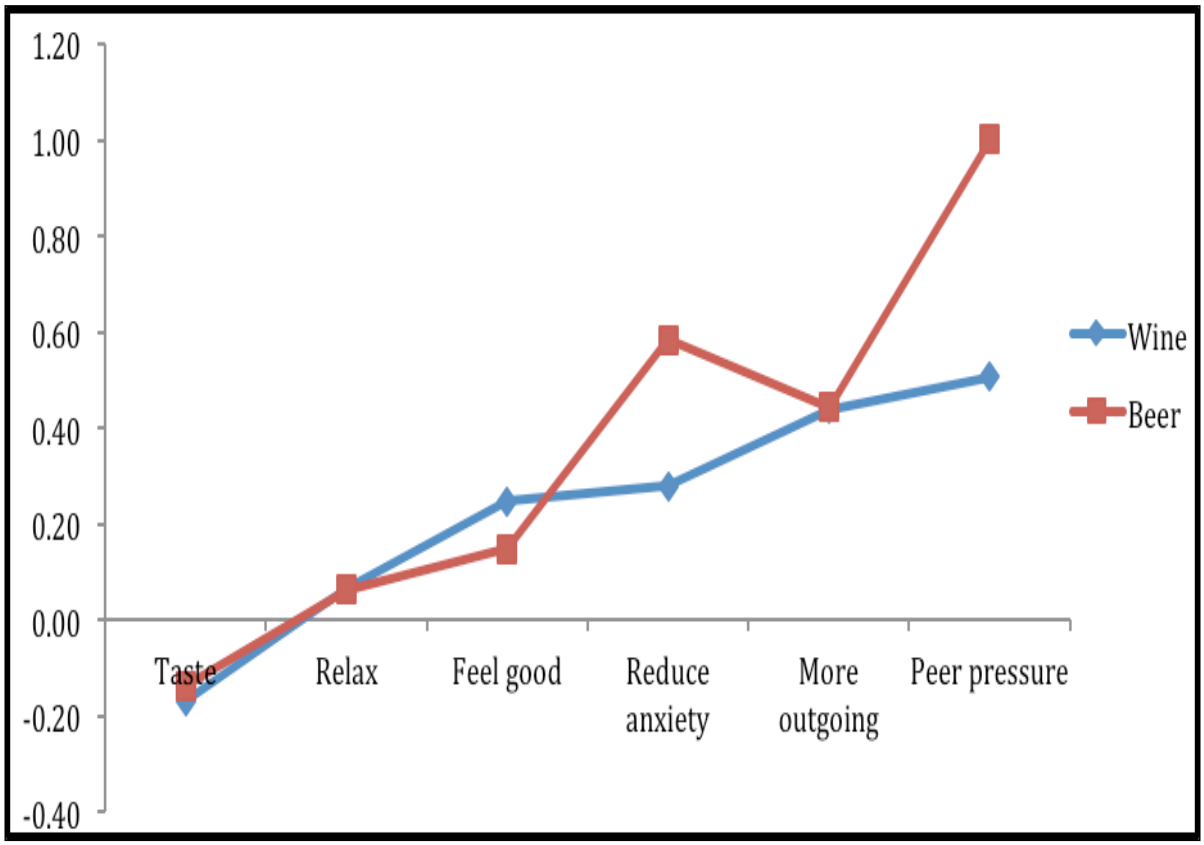


Figure 11: Differences in drinking motives in 2011 compared to 2007 for beer and wine.

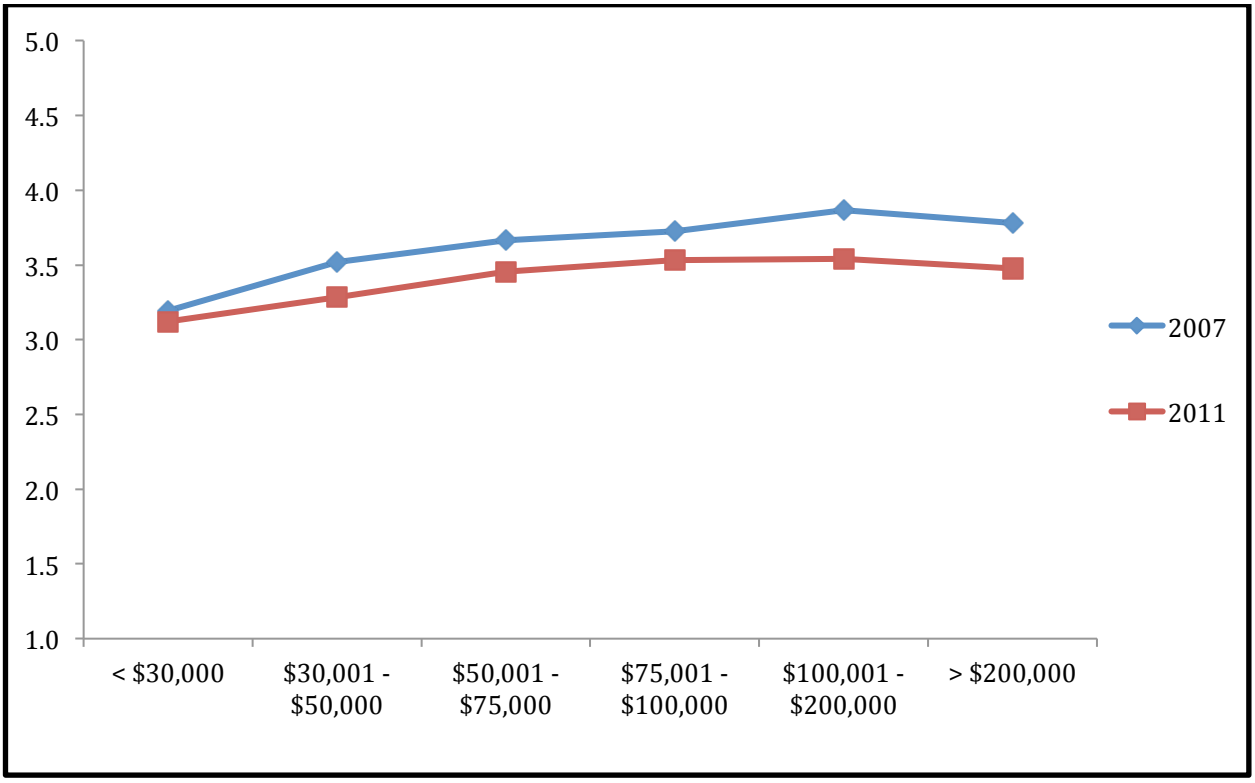


Figure 12: Willingness of respondents to pay more (per bottle) to get something extra in 2007 compared to 2011 based on their income. (Rating: 1 - strongly disagree; 5 - strongly agree)

Identifying needs of consumers and developing products that meet that need are likely to have more success that presuming that higher income earners will be more willing to pay for innovations. For instance, as identified earlier, consumers are drinking wine more frequently, but probably in smaller volumes; it was also suggested that they might compensate for this by spending more per bottle. An example innovation that meets that need is high-quality wine sold in smaller vessels.

Conclusions

Substantial consumption changes have occurred since 2007. Wine drinkers are consuming wine more frequently and possibly in less volume on each drinking occasion. This rapid change suggests a need to re-examine established produce offerings, such as serving size. A 750ml bottle may not meet the needs of wine consumers in the future, as readily as it did in the past.

Consumers are less concerned about the environmental practices followed to produce wine and whether wine is 'organic' than they were in 2007. Only pockets of the wine industry have sought to produce offerings that deliver to these areas, and while there may be niche interest, it appears unnecessary for large changes to the profile of the industry delivering to these areas in the short-term.

Consumer attitude toward returning wine appears to have changed markedly since 2007, with consumers now more willing to return wine. This change should be welcomed, since a poor experience with wine can only be addressed if consumers are willing to report the experience. Where consumers have a poor experience but do not return the product, they may avoid that brand in future, or worse, avoid wider 'brands' such as regions.

Overall, it has been surprising to see how attitudes have changed so much in a relatively short period of time. As mentioned, the period between 2007 and 2011 may be a particularly turbulent one, but these results do demonstrate the need to periodically repeat population-based attitudinal surveys.

PART 5: SENSORY, CONSUMER, AND PERCEPTION FACTORS

Authors: A/Prof Anthony Saliba, Prof Hildegarde Heymann, and Ms Maame Blay

Summary

The broader project investigates how the 'Chardonnay Challenge' came about. That is, why Chardonnay performance has declined in recent years. This report covers one of the background questions to the project – 'is taste the problem'? This report presents results from sensory and consumer research, as well as a laboratory experiment, to determine whether there are existing styles of Chardonnay that appeal to consumers and how knowing that wine is 'Chardonnay' influences taste preference judgements – effectively the influence of the perception of Chardonnay.

The sensory results have shown six distinct flavour styles, demonstrating that a broad range of flavour offerings are available for Chardonnay. The consumer work has shown that fresh fruit characters and a creamy mouthfeel are liked most by consumers; oak is not liked, but partly because wines high in fresh fruit tend to be low in oak character. There may be future opportunity for wines with a balance between oak and fruit character. The characters of sour and fresh vegetable were not well liked by any consumers. These findings provide concrete advice to winemakers on the kind of flavour that consumers do and don't like, however, for the purposes of this project, the aim was to investigate whether there were any styles currently made in Australia that appealed to consumers. The answer to that question is a resounding 'yes'. Chemical analysis undertaken and reported in another report has tentatively identified compounds responsible for key sensory attributes.

The laboratory experiment results showed that consumer judgements on taste preference were NOT influenced by knowing that they were drinking Chardonnay. So surprising was this finding that we repeated a similar experiment using in-situ testing and a slightly different response variable. The results again showed that consumer preference was not influenced by knowing that the wine being tasted was Chardonnay. Two interpretations are possible; one, these results suggest that consumer attitudes toward Chardonnay are not negative, or two, the negative attitudes toward Chardonnay do not influence taste preference judgements. The first interpretation is more likely, though further data will be collected and analysed in further reports to disambiguate these findings.

Background

In the review of consumer attitudes toward Chardonnay that we conducted, we found a

paucity of peer-reviewed literature. We designed a range of studies that sought to fill that gap, firstly in the sensory area by conducting a descriptive analysis on Australian Chardonnay, then measuring consumer preference. This allowed us to determine whether 'taste' was a limiting factor in the acceptance of Australian Chardonnay.

Next, we conducted a 'deception experiment' in the laboratory, where we presented two Chardonnay wines to consumers and sought ratings for preference. We then presented the same wines, but this time told participants that the wines were a 'new variety'. Surprised by the results, we then repeated the experiment using in-situ testing. The results of those studies are reported here, as background to the question: 'what IS the cause of the Chardonnay challenge?'

Experiment 1 – Sensory

Materials and Methods

Twenty-one Australian Chardonnay wines, currently commercially available, were chosen for the study. The choice of wines was based on the requirement that the wines were made from grapes harvested from different geographical regions. Most of the wines were below AU$ 15 per 750 mL bottle and five were from cooler climate areas (Table 1).

A 12 member sensory descriptive panel (6 men and 6 women, ranging in age from 21 to 50 years) were selected based on interest and availability. Most of the panellists had had extensive descriptive analysis experience with Australian Semillon wines (Blackman and Saliba, 2009). Over six 1-hour sessions the panel smelled and tasted all the wines in the study and through consensus created the descriptors and the reference standards (Table 2). At the end of the training period the panellists evaluated a subset of the wines in duplicate and these data were evaluated utilising the software program Panel Check. The results showed that the panel was ready to do the actual evaluations of the wines.

In the evaluation stage, the wines were served in blocks of seven wines, with three blocks constituting a replication. All wines were evaluated in triplicate during the nine sessions. Wines were served to panellists in a completely randomised order within a block. Wines were coded with three digit random numbers. Wines were served in 25 mL aliquots in ISO wine glasses covered with glass Petri dish lids. The wines were served at ambient temperature (20 C) in booths equipped with red lights and a computerised data collection system (Compusense, Guelph, Ontario, Canada). All wines were expectorated with water and crackers were used as palate cleansers.

The individual descriptor data were analysed by univariate three-way analysis of variance (ANOVA) with main effects (panellist, wine, and replication) and all two-way interactions. In cases where there were significant wine main effects as well as significant wine by replication and/or wine by panellist interactions pseudo mixed models were used. The raw data were also analysed by multivariate analysis of variance (MANOVA;

three-way with two-way interactions) and canonical variates analysis (CVA). Additionally, Fisher's protected least significant difference (lsd) was used as a mean separation technique. The significant mean values for the wines were used in a hierarchical cluster analysis using Euclidean distances and Wards' linkage, with a 6 member solution. An alpha-level of 5% was used for all analyses.

Table 1: Codes, origin, vintage and approximate price, of wines used in the study (all prices are approximate; cc = cool climate)

W1	Victoria 2009 ($22)
W2	Orange 2009 ($12; cc)
W3	Yarra Valley 2010 ($26)
W4	Griffith 2010 ($7)
W5	South Eastern Australia 2010 ($10)
W6	South Australia 2010 ($11, unwooded)
W7	South Australia 2010 ($9)
W8	Adelaide Hills 2010 ($16; cc)
W9	South Eastern Australia 2010 ($9)
W10	Orange 2010 ($16; cc)
W11	Western Australia 2010 ($14, unwooded)
W12	South Eastern Australia 2011 ($4)
W13	South Australia 2009 ($13)
W14	South Eastern Australia 2010 ($10)
W15	South Eastern Australia 2010 ($9)
W16	Adelaide Hills 2009 ($16; cc)
W17	South Eastern Australia 2010 ($9)
W18	Riverland 2010 ($8)
W19	Tumbarumba 2009 ($17; cc)
W20	Hunter Valley 2006 ($48)
W21	Riverland 2009 ($10)

Table 2: Descriptors and Reference Standards

Confectionary	2 Allen's Red Frogs + 1 Musk Stick (broken into 8 pieces) NO WINE
Green Apple	12.5 g Granny Smith Apple wedge; cut into 4 pieces + 25 ml wine*
Lemon/lime	1"x1" lemon peel + 1"x1" lime peel +50 ml wine
Grapefruit	25 ml Original Juices Chilled Grapefruit Juice NO WINE
Peach	25 g SPC Peach Halves in fruit juice, cut into 6 pieces + 25 ml wine
Apricot	25 g SPC Apricot Halves in fruit juice, cut into 6 pieces + 25 ml wine
Tropical fruit	25 ml syrup Chunks of Tropical Fruit in light syrup NO WINE
Melon	10 g Honeydew Melon, cut into 4 pieces NO WINE
Fresh Veg	10 g McCains Frozen Sliced Green Beans + 10 g McCains Frozen Green Peas NO WINE
Honey	10 g Woolworths Pure Blend Honey + 25 ml hot water NO WINE
Butter	14 g Woolworths Tasmanian Butter + 25 ml wine
Vanilla	2 ml Queen Imitation Vanilla + 25 ml wine
Straw	2 g chaff NO WINE
Oak	10 g single toast oak chips (Double Chauffe, Boise France; Maumusson Laguian) soaked in 200 ml wine overnight. Decanted. Pour 25 ml.
Char/smokey	45 g double toasted oak chips (Single Chauffe, Boise France; Maumusson Laguian) soaked in 200 ml wine overnight. Decanted. Pour 25 ml.
Acidic	1.0 g tartaric acid in 400 ml wine, pour 25 ml per panellist.
Bitter	0.1 g quinine in 400 ml wine, pour 25 ml per panellist.
Sweet	30 g sucrose in 400 ml wine, pour 25 ml per panellist.

Table 2 Continued	
Astringent	0.02 g tannin in 600 ml wine, pour 25 ml per panellist.
Creamy Mouth Feel	Defined as a smooth, velvety, creamy feeling in the mouth
Base wine	Sunnyvale Dry White Wine 4 L Bag in the Box. Miranda Wines, Merbein, VIC

Results and Discussion

The MANOVA was significant with Wilks' lambda equal to 0.283478. The three-way ANOVAs with two-way interactions for the attributes indicated that all attribute except Lemon/Lime and Grapefruit significantly discriminated among the wines. The mean separation values for the significant attributes are indicated in Table 3. W11 and W12 (both unwooded) had the highest perceived intensities of confectionery, tropical fruit and melon. These two wines and W4 were also the highest in perceived intensities of green apple, peach and apricot. The wines with the highest perceived fresh vegetative aromas were W2 and W19, both of these wines came from cooler growing areas (Orange and Tumbarumba, respectively).

W8 had the highest perceived honey aroma, followed by W3, W15 and W20. The wines that had the highest perceived butter aromas were W3, followed by W8, W13, W16, W20 and W21. Wines high in perceived vanilla were W21 and W20 and the wine with the most perceived straw aroma was W20. Wines highest in oak aroma were W20, followed by W21 and W19, and the wines with the highest perceived char/smoky aromas were W19 followed by W20. The sourest wines were W13 and W19, followed by W20. The bitterest wines were W17 followed by W21, W16 and W13. W5 was the sweetest followed, by W12 and then W11. The most astringent wine was W19, followed by W16 and then W13. The wine with the creamiest mouthfeel was W5, followed by W8.

The CVA loading and scores plots (Figure 1a and 1b) show that the 95% confidence intervals (CI) for W12 and W13 overlap and that these wines are highest in green apple, tropical fruit, melon and confectionary. Simultaneously, these wines were low in oak, butter and vanilla. W19 was astringent, bitter and sour but had similar oak and char flavours to wine 16. Wine 16 did not differ from W 20 and W3 and these wines did not differ from W21. W5 had the creamiest mouth feel and was also high in vanilla and butter.

The cluster analysis (Figure 2) shows that a 6 cluster solution is sensible. Cluster A contains W19, W16, W21 and W20 which with the exception of W3 is similar to the left side of the CVA score plot. Cluster B contains W11 and W12 which is similar to the right side of the CVA scores plot. W5 occupies its own Cluster C. Cluster D contains W18, W17, W4 and W14 which occupy a space below W5 and to the left of W11 and W12 on the CVA scores plot. Cluster E contains W7, W6, W2, W10 and W15; most of these products are to the south of the middle line on the CVA plot. Cluster F contains W3, W8, W13, W9 and W1 and on the CVA scores plot these wines tend to occupy a middle ground – neither high nor low in the rated attributes.

Table 3a: Attribute means and mean separation by Fisher's Least Significant difference

Wine*	Confectionary	Green Apple	Peach	Apricot	Tropical fruit
w01	1.8 d	2.0 de	1.9 d	1.6 cd	1.7 de
w02	1.6 c	2.3 g	1.5 b	1.2 a	1.6 cd
w03	1.6 c	2.1 ef	1.7 c	1.5 b	1.2 b
w04	3.3 j	2.5 h	3.2 j	2.6 k	3.0 i
w05	3.1 i	1.7 b	2.9 i	2.8 l	3.2 j
w06	2.5 g	2.3 g	2.3 ef	1.8 ef	2.2 g
w07	2.7 h	2.7 i	2.4 fg	2.2 ij	2.2 g
w08	2.4 fg	1.8 bc	3.2 j	2.3 j	1.8 e
w09	2.0 e	2.2 fg	2.2 e	2.0 gh	2.1 fg
w10	2.1 e	1.9 cd	1.9 d	1.7 de	1.8 e
w11	4.0 k	2.5 h	2.9 i	2.1 hi	4.2 k
w12	4.1 k	2.8 i	3.9 k	3.1 m	4.4 l
w13	2.0 e	1.7 b	2.5 gh	1.8 ef	2.1 fg
w14	2.3 f	1.8 bc	2.8 i	2.3 j	2.8 h
w15	2.0 e	1.8 bc	1.8 cd	1.9 fg	2.0 f
w16	1.4 b	1.7 b	1.5 b	1.4 b	1.0 a
w17	2.4 fg	2.1 ef	2.6 h	2.2 ij	2.2 g
w18	2.7 h	2.0 de	2.5 gh	2.2 ij	2.2 g
w19	1.0 a	1.9 cd	1.3 a	1.2 a	1.0 a
w20	1.1 a	1.8 bc	1.9 d	1.7 de	1.6 cd
w21	1.9 d	1.5 a	1.8 cd	1.4 b	1.3 b
lsd	0.18	0.13	0.15	0.14	0.15

*Wines within a column with different letters are significantly different from each other

Table 3b: Attribute means and mean separation by Fisher's Least Significant difference

Wine	Melon	Fresh Veg.	Honey	Lemon/lime	Grapefruit
w01	1.6 de	0.9 cd	1.5 de	2.6	1.9
w02	1.7 ef	1.6 g	1.7 f	2.3	1.9
w03	1.3 ab	1.1 de	2.0 gh	2.9	1.9
w04	2.1 i	0.7 b	1.5 de	3.3	2.5
w05	2.0 hi	0.5 a	1.9 g	2.6	2.0
w06	1.7 ef	1.1 de	1.0 a	2.9	2.2
w07	1.7 ef	1.2 ef	1.5 de	3.0	2.3
w08	2.3 j	0.8 bc	2.1 h	2.7	2.3
w09	2.1 i	0.8 bc	1.6 e	3.1	2.3
w10	1.4 bc	1.3 f	1.3 c	3.1	2.1
w11	2.7 k	1.3 f	1.0 a	2.9	2.6
w12	2.9 l	1.3 f	1.4 d	2.9	2.1
w13	1.7 ef	0.8 bc	1.7 f	2.6	2.0
w14	1.9 gh	0.9 cd	1.2 b	3.2	2.4
w15	1.5 cd	0.8 bc	2.0 gh	3.1	2.2
w16	1.4 bc	1.3 f	1.3 c	2.2	1.9
w17	1.7 ef	0.5 a	1.0 a	3.3	2.4
w18	1.7 ef	1.0 cd	1.1 b	2.7	2.4
w19	1.5 cd	1.8 h	1.3 c	2.7	1.8
w20	1.8 fg	1.3 f	2.0 gh	3.1	2.3
w21	1.2 a	0.7 b	1.9 g	2.7	2.0
lsd	0.13	0.12	0.13		

Table 3c: Attribute means and mean separation by Fisher's Least Significant difference

Wine	Butter	Vanilla	Straw	Oak	Char
w01	2.2 f	2.6 gh	2.5 jk	3.1 h	2.2 f
w02	1.8 e	2.0 de	2.4 ij	2.4 e	1.6 c
w03	3.2 i	3.0 j	2.2 gh	2.8 g	2.2 f
w04	1.8 e	2.3 f	2.3 hi	2.2 d	1.6 c
w05	2.6 g	3.5 l	2.5 jk	3.4 i	2.7 g
w06	1.6 d	1.9 cd	1.7 c	1.6 b	1.1 b
w07	1.3 c	1.8 c	1.8 cd	2.1 cd	1.6 c
w08	2.9 h	2.7 hi	1.9 de	3.1 h	1.9 d
w09	2.1 f	2.8 i	2.1 fg	2.9 g	1.9 d
w10	2.1 f	2.0 de	2.6 kl	2.6 f	2.0 de
w11	0.9 a	1.2 a	1.3 a	1.0 a	0.7 a
w12	1.1 b	1.4 b	1.5 b	1.6 b	0.8 a
w13	2.9 h	2.8 i	2.2 gh	3.5 i	2.1 ef
w14	1.8 e	1.9 cd	1.8 cd	2.0 c	1.5 c
w15	1.7 de	1.9 cd	2.4 ij	2.3 e	1.6 c
w16	2.9 h	3.1 j	2.7 lm	4.4 l	3.9 j
w17	1.7 de	1.9 cd	2.0 ef	2.3 e	1.6 c
w18	2.2 f	2.1 e	2.2 gh	2.6 f	1.5 c
w19	2.5 g	2.5 g	2.8 m	4.1 k	3.8 i
w20	2.9 h	3.1 j	3.1 n	4.5 m	2.7 g
w21	2.8 h	3.4 k	2.7 lm	3.9 j	3.3 h
lsd	0.14	0.15	0.15	0.15	0.16

Table 3d: Attribute means and mean separation by Fisher's Least Significant difference

Wine	Sour	Bitter	Sweet	Astringent	CreamyMF
w01	4.3 hi	2.9 e	3.0 e	3.2 e	2.3 cd
w02	4.0 ef	2.5 bc	2.5 b	2.2 a	2.4 d
w03	4.2 gh	2.6 cd	3.0 e	2.6 b	2.9 f
w04	3.7 bc	2.4 b	3.3 f	2.6 b	2.6 e
w05	3.6 b	1.9 a	4.0 h	2.3 a	3.1 g
w06	4.2 gh	2.7 d	2.1 a	3.0 d	1.8 a
w07	4.4 ij	3.0 ef	2.9 d	2.8 c	2.0 b
w08	4.0 ef	2.4 b	2.7 c	2.9 cd	3.0 g
w09	3.9 de	2.6 cd	2.9 d	2.9 cd	2.4 d
w10	3.8 cd	3.0 ef	2.7 c	2.9 cd	2.5 e
w11	4.1 fg	2.5 bc	3.5 g	2.5 b	2.0 b
w12	4.2 gh	1.9 a	4.0 h	2.2 a	2.4 d
w13	4.7 k	3.1 f	2.7 c	3.3 f	2.4 d
w14	3.1 a	2.6 cd	3.4 f	2.5 b	3.4 h
w15	3.8 cd	2.9 e	2.5 b	3.2 e	2.1 b
w16	4.2 gh	3.1 f	2.4 b	3.6 g	2.3 cd
w17	3.9 de	3.3 g	2.7 c	3.0 d	2.4 d
w18	3.6 b	2.7 d	2.7 c	2.6 b	2.6 e
w19	4.8 k	2.9 e	2.4 b	3.9 h	2.2 c
w20	4.5 j	2.9e	2.7 c	3.0 d	2.8 f
w21	3.8 cd	3.1 f	2.4 b	3.2 e	2.8 f
lsd	0.14	0.16	0.14	0.16	0.14

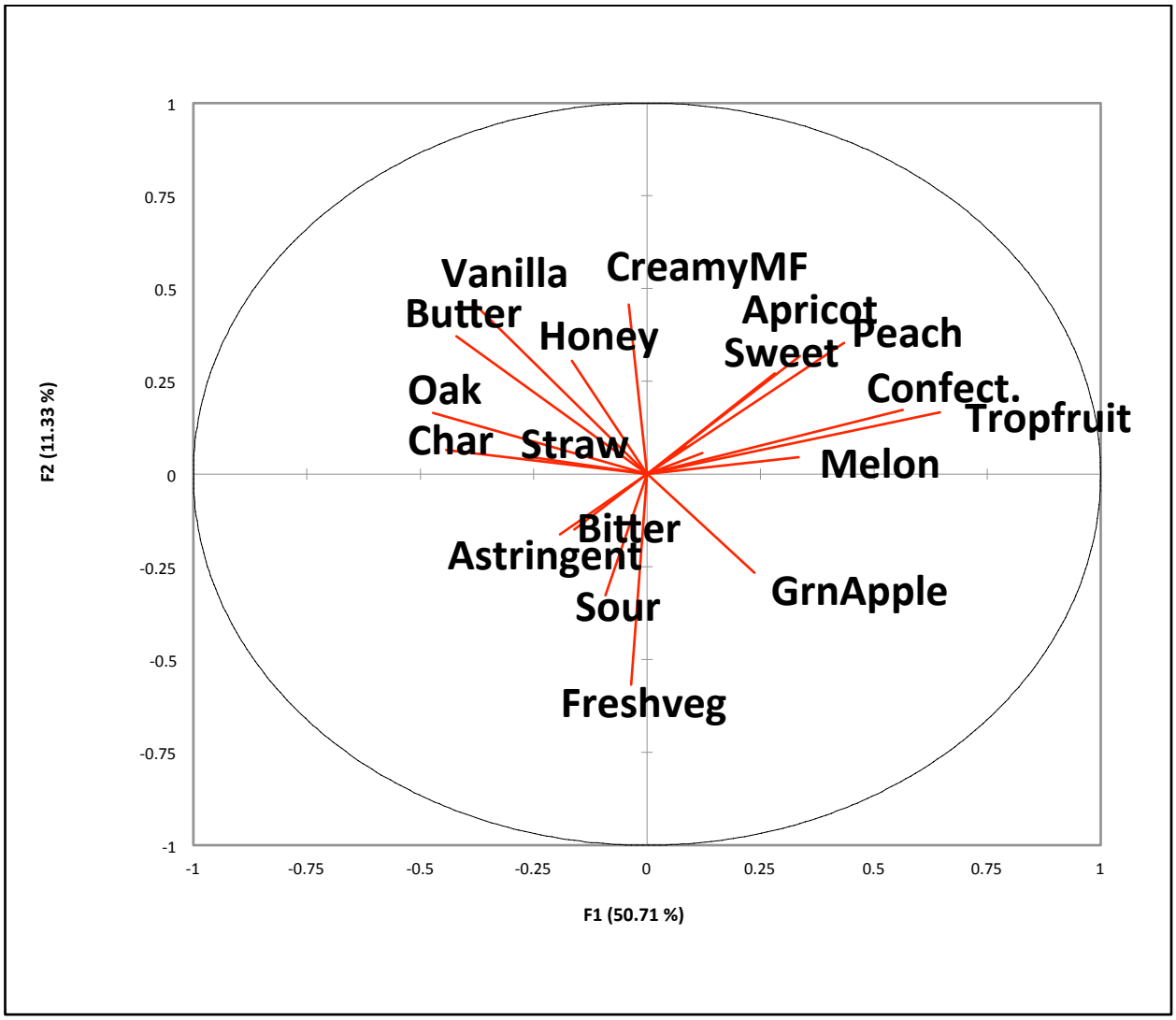


Figure 1a: Canonical Variate Analysis Loadings for CV1 and CV 2

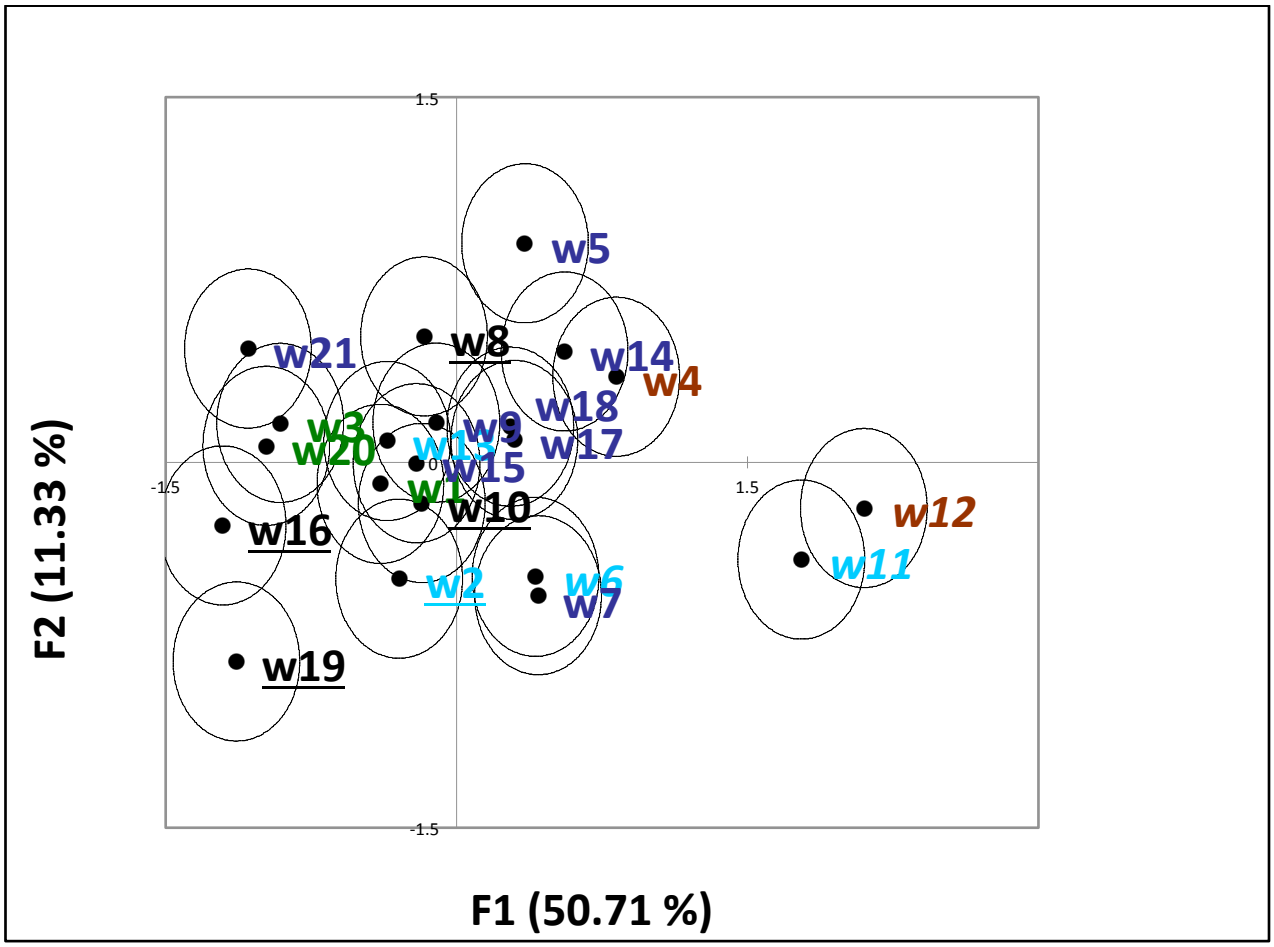


Figure 1b: Canonical Variate Analysis Scores for CV1 and CV2

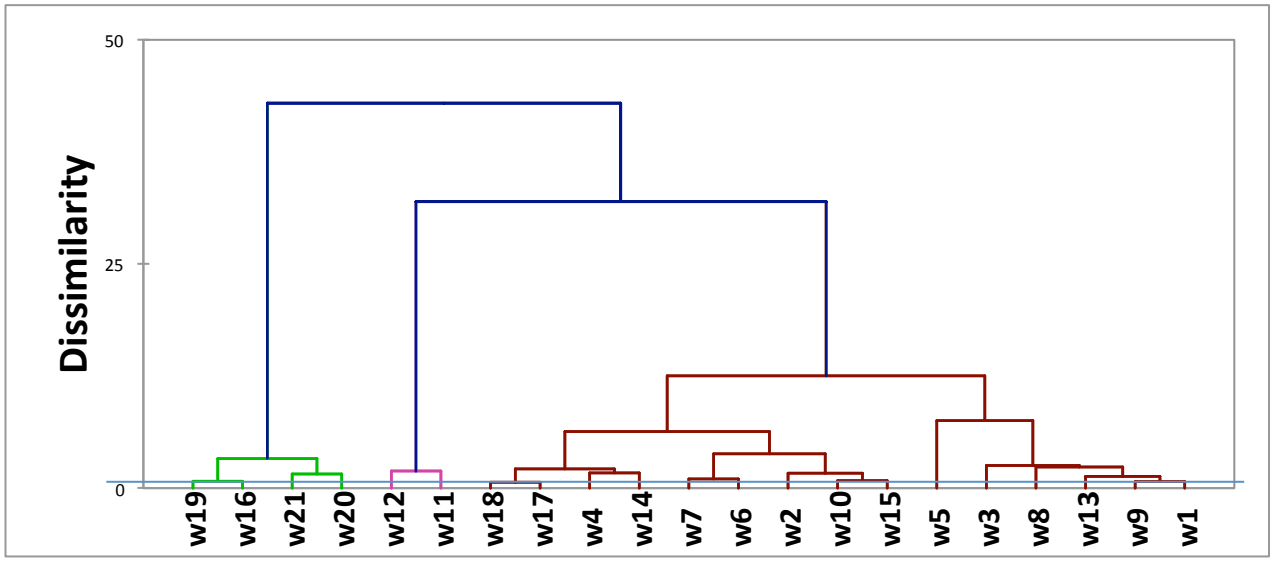


Figure 2: Dendrogram of the Ward's Hierarchical Clustering of the significant wine means. A 6 cluster solution is indicated.

Conclusion

The sensory results show a broad range of styles, with the cluster analysis suggesting at least 6 distinct styles. While at least some of these styles appear to have sensory characteristics that would appeal to consumers, this was not taken for granted. Wines that represent each of the styles were chosen and used in consumer testing reported in the next section

Experiment 2 – Consumer

Rationale – Preference Mapping

Preference mapping is a powerful tool that can be used to show areas of new product development, to help with product optimisation and also to understand sensory attributes which drive consumer preferences for selected products.

Two main types of preference mapping techniques are used; internal preference mapping and external preference mapping. The difference between these two types of preference mapping is based primarily on the source of information used to create the product space to derive the product dimensions. With internal preference mapping, the matrix used to produce a perceptual map of the product space is consumer preference data. The resulting product map shows the dimensions of product liking and gives an indication of the direction of product liking within the product space. With external preference mapping, the product dimensions are derived from an external source such as a descriptive profile of the products to create a product map. Consumer liking data can then be regressed onto the dimensions of this map to give an indication of the attributes that drive consumer preference for these products.

Since its development in the 1960s, several researchers have used different regression

models to explain the relationship between product dimensions and consumer preference. Methods such as partial least square regression models, as well as response surface methodology have been used, not only to understand the drivers of consumer liking but also to determine optimal product liking. The preference mapping technique used will depend mostly on the purpose for carrying out a mapping technique, whether the aim is to determine drivers of preference or to determine optimal products in new product development. External preference mapping is often the method of choice where sensory drivers of product liking are the desired outcome. Often complex regression models such as quadratic model are fitted to determine the nature of the relationships. Simple vector models may also be fitted to the data to explain drivers of product liking.

In Australia there is a steady decline in consumer consumption of Chardonnay wines. The aim of this section of the project was to determine whether there are any Chardonnay styles currently produced in Australia that consumers like. Preference mapping is applied to the set of wines defined in the previous section thought to represent the six styles of Australian chardonnay identified. Ultimately, the aim was to determine the sensory attributes in Chardonnay that drive product liking amongst Australian consumers.

Method

All analyses were performed with XL-Stats. PCA was used to describe the sensory product space. Similar analyses have been reported earlier in this report, though on this occasion consumer liking was included in the results. Cluster analysis of consumers' preferences was performed and the mean preference scores for the clusters were determined.

Results

Defining the sensory product space

Principal component analysis was used to describe the sensory product space within which the products are found. Figure 2 below shows the product space and the attributes that describe the product space. Only the first two dimensions of the product map are shown here. Assuming a correlation coefficient of 0.70 or greater represented a strong correlation between the product attribute and the principal component axes, the product sensory space can be defined in the first dimension as confectionary tropical fruit flavour in the positive direction and oaky flavour in the negative direction. The second dimension of the product map was not very well explained but characterised by a sour and fresh vegetable flavour in the negative direction and a creamy mouth feel in the positive direction. Most of the wines were clearly distinguished in the first dimension of the product map which explained about 53% of the variance in the data. Table 4 below shows how the different sensory attributes correlate with the first two product dimensions of the map.

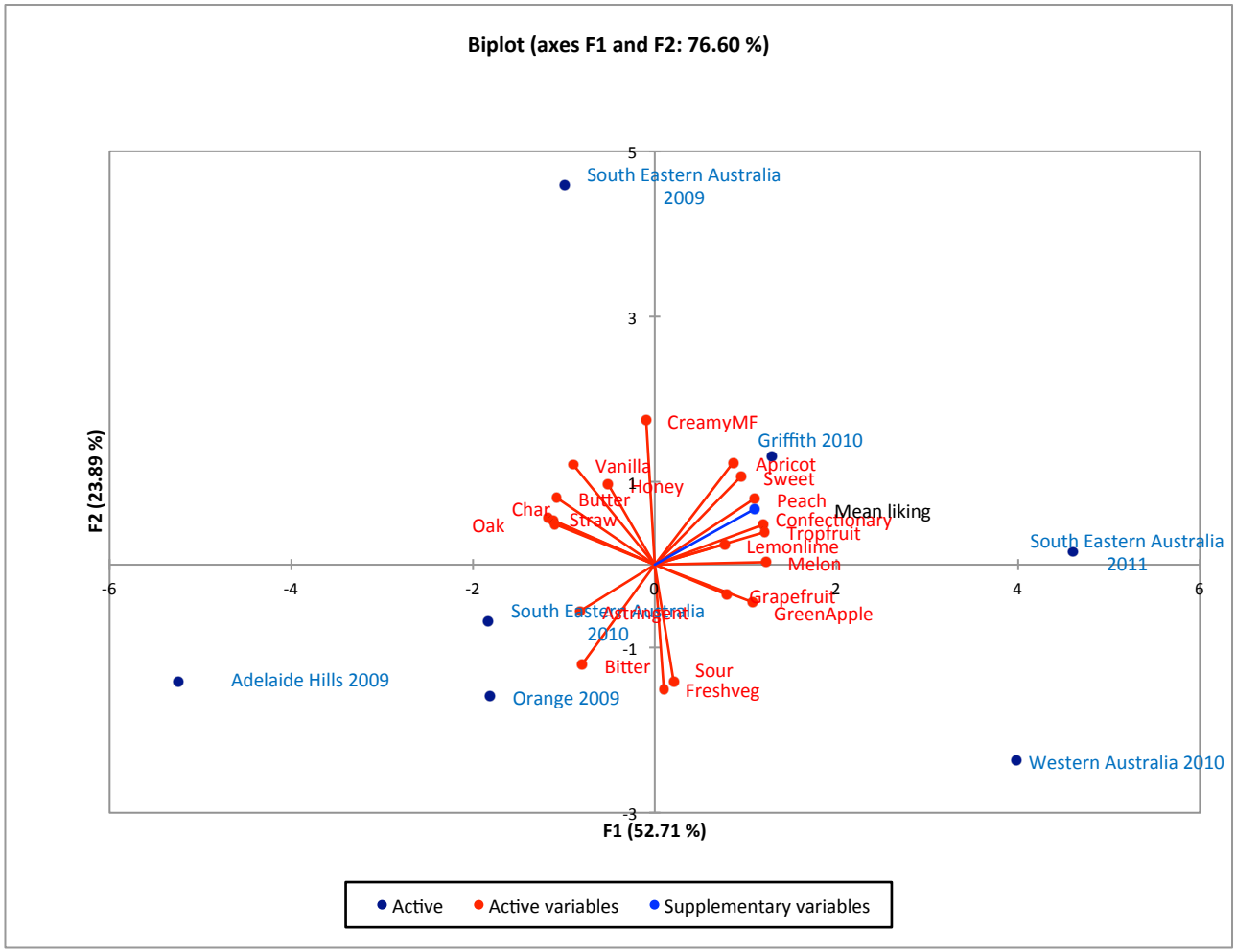


Figure 2: PCA biplot of sensory descriptors, wines and mean consumer liking.

Table 4: Correlation of product attributes to principal components of the sensory product map

Sensory Attribute	F1	F2
Confectionary	0.937	0.257
Green Apple	0.843	-0.240
Lemon lime	0.604	0.128
Grapefruit	0.623	-0.192
Peach	0.858	0.420
Apricot	0.677	0.651
Tropical fruit	0.952	0.210
Melon	0.962	0.015
Fresh vegetable	0.078	-0.795
Honey	-0.402	0.515
Butter	-0.849	0.429
Vanilla	-0.707	0.639
Straw	-0.923	0.299
Oak	-0.884	0.281
Char	-0.863	0.261
Sour	0.163	-0.749
Bitter	-0.626	-0.638
Sweet	0.751	0.565
Astringent	-0.646	-0.298
Creamy Mouth Feel	-0.076	0.924

Consumer analysis - clustering

Using XL-stats' AHC cluster analysis method and selecting auto clustering, five groups were defined. The analysis was redone to create three clusters as two of the initial cluster groups; 2 and 4 were very small (8 and 6 consumers in each group respectively). The resulting three-cluster grouping was used for the preference mapping analysis.

Three consumer clusters were identified using the cluster analysis method. Figure 3 below summarises the mean liking scores of the products for the different clusters. Table 5 characterise the demographics and wine consumption patterns for the consumer groups and the percentage of consumers within each cluster. Cluster 1 was the largest group and was highest in wine enthusiasm. Cluster 2 was lowest in wine knowledge while cluster 3 had a high proportion of females. These clusters appear fairly crude and not well explained by the macro variables reported here, however the creation of sophisticated segmentation based on flavour preference was not the aim of this work.

The data is available to conduct such an analysis and this work will be undertaken and reported elsewhere. For the purposes of the present project, this work was undertaken to determine whether there were consumer segments that liked the taste of some Chardonnay styles. The results shown in Figure 3 clearly show Chardonnay wine styles that are substantially liked by a large range of consumers.

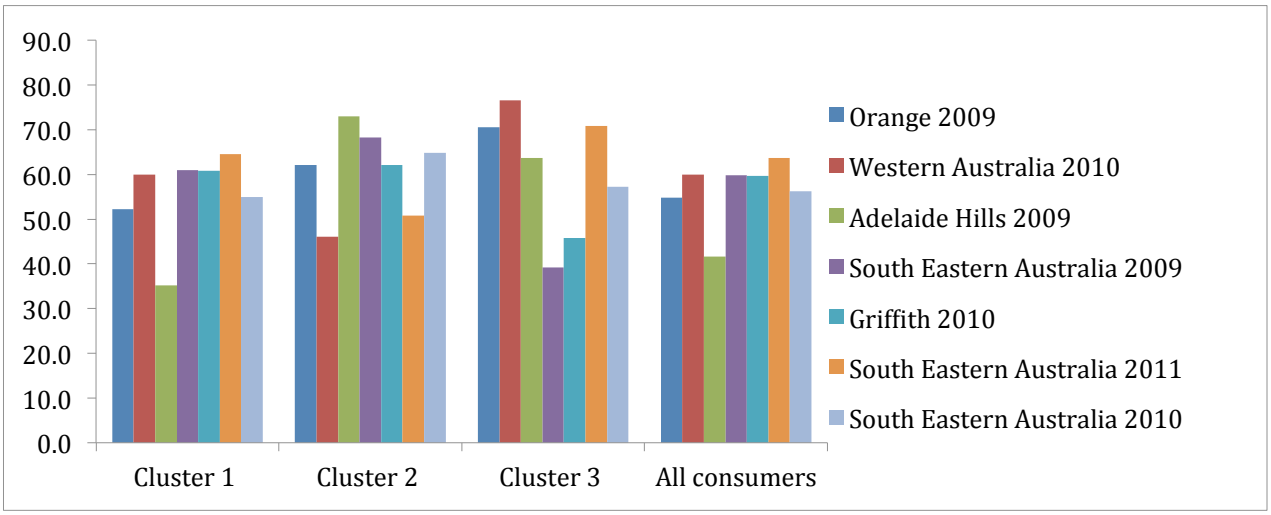


Figure 3: Mean preference scores for consumer clusters for the different wines

Table 5: Consumer demographics of cluster groups for 3 groups cluster analysis

Consumer group	Number of consumers	Male	Female	Enthusiasm	Knowledge	Years of drinking	Glasses per W/E
All consumers	134	67	67	5.6	4.3	24.3	3.0
Cluster 1*	108	57	51	5.7	4.4	25.1	3.0
Cluster 2**	14	6	8	5.2	3.9	22.1	3.1
Cluster 3	12	4	8	5.3	4.3	19.6	3.4

Conclusion

The sensory data had suggested that there were styles that would appeal to consumers, and the consumer data confirmed that. There can be no doubt that the source of the 'Chardonnay challenge' is NOT the currently made styles. That is, there are clearly some styles that appeal to consumers, from a taste viewpoint. We now need to check whether consumer attitudes toward Chardonnay effects taste preference.

Experiment 3 – Lab Test

Rationale

In order to determine the effect of 'perception' of Chardonnay on reported liking, a lab-based experiment was conducted. Given that there is a view that Chardonnay suffers from an 'image problem', and that consumers look negatively upon Chardonnay, it would be hypothesised that consumers would report liking wine less when they are told it is Chardonnay, as compared to being told that it is a different variety. This hypothesis accords with many conversations we have had with cellar door operators who report that visitors report not liking Chardonnay, only to subsequently report liking a Chardonnay given to them under the guise of another name.

Method

Testing was conducted at the sensory laboratory at the NWGIC. A total of 61 white wine consumers were recruited with the demographic characteristics shown in Table 6.1. Effort was taken to ensure a fairly equal number of consumers in each age/gender category.

A forced choice, 2-alternative method was used. That is, participants saw two wines and were asked to choose their most preferred sample. At all times, the two choices were the SAME wine. The difference was that one sample was labelled as 'Chardonnay' and the other as 'New Variety'. This method essentially measures the effect of 'perception' on taste preference. All counterbalancing was undertaken to control for order effects.

Table 6.1: Demographic breakdown of the sample.

		Age Category					Total
		20-29	30-39	40-49	50-59	60 & above	
Gender	Male	6	5	6	7	8	32
	Female	6	7	6	5	5	29
Total		12	12	12	12	13	61

Two Chardonnay wines were tested. Based on the consumer results reported above, the wines most and least liked by consumers were chosen. Only one consumer asked if the wines were the same in each test bracket, and that consumer's results were removed. At the completion of the study, participants were asked about the wines in order to gauge whether they had 'believed' that the wines were different in brackets, or whether they had recognised them as the same.

Further, as part of debriefing, consumers were told that the bracket wines were actually the same. At no time did any of the 61 participants used in this experiment indicate that they knew the wines were the same. This suggests that the experiment did successfully 'deceive' participants and that responses are a genuine measure of the effect of perception on taste preference.

Results and Discussion

Chi-square tests were used to determine whether being told that wines were either Chardonnay or a New Variety significantly influenced consumers (Table 6.2). Analysis was conducted separately for the highly and lowly liked wines. The test presumed that the Chardonnay and New Variety should be chosen equally as often, and effectively measures the probability that the actual results occurred by chance, or indeed indicated that respondents were influenced by what they were told. The results for both wines showed clearly that respondents were not influenced by what they were told – that they did not prefer the 'New Variety' over 'Chardonnay'. Recall, the test wines were actually the same.

The results indicate that respondents in this study did not rate wines lower when they were told that the wines were Chardonnay, and the effect did not depend on whether the wine was rated (elsewhere) as highly or lowly liked. This was an unexpected result, and not explained by a small sample size, so we conducted much further analysis to see whether there were any other factors that could explain the results. Some examples of what we tested are:

- Whether high 'food neophobia' scores caused people to rate the 'new variety' down
- Effects of age, gender and experience
- Effects of liking of Chardonnay, current

consumption of Chardonnay or any other variety

However, we could find NO evidence that the results could be explained by anything other than respondents NOT being negatively influenced by being told wine was Chardonnay.

Additional work- In-situ testing

The popular press and general opinion seems so strongly of the view that Chardonnay is negatively perceived that we were surprised by the results reported in the previous section. Therefore, we undertook to conduct in-situ testing using a slightly different approach, to see whether the results we obtained related to the methodology used. This time, we recruited 95 white wine drinkers and tested them at a food event. We used three Chardonnay wines, two from the lab work (highly and lowly liked wines) and an additional wine that was liked moderately. We used the same basic design, where participants saw two wines, one labelled "Chardonnay" and one labelled "New Variety". This time, respondents used a 9-point liking scale. Similar controls such as counterbalancing and debriefing participants were used, as reported above.

Table 6.2: Chi-square results

High Preference

	Observed N	Expected N	Residual
Chardonnay (352)	27	30.5	-3.5
New Variety (417)	34	30.5	3.5
Total	61		

Low Preference

	Observed N	Expected N	Residual
Chardonnay (141)	28	30.5	-2.5
New Variety (521)	33	30.5	2.5
Total	61		

Test Statistics

	Preference High Liked	Preference Low Liked	Pref both wines combined
Chi-square	.803a	.410a	1.180b
df	1	1	1
Asymp. Sig.	.370	.522	.277

The results obtained were in resounding agreement with the lab experiment, in that participant preference ratings were not significantly influenced by being told that the wine was Chardonnay. Table 6.3 shows the mean difference between 'Chardonnay' and 'New Variety' (remembering that wines were actually the same), for each of the three like categories. The mean differences are small, and Table 6.4 shows that they are not significant. Once again we conducted analyses into whether variables such as age, gender, etc., might explain the results, but we found no explanation other than the main effect – that the perception of Chardonnay did NOT significantly impact on participant judgements. After trying several methods, we came to the conclusion that the perception of Chardonnay did not influence taste preference scores.

Table 6.3: Mean difference between New Variety and Chardonnay

Descriptive Statistics

	N	Minimum	Maximum	Mean difference	Std. Deviation
High Liked	96	-6.20	7.40	-.0903	2.91161
Moderately Liked	96	-7.00	4.70	-.1115	2.34057
Low Liked	96	-7.30	7.20	-.3053	2.98639
Valid N (listwise)	96				

Table 6.4: ANOVA results showing no significant differences between ratings

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
High Liked	**Between Groups**	14.247	5	2.849	.324	.897
	Within Groups	791.113	90	8.790		
	Total	805.360	95			
Moderately Liked	**Between Groups**	8.105	5	1.621	.285	.920
	Within Groups	512.329	90	5.693		
	Total	520.434	95			
Low Liked	**Between Groups**	25.887	5	5.177	.567	.725
	Within Groups	821.374	90	9.126		
	Total	847.261	95			

Recommendations

After testing the sensory characteristics of Australian Chardonnay, the consumer taste preference and influence of perception of Chardonnay on taste preference judgements, we have come to the following conclusions:

- There are several sensory styles that should appeal to wine consumers
- The Australian domestic market like a range of styles of Australian Chardonnay currently produced
- Australian consumers are not negatively influenced, on average, when they are told that they are drinking Chardonnay
- A corollary of above is, that consumer's do not have a negative perception of Chardonnay

The last point was thoroughly tested via focus groups and quantitative questionnaire, to determine whether a negative perception of Chardonnay was causing consumers to avoid purchasing Chardonnay. The results of those studies are reported elsewhere, but overall, we continue to find that consumers perceive Chardonnay much as they have for some time. It may be the case that we as an industry overstated the position of Chardonnay with consumers, and therefore we were surprised when sales began to fall.

However, sales began to fall only when other competitors became more available, such as Pinot Gris/Grigio and Sauvignon Blanc, especially New Zealand Sauvignon Blanc. At that point, the Australian industry had substantially over-planted Chardonnay and the combined effect of over-supply and new competitors in the market was that sales volume dropped and prices dropped substantially.

The situation can be improved somewhat by attempts to improve perception toward Chardonnay – but remembering that perception has not changed as many have purported, it would be a substantial undertaking to shift the perception of Chardonnay markedly. That is, with the perception of Chardonnay already moderately high amongst a major proportion of the market, it would be difficult to initiate an up-swing in perception – ostensibly there is a kind of 'ceiling effect'. Some suggestions for improving the Chardonnay 'brand' are presented in other reports generated under this project. However, given that the main cause of the current Chardonnay challenge is oversupply, there seems to be only two alternatives. One, reduce supply, which is already happening organically within the industry. Or two, find genuine new markets for Australian Chardonnay.

The two obvious markets are current non-drinkers of wine in Australia (but consumers of other alcoholic beverages), or international markets. Further research and consideration should be focused on these potential solutions. We have already started a project to examine how Australian Chardonnay wine compares and contrasts with Chardonnay produced elsewhere in the world. The results of that work should be available early in 2013.

PART 6: CHEMICAL ANALYSIS OF CHARDONNAY WINE – ESTABLISHING OBJECTIVE MEASURES OF SENSORY FEATURES

Author: Dr Leigh Schmidtke

Introduction

The determination of compositional data pertaining to the presence and concentration of aroma compounds in foods and natural products has been the subject of considerable investigations since the commercial development of the gas chromatogram in the 1950's. Flavour and aroma chemists have attempted to ascertain the most important chemical constituents contributing to the aroma perception of specific products, and mapping the concentration of these compounds to consumer preference remains the driver of research in consumer product aroma quantification. Furthermore, linking key aspects of product development and manufacturing processes in the production chain may help to establish positive and negative contributors to product composition and perceived quality.

In this investigation we report a comprehensive semi automated data analysis approach using multivariate curve resolution techniques applied to a GC-MS data set from chardonnay wines to extract peak areas of volatile compounds and ion abundance ratios for compound identification. The compound peak areas are mapped to sensory features obtained by descriptive sensory analysis and the identification of volatile compounds associated with sensory attributes identified. This approach enables us to report the identification of important compositional aspects of the wines and establishes objective measures of some sensory properties.

Materials and Method

Wine samples were collected and extracted for analysis on the day of sensory panel appraisal so that variation between sensory and analytical replicates was minimized. A total of 21 different wines were subjected to descriptive sensory assessment in triplicate over a period of 10 days with a trained panel of 16 assessors. For the determination of volatile compositions all wines were assessed, extracted and analysed in random order within replicate blocks. Prior to extraction 50mL of wine was spiked with 50µL of internal standard mixture comprising 3-tert-butyl-4-hydroxyanisole; methylisobutyl ketone and 4-methyl-2-pentanone to give final concentrations of 4000, 1000 and 4000 µg L-1

respectively. Samples were extracted with LiChrolute cartridges (Merck) following the method of Lozez et al15 and the eluant spiked with an internal standard mix comprising 2-octanol and 4-hydroxy-4-methyl-2-pentanone to give final concentrations of 6650 and 6650 µg L^{-1} respectively.

GC/MS analysis

For SPE analysis 1µL of extract was injected into an Varian 3800 gas chromatograph fitted with a 60 m x 0.25 mm i.d. fused-silica capillary column with a 0.25 µm wax (DB-WAXetr) stationary phase (J&W Scientific, Folsom, CA) using a CombiPAL autosampler. The injector temperature was 240°C; and the split ration 10:1. The helium flow rate through the column was 1.5 mL min-1 with an average velocity of 31 cm sec-1; the column temperature was held at 40°C for 5 min, then increased at 2°C min-1 to 210°C and held for 20 min. Mass spectra were collected using a Saturn 2000 ion trap set to EI AGC ionization mode and a scan time of 0.65 sec, in the range of 35 to 350 m/z.

A maximum ionization time was set to 25000 microseconds and target TIC at 20000 counts. Mass range segments (10 to 99; 100 to 249; 250 to 350) were set to an ion storage level of 35.0 m/z, ionization time at 100% and background mass of 45 m/z. Transfer line, manifold and trap temperatures were 230°C; 40°C and 180°C respectively. Spectra were not collected between 7.30 and 10.00 min to exclude solvent peaks in the chromatogram.

Multivariate Curve Resolution Alternating Least Squares (MCR-ALS) Analysis of GC/MS data

All GC/MS files were exported in three dimensional CSV or ASCII format from MS Workstation SP1 version 6.5 for processing in MATLAB version R2011b (Mathworks, Natick, MA) where all data treatments procedures were performed. The total ion chromatogram (TIC) for each sample was overlaid without spectral alignment to enable visual identification of appropriate time windows for automated processing. Once the time windows were established for each data set, files were processed. Each m/z channel was smoothed by subtracting the minimum m/z value and then filtered by convolution using a vector of size 7. A smoothed and corrected TIC for each sample was then determined from the sum of each m/z channel in the time window and this profile was used for alignment of elution profiles using the maximum cross-correlation approach. The sample shift from the alignment of the TIC was then applied on a sample by sample basis to each m/z channel to align all sample elution profiles within the time window thereby creating an aligned three dimensional matrix (elution time*m/z channel*sample). A two dimensional matrix representing the mean m/z elution profile was then used to determine the number of interesting features (peaks) within the time window. The number of features was determined by principal component analysis (PCA) using the singular value decomposition of the transformed matrix; an offset of 1 was

added to all m/z channels which were then down weighted by log10 transform; mean centered and variance scaling using the Pareto equation prior to PCA.

Spectra associated with each peak of interest was estimated with the SIMPLISMA approach using the PURE algorithm. Estimated spectra were then passed along with the column augmented elution profile of all samples (elution time*(samples*m/z)) in the time window to the MCR-ALS algorithm.

Spectral libraries of peaks derived from MCR-ALS were exported from Matlab in a format compatible with the National Institute of Standards and Technology (NIST) Mass Spectral Search Program (version 2.0). Target compound identification of peaks of interest and internal standards was conducted using NIST search results and confirmed using published retention time indices and/or pure compounds run in identical GC/MS conditions.

Exploratory Data Analysis of GC MS Peaks to Identify Interesting Sample Groups

Peak areas from the MCR-ALS decomposition of SPE GC-MS data sets were subject to exploratory data analysis. Peak areas were preprocessed by normalizing all peaks in the data sets to the peak area associated with the injection internal standard (SPE: 4-hydroxy-4-methyl-2-pentanone) to eliminate minor injection discrepancies between samples. All peak areas were then normalized to the peak area for the internal standard for extraction (SPE: 3-tert-butyl-4-hydroxyanisole) to eliminate discrepancies associated with extraction efficiency. Pre-processing of peak areas was done by addition of an offset of one, logarithmic transform, mean centre and variance scaling prior to PCA. Peaks associated with the internal standards were excluded from the PCA. Interesting sample groups were identified in scores plots and a nominal cut-off of 0.7 times the highest absolute loading value for a specific principal component (PC) was used to establish important peaks associated with these groups.

Exploratory Data Analysis of Sensory Assessment

Sensory data was modeled using PARAFAC as the assessors responses can be considered a three dimensional structure of dimensions 16 (samples) x 15 (sensory attributes) x 48 (16 x 3; sensory assessor x replicate). The data was mean centered across mode 1 with no scaling applied as it can be reasonably expected that sensory data will have similar variances as the same scale has been used during evaluations. PARAFAC models extracting increasing numbers of components were fitted to the sensory data until the core consistence results had been stabilized. Factor loadings from the model were plotted to visualize the relationship between samples and sensory attributes. To assess the quality of the loadings, the residual sum of squares for each mode (samples, attributes and assessors) were used and variables exceeding the 99% confidence interval were flagged as those that were poorly

fitted. These variables were removed and the PARAFAC model re-fitted to the data.

Identification of Peaks Associated with Wine Sensory Features

SPE peak data sets were preprocessed as described above. The peak table was regressed across the replicate mean sensory values for each wine calculated following removal of the poorly performing sensory assessors' results. Prior to regression the samples/replicates were allocated to either a calibration or independent test set using described methods (TABLE 1) so that approximately 60 percent of the samples were placed in the calibration set. Peak selection within the calibration set was conducted using the forward interval (iPLS) regression for each analyte and model combination. Predictive models of the sensory attributes from the peak areas were constructed using either PLS1 or PLS2 regression analysis using the SIMPLS algorithm with cross validation using random sample subsets with six data splits. The number of latent variables chosen for each model was determined from eigenvalues and minima of the root mean square errors of calibration, cross validation and prediction. For PLS2 models multiple predictands were selected based upon the PARAFAC modeling of sensory data such that attributes modeled by the same loading or those with similar loading values were modeled together. The validation data set was used as an independent data block to determine the predictive ability of the models. For PLS models with good predictive ability, the variables (peaks) used in the model were identified and loadings plotted to visualize the influence of each peak on the model. All PCA and PLS regression analysis was performed using the PLS toolbox (version 6.5, Eigenvector Research Inc, Wenatchee, Washington).

Results and Discussion

Exploratory Data Analysis of GC-MS Peaks to Identify Interesting Sample Groups

A total of 126 discrete peaks and associated spectra were extracted from the chromatograms including 5 peaks of internal standards. Peak areas for internal standards were used to normalize for injection volume irregularities and extraction inefficiencies and were then excluded from further analysis. Principal component analysis (PCA) of the remaining normalized peak areas derived from the GC-MS analysis for triplicate wine samples is shown in figure 1. Broadly there is good agreement of analysis for wine replicates indicating that this means of analysis and data decomposition is robust. This is specifically noted in Principal Component (PC) 1 in which wine replicates for samples are plotted in close proximity. Two extracted principal components account for approximately 39% of data variance with PC1 indicating a clear separation of wines based upon volatile composition. Loading plots for PC1 and PC2 are illustrated in figure 2.

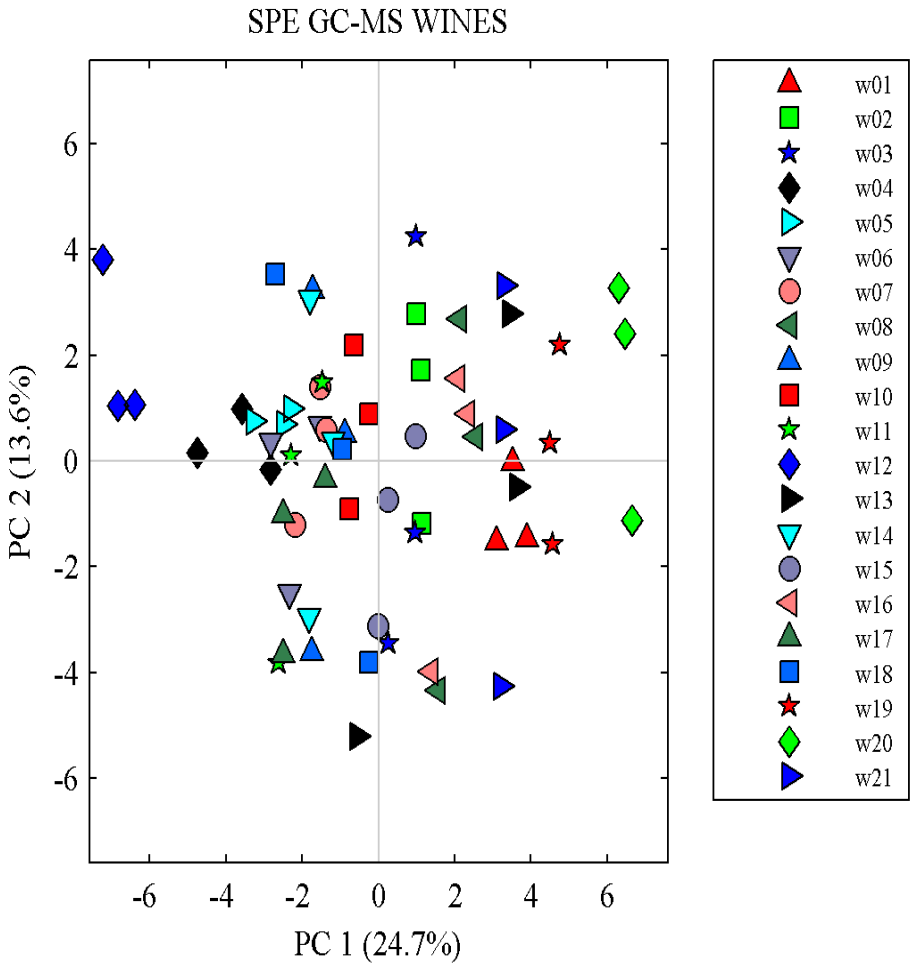


Figure 1. Principal Component Analysis of GC-MS peak areas for wine samples analysed in triplicate.

Loading plots are constructed to identify those peaks with significant influence within the PCA. A nominal cut off of 0.7* the maximum loading associated with a specific PC has been used to identify peaks with the largest influence on the extracted PC. For PC1 important peaks contributing in the positive dimension are identified as 62, 115, 109 and 93; and those with negative loadings are peaks 18, 67 and 27. Tentative identification of these peaks is shown in Table 1. The tentative identification of these compounds is based upon NIST spectral matches and reported retention indices. Confirmation of the identity will continue by injection of pure compounds where available to verify elution and spectral profiles. As PC2 (and other extracted PC's) did not illustrate any specific and consistent sample grouping the interpretation of the significance of the loadings will not be discussed.

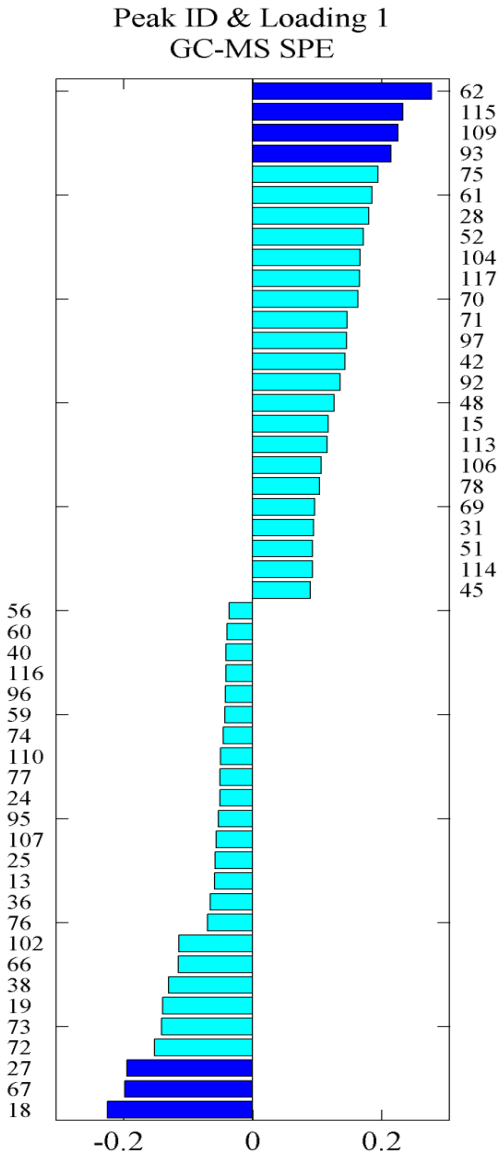


Figure 2. Loading plot of PC1 for GC-MS peaks. Peak numbers are indicated on the vertical axis. A nominal cut off of 0.7* the maximum loading is indicated by dark shaded peaks.

Table 1: Tentative identification of important compounds associated with PC1.

Peak Number	Tentative Identity	CAS
62	Ethyl succinate	123-25-1
115	(3 or 4) methyl benzaldehyde	104-87-0
109	Diethyl tartrate	87-91-2
93	Diethyl malate	626-11-9
27	Hexyl acetate	142-92-7
67	NID†	
18	Isoamyl butyrate	106-27-4

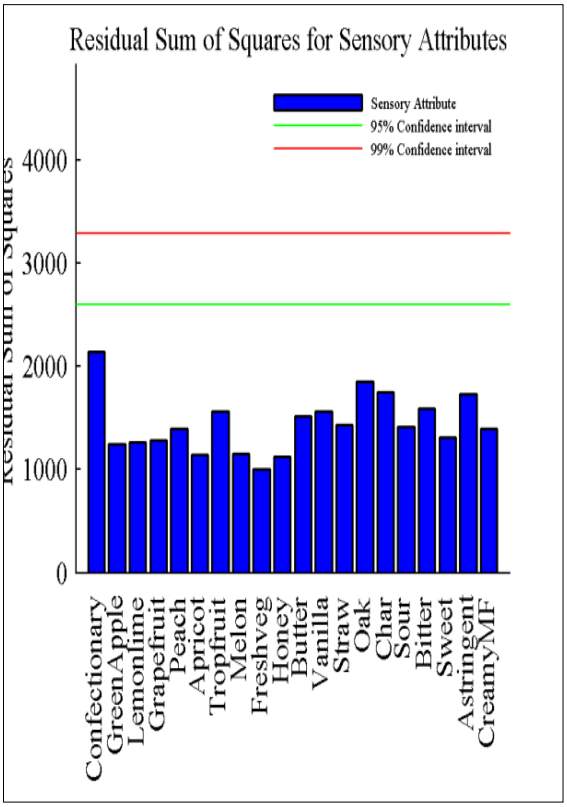
† Not Identified

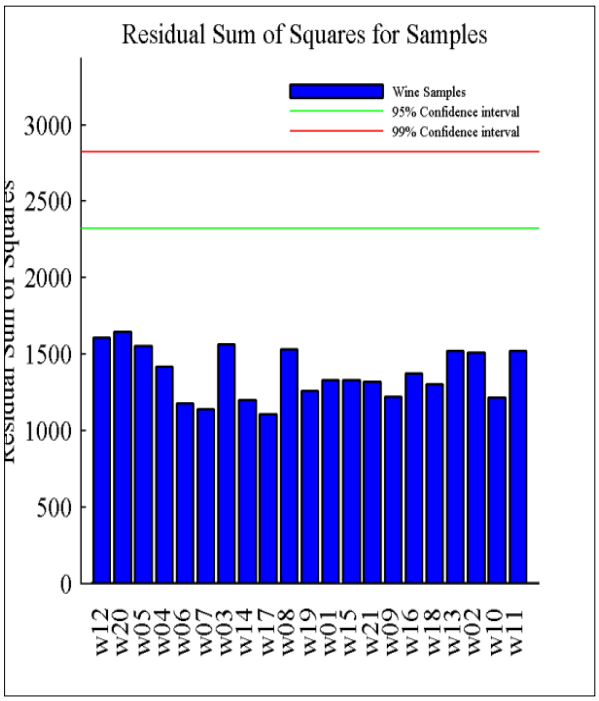
Exploratory Data Analysis of Sensory Assessment

The decomposition of the sensory data is not an intended focus for this aspect of the investigation but rather was conducted to identify trends in the sensory dimensions of the wines and to identify panellist reliability. Poorly modelled panellist responses indicate highly variable sensory results that may inadvertently influence the identification of chemical data correlated with the sensory features. Hence the primary importance of the PARAFAC model is to identify those panellists with poor reproducibility in their sensory evaluations and to remove these sensory scores prior to fitting a regression model to the GC-MS peak table. PARAFAC modelling of the combined sensory scores indicate a two factor model that accounted for approximately 14% of data variability. The residual sums of squares (RSS) for each mode (Sensory Attributes, Samples and Panellists) of

the fitted model are shown in figure 3. All sensory attributes and samples are well modelled with RSS below the 95% confidence interval. Five panellist/replicates sensory scores (#1, #2, #10, #16 and #22) are poorly modelled with high RSS (> 95%CI) and these panellist/replicates were excluded from regression modelling.

Loadings from the PARAFAC sensory decomposition for wine samples and the sensory attributes are illustrated in figure 4. Wines are located within these loading plots on a diagonal (top right to bottom left) and the sensory attributes corresponding to the sensory features are largely attributed to fruit characteristics (loading 1) and oak flavour components (loading 2).





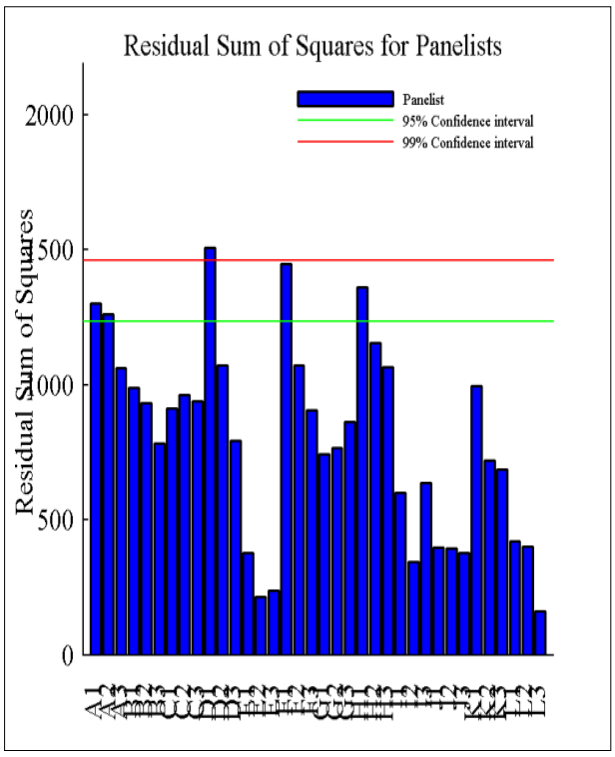
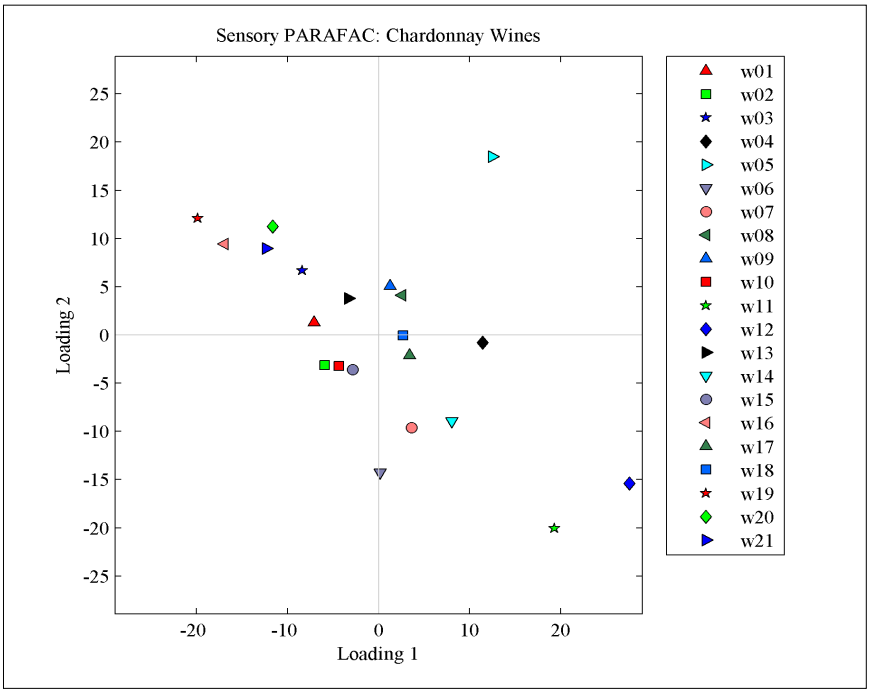


Figure 3. Residual sum of squares of sensory PARAFAC models.



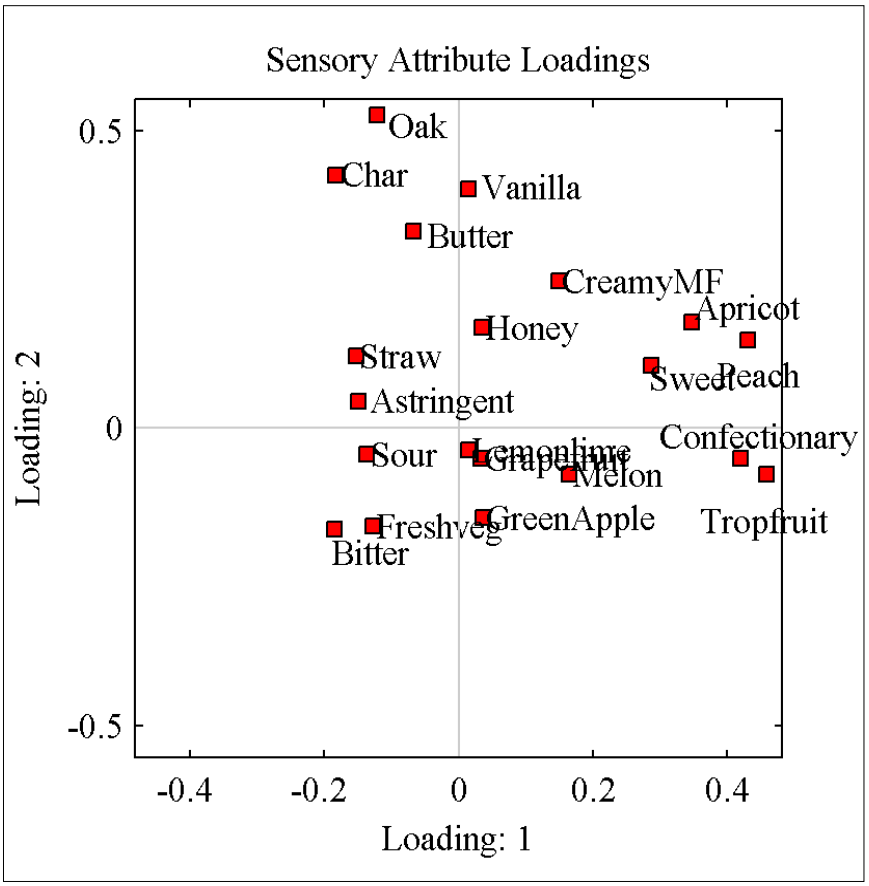


Figure 4. PARAFAC loadings of sensory scores for modes samples and sensory attributes. Loading 1 characterises fruitfulness and loading 2 principally models oak flavor components.

Identification of Peaks Associated with Wine Sensory Features

Regression results for PLS1 models of the sensory scores from the GC-MS peak table are indicated in table 2. PLS2 models of multiple sensory features were modeled based upon the sensory PARAFAC loadings; i.e. multiple sensory attributes were chosen that were modeled in the same loadings. However, PLS2 models did not improve the predictive outcomes and are therefore not considered beneficial for identifying objective measures of the sensory features. A nominal cut off of r2>0.60 has been used to identify predictive models that capture data from the GC-MS peak table that is associated with the sensory features. Sensory attributes **Confectionary, Peach, Apricot, Tropfruit, Melon, Oak** and **Char** were considered most appropriate for peak identification based upon the regression co-efficient of determination.

Peaks selected for regression modeling, peak number and associated regression coefficients (b-coefficients) are illustrated in figure 5. The regression coefficients indicate the direction of concentration of the selected compound (peak) when predicting the sensory scores. Thus in multivariate regression models, positive regression coefficients will indicate a positively correlated variable whereas negative coefficients indicate the opposite. The plots of the regression coefficients thus establishes a visual framework of the selected peaks associated with specific sensory attributes in such a way that can be used to indicate how the compounds change in concentration (and thus peak areas) when the sensory scores increase. Tentative identification of the selected peaks is presented in table 3. Compounds that correlate with the sensory features require confirmation by injection of pure compounds and comparison of Kovats Retention Indices for identification.

Table 2: Regression model parameters for PLS prediction of sensory scores from GC-MS peak table. Models with good predictive outcomes are indicated by bold text.

	Sensory Scores					
Attribute	**min**	**max**	**mean**	**r2**	**RMSEP**	**#LV**
Confectionary	0.78	4.31	2.29	0.692	0.80	5
GreenApple	1.10	3.85	2.04	0.417	0.56	5
Lemonlime	1.90	4.08	2.86	0.358	0.62	5
Grapefruit	1.43	3.78	2.16	0.252	0.38	2
Peach	1.11	4.64	2.32	0.731	0.37	2
Apricot	1.06	3.48	1.95	0.653	0.40	2
Tropfruit	0.72	5.22	2.16	0.864	0.44	4
Melon	0.83	3.64	1.81	0.642	0.40	4
Freshveg	0.28	1.98	1.04	0.519	0.35	4
Honey	0.68	2.73	1.52	0.235	0.52	2
Butter	0.66	3.75	2.13	0.593	0.57	4
Vanilla	1.11	4.11	2.38	0.578	0.62	4
Straw	1.18	3.48	2.22	0.527	0.34	4
Oak	0.88	5.30	2.78	0.692	0.64	2
Char	0.49	4.61	2.00	0.637	0.91	3
Sour	2.78	5.19	4.03	0.382	0.61	5
Bitter	1.57	3.89	2.72	0.312	0.43	5
Sweet	1.71	4.43	2.88	0.437	0.65	4
Astringent	1.65	4.50	2.88	0.332	0.49	4
CreamyMF	1.42	4.03	2.49	0.351	0.49	4

RMSEP = root mean square error of prediction LV = latent variables

Table 3: Tentative identification of peaks associated with sensory features in chardonnay wines. Peak numbers corresponds to the identity of peaks plotted in figure 5.

Peak Number	Tentative Identity	CAS
4	1,4-hexadiene	7319-00-8
6	2.4-hexadiene	5194-50-3
7	Ethyl Acetate	141-78-6
8	NID	
9	NID	
10	NID	
12	NID	
15	Butanoic acid, 3-methyl-, ethyl ester	108-64-5
17	NID	
18	Isoamyl butyrate	106-27-4
20	1-Butanol	71-36-3
23	1-Butanol, 3-methyl-	123-51-3
	1-Butanol, 2-methyl-	137-32-6
	1-Pentanol	71-41-0
24	Hexanoic acid, ethyl ester	123-66-0
	Pentanoic acid, 4-methyl-, ethyl ester	25415-67-2
26	NID	
27	Acetic acid, hexyl ester	142-92-7
	1-Pentanol, 4-methyl-	626-89-1
28	2-n-Butyl furan	4466-24-4
	Furan, 2-propyl-	4229-91-8
29	NID	
31	1-Pentanol, 4-methyl-	626-89-1
35	1-Pentanol, 4-methyl-	626-89-1
	1-Hexanol	111-27-3
36	3-Hexen-1-ol, (Z)-	928-96-1
	3-Hexen-1-ol, (E)-	928-97-2
38	1-Propanol, 3-ethoxy-	111-35-3
40	NID	
43	Furfural	98-01-1
	3-Furaldehyde	498-60-2
44	NID	
45	3(2H)-Thiophenone, dihydro-2-methyl-	13679-85-1
48	NID	
50	2,3-Butanediol	513-85-9
54	NID	
56	NID	
58	NID	

Table 3 Continued		
Peak Number	**Tentative Identity**	**CAS**
60	Benzeneacetaldehyde	122-78-1
61	NID	
64	NID	
65	1-Propanol, 3-(methylthio)-	505-10-2
67	NID	
69	NID	
75	Hexanoic acid	142-62-1
76	NID	
78	cis-3-Methyl-4-octanolide	39638-67-0
79	NID	
82	Phenylethyl Alcohol	60-12-8
	Benzeneacetaldehyde	122-78-1
84	Phenylethyl Alcohol	60-12-8
	Benzeneacetaldehyde	122-78-1
87	NID	
90	NID	
91	NID	
99	NID	
103	NID	
105	NID	
108	NID	
109	NID	
115	NID	
116	NID	
118	Ethyl hydrogen succinate	1070-34-4
120	NID	
123	Benzoic acid, 4-hydroxy-3-methoxy-, methyl ester	3943-74-6

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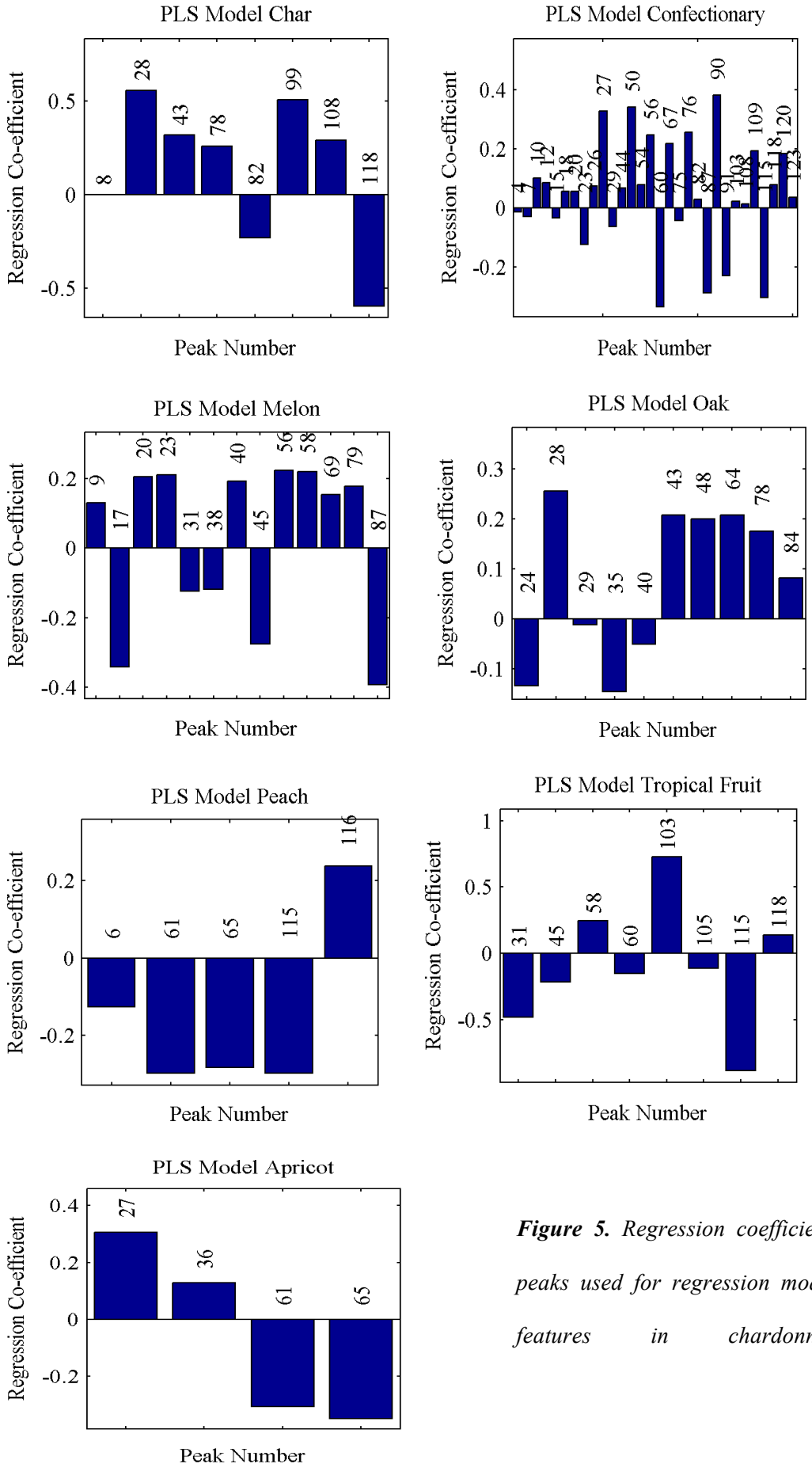


Figure 5. *Regression coefficients of selected peaks used for regression models of sensory features in chardonnay wines.*

PART 7: CHARDONNAY ATTITUDES – QUANTITATIVE SURVEY

Authors: Ms Jasmine B. Thomas and A/Prof Anthony Saliba

Results and Interpretation

Main messages

Purchasing

- 72% of participants purchase Chardonnay
- Participants were most likely to purchase Chardonnay for at home consumption, to pay approximately $14, and to purchase from large national general retailers

Consumption

- 76% of participants consume Chardonnay
- Sauvignon Blanc and Chardonnay account for most of the white wine consumption of participants (24.0 and 23.4% respectively)

Current Perceptions

- The vast majority of participants like and have a positive perception of Chardonnay
- Chardonnay is considered to be characterised by full, lingering, and fruity flavours, as well as yellow colour
- Compared to other white wine varieties, Chardonnay is considered to be liked more by women than by men, to go well with food, and to be mainstream and widely recognised
- 31% of participants were unaware that Chardonnay is used in sparkling wines
- Chardonnay is associated with dinner parties and at home consumption

Sources of Current Perceptions

- Perceptions are the result of personal experience with Chardonnay products as opposed to popular culture, such as 'Kath and Kim'

'Stickiness' of Current Perceptions

- Consumers believe that there is potential for their perceptions to improve because they are willing to try Chardonnay products new to them and that others recommend
- Attitudes toward Chardonnay have not changed in the previous 5-10 years

Potential Means of Change in Perceptions

- Participants were indifferent as to whether

the Chardonnay they consume is produced domestically or is imported

Patterns of Chardonnay Consumption and Purchasing

Of the overall sample, 75.9% of participants indicated that they personally consume Chardonnay products, whilst 72.0% indicated that they personally purchase Chardonnay products.

Chardonnay Consumption

Preference for Chardonnay was assessed indirectly by asking all participants what percentage of their normal volume consumption of white wine over the last 12 months is accounted for by various varieties (Table 1). Participants indicated that Sauvignon Blanc (24.0%) and Chardonnay (23.4%) account for the majority, and approximately the same amount, of their white wine consumption.

Table 1: Consumption of White Wine Varieties

Variety	Mean (%)	SD	SE
Sauvignon Blanc	24.0	26.0	0.6
Chardonnay	23.4	25.2	0.6
Sparkling	15.3	22.3	0.5
Riesling	9.1	16.3	0.4
Chardonnay blends	6.3	11.4	0.3
Semillon	5.9	10.4	0.2
Pinot Gri/Grigio	5.4	10.9	0.2
Savagnin	2.0	7.0	0.2
Viogneir	1.5	4.1	0.1

The following results reported in this section relate to the 75.9% of participants indicating that they personally consume Chardonnay. As Table 2 shows, there was a relatively even distribution of participants consuming Chardonnay in the categories between 'several times a week' and 'once a month'. Participants were least likely to consume Chardonnay on a daily basis (2.3%).

In order to further explore consumption of Chardonnay, participants were asked to divide their normal volume of Chardonnay consumption over the last 12 months between various styles of Chardonnay. As Table 3 shows, straight Chardonnay products account for the vast majority of Chardonnay consumption (66.4%). Results also indicate that participants consume an average of 2.5 bottles (SD = 3.5) and 0.3 casks (SD = 1.2) of Chardonnay in a typical month.

Table 2: Frequency of Chardonnay Consumption

Frequency	n	%
Everyday	36	2.3
Several times a week	307	20.0
Once a week	298	19.4
Once a fortnight	258	17.0
Once a month	282	18.3
Once every two months	153	10.0
Less than every two months	203	13.2

Table 3: Consumption of Chardonnay Products by Style

Chardonnay Style	M (%)	SD (%)
Chardonnay	66.4	29.6
Chardonnay blends	18.1	20.5
Sparkling Chardonnay	15.5	23.0

Chardonnay Purchasing

The 72.0% of participants indicating that they personally purchase Chardonnay were asked: when you purchase Chardonnay, what percentage is for the following reason? The results indicate that normal at home consumption is the primary reason for Chardonnay purchasing (64.4%)(Table 4). All other reasons received a mean score of 10% or less, with participants least likely to purchase Chardonnay for home cellaring (1.8%).

Table 4: Reasons for Chardonnay Purchasing

Purchase Reason	M (%)	SD (%)
For normal at home consumption	64.4	33.7
Away from home with others	10.1	17.1
Away from home when dining	10.1	16.9
Celebration occasion	6.7	12.9
Gift for someone	5.7	13.1
Cellaring (ageing) the wine at home	1.8	6.8

All participants were asked how much they pay for Chardonnay and Chardonnay blends for the aforementioned purchase reasons. Table 5 demonstrates that participants on average pay more for Chardonnay products than for Chardonnay blends. When purchasing Chardonnay as a gift, cellaring or to celebrate consumers pay 25% more (approximately $20)

than they do for their own at home consumption ($14.30). The column indicating the number of participants purchasing for each reason provides insight also, showing that participants may spend 25% less on their own at home consumption, however this is the reason they are most likely to have for Chardonnay purchasing (n = 1397) and least likely to purchase for cellaring (n = 393).

Participants were asked to indicate what percentage of their overall Chardonnay purchasing takes place at various locations. As Figure 1 shows, half of all Chardonnay purchasing (M = 50.2%, SD = 38.7%) takes place at large national general liquor store retailers, followed by supermarkets or grocery stores (M = 16.0%, SD = 27.9%). All other locations only accounted for 10% or less of overall purchasing, and participants were least likely to purchase Chardonnay at bars or pubs (M = 3.7%, SD = 11.9%).

Participants were asked how often they purchase Chardonnay and find that it has a fault or taint, and how often they return Chardonnay because of a fault or taint. The results, as demonstrated in Figure 2, show that approximately 43% of participants have purchased Chardonnay that is faulty or tainted, however, only approximately 27.1% have ever returned Chardonnay products on the basis of a fault or taint.

Participants were asked to indicate how much they expect to pay for Chardonnay as compared to other white wine varieties on a seven-point likert scale (much less = 1, the same = 4, much more = 7). The results indicate that consumers expect to pay the same for Chardonnay products as they do for other white wine varieties (M = 4.0, SD = 0.9).

Table 5: Chardonnay and Chardonnay Blends Purchasing

	N	Min ($)	Max ($)	M ($)	SD ($)
Chardonnay					
Gift for someone	820	1.0	160.0	20.3	13.7
Cellaring (ageing) the wine at home	393	1.0	124.0	20.0	17.3
Celebration occasion	822	1.0	150.0	19.3	13.3
Away from home when dining	936	0.1	120.0	18.8	11.0
Away from home with others	867	1.0	120.0	16.0	9.9
For normal at home consumption	1397	1.0	200.0	14.3	11.6
Chardonnay Blends					
Gift for someone	668	0.5	130.0	18.5	13.1
Celebration occasion	618	1.0	190.0	18.1	14.9
Away from home when dining	680	0.1	130.0	17.2	12.4
Cellaring (ageing) the wine at home	330	1.0	130.0	17.0	14.7
Away from home with others	703	0.0	160.0	14.6	11.6
For normal at home consumption	1212	0.1	200.0	12.7	11.3

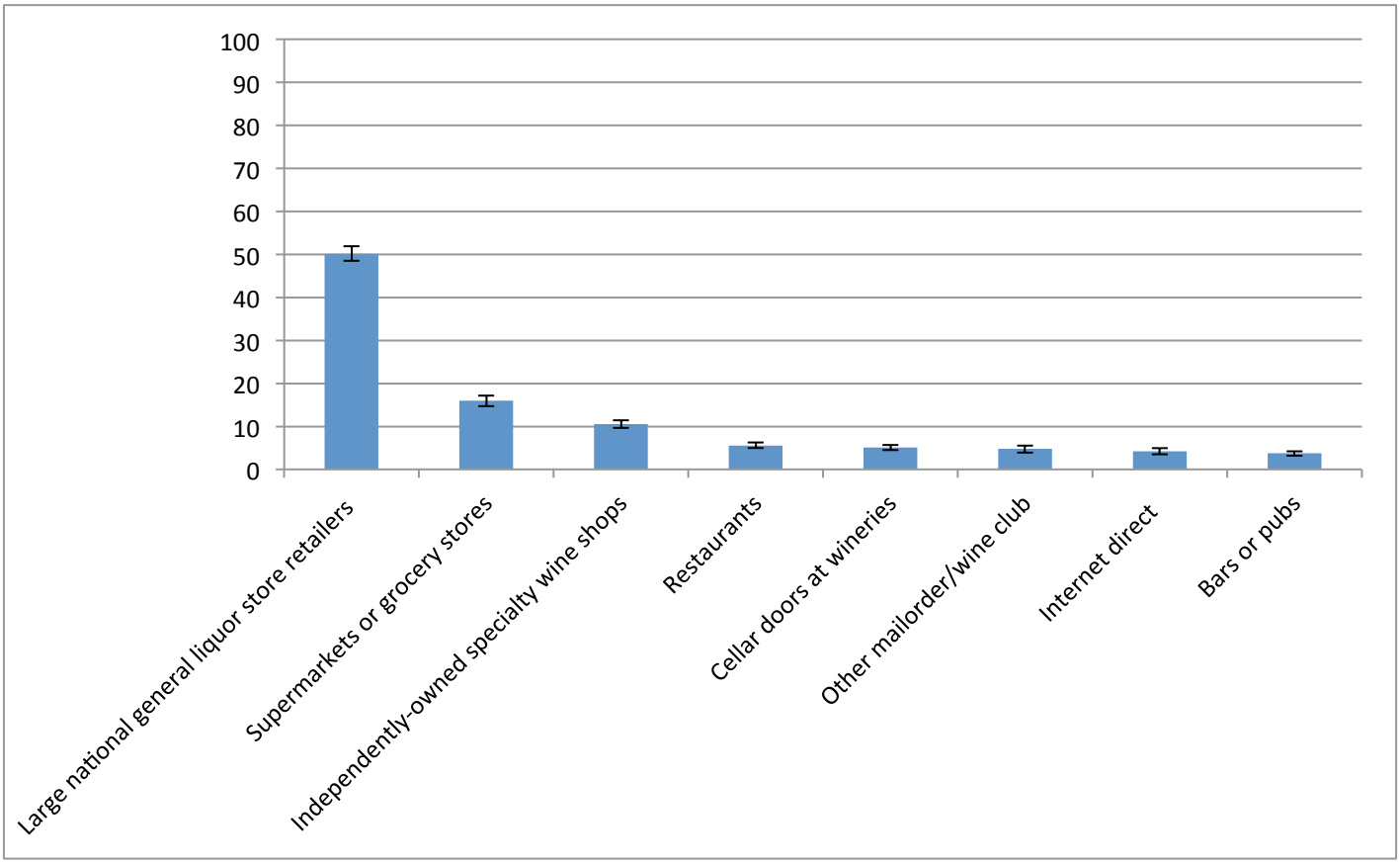


Figure 1: Chardonnay Purchase by Location – Mean and 2*SE

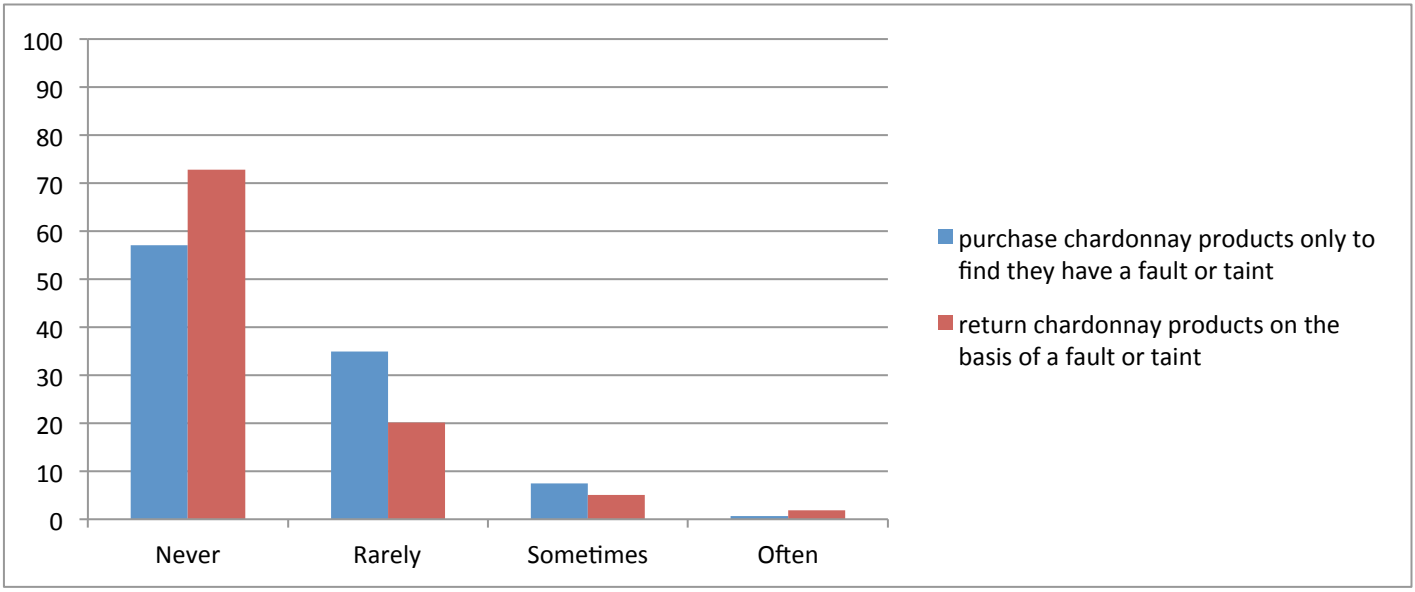


Figure 2: 'How often do you...' – Percent of overall sample

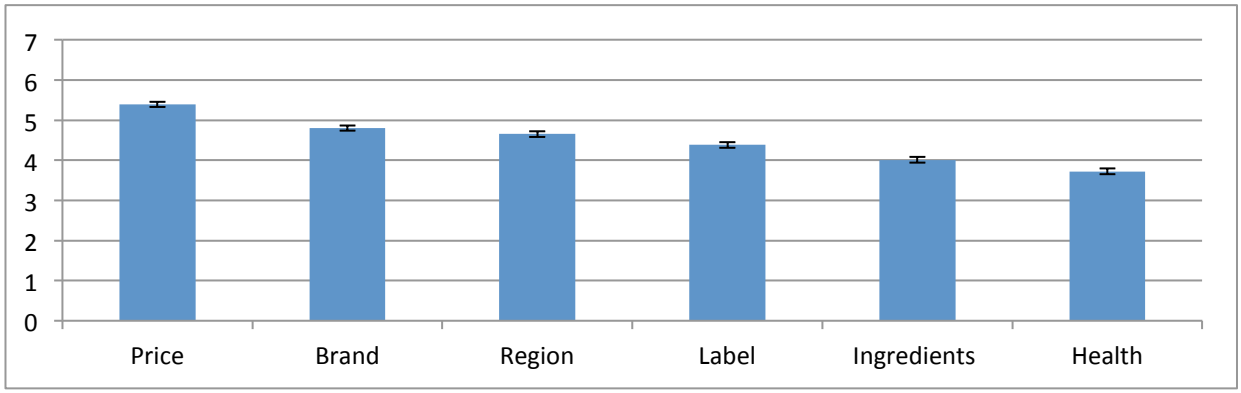


Figure 3: Choice factors for Chardonnay – Means and 2*SE

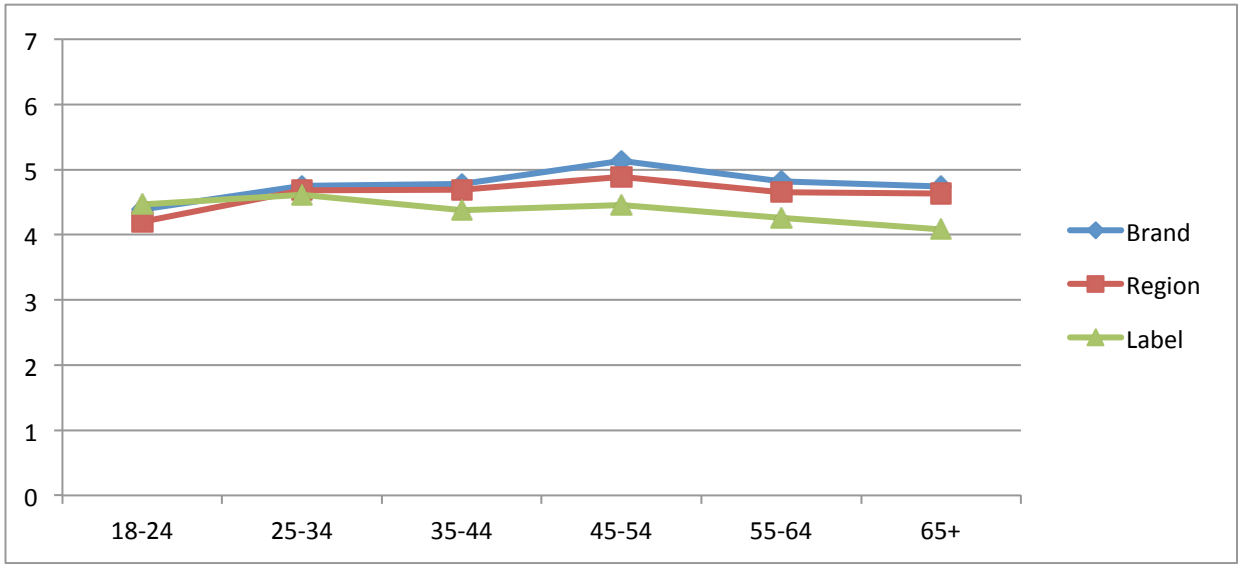


Figure 4: Age comparisons for choice factors

Participants were asked to respond to a series of wine choice statements in relation to Chardonnay (as shown in Figure 3) on a seven-point likert scale (strongly disagree = 1, indifferent = 4, and strongly agree = 7). As Figure 3 shows, price (M = 5.4, SD = 1.5), brand (M = 4.8, SD = 1.6), and region (M = 4.65, SD = 1.6) were considered to be the only agreeable choice factors.

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the choice factors. In relation to gender main effects, females were more likely than males to consider brand (F (1, 2012) = 9.0, p=.003, partial et squared = .004) and price (F (1, 2012) = 9.6, p=.002, partial eta squared = .01) to be important choice factors. An interaction effect was identified in which male participants aged 18-24 were significantly more likely than males aged 55-64 to consider health an important choice factor (F (5, 972) = 2.7, p=.02, eta squared = .01).

In relation to age main effects, significant

differences were identified for 3 choice factors. As Figure 4 shows, the factor 'label' was characterised by younger participants being more likely to agree than older participants (F (5, 2012) = 4.1, p=001, partial eta square = .01). Brand was considered significantly less important to participants aged 18-24 than to those aged 35-64, and participants aged 65+ considered it more important than those aged 18-44 (F (5, 2012) = 5.6, p<.001, partial eta squared = .01). Finally, participants aged 18-24 were significantly less likely than all other age groups to consider region in their choice of Chardonnay (F (5, 2012) = 4.8, p<.001, partial eta squared = .01).

Current Perceptions of Chardonnay

Participants were asked directly if they like Chardonnay. The vast majority of participants indicated that they like Chardonnay (74.5%).

Participants were asked to respond to the statement 'I limit or avoid drinking Chardonnay because...' followed by a series of five experience related factors (as shown in Figure 5) on a five-point likert scale (strongly disagree = 1, indifferent = 3, and strongly agree = 5). As Figure 5 shows, the overall mean score for each of the factors were between 2.4 and 2.9, indicating indifference to the factors.

Comparisons were then made for each factor on the basis of gender (Figure 6). The only significant difference found was for the item 'I limit or avoid drinking Chardonnay because of negative past experiences'. Females (M = 2.5, SD = 1.3) were more likely to avoid Chardonnay because of negative past experiences than males (M = 2.3, SD = 1.2); t (2021.5) = 3.6, p<.001, mean difference = .2, 95% CI: -.32 to -.09, eta squared = .01 (equal variance not assumed).

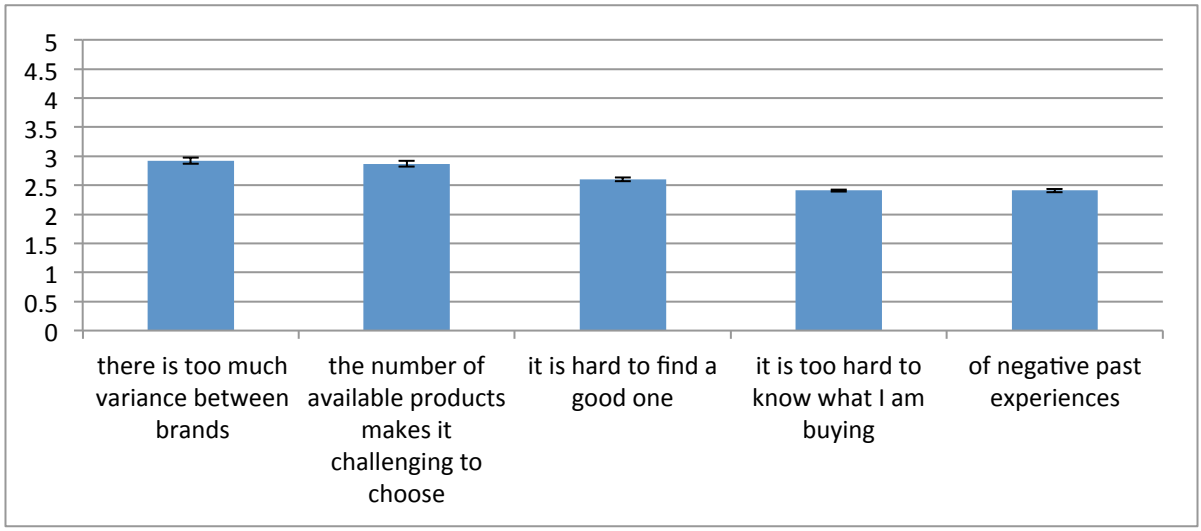


Figure 5: 'I limit or avoid drinking Chardonnay because...' – Mean and 2*SE

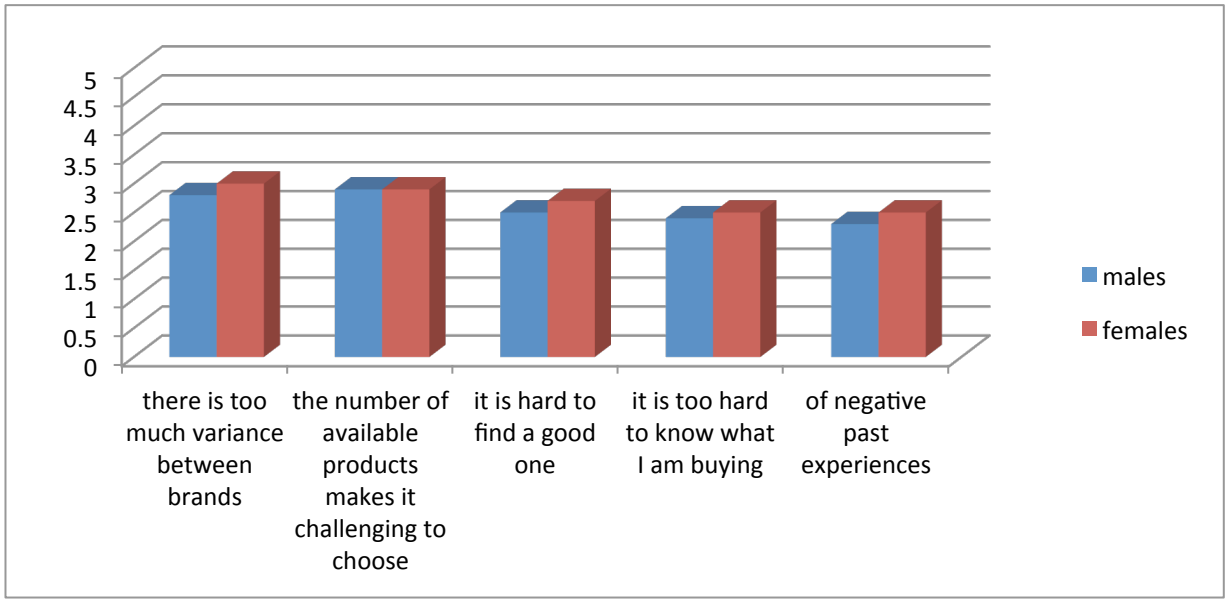


Figure 6: *Gender comparison for 'I limit or avoid drinking Chardonnay because...' – Mean*

A series of one-way ANOVA's were conducted to assess age differences for each of the factors. Figure 7 highlights an experience trend in which the older three categories (ages 45-65+) were more likely to disagree with each factor than the younger three categories (ages 18-44). Significant differences were identified in terms of age for each factor (Table 6).

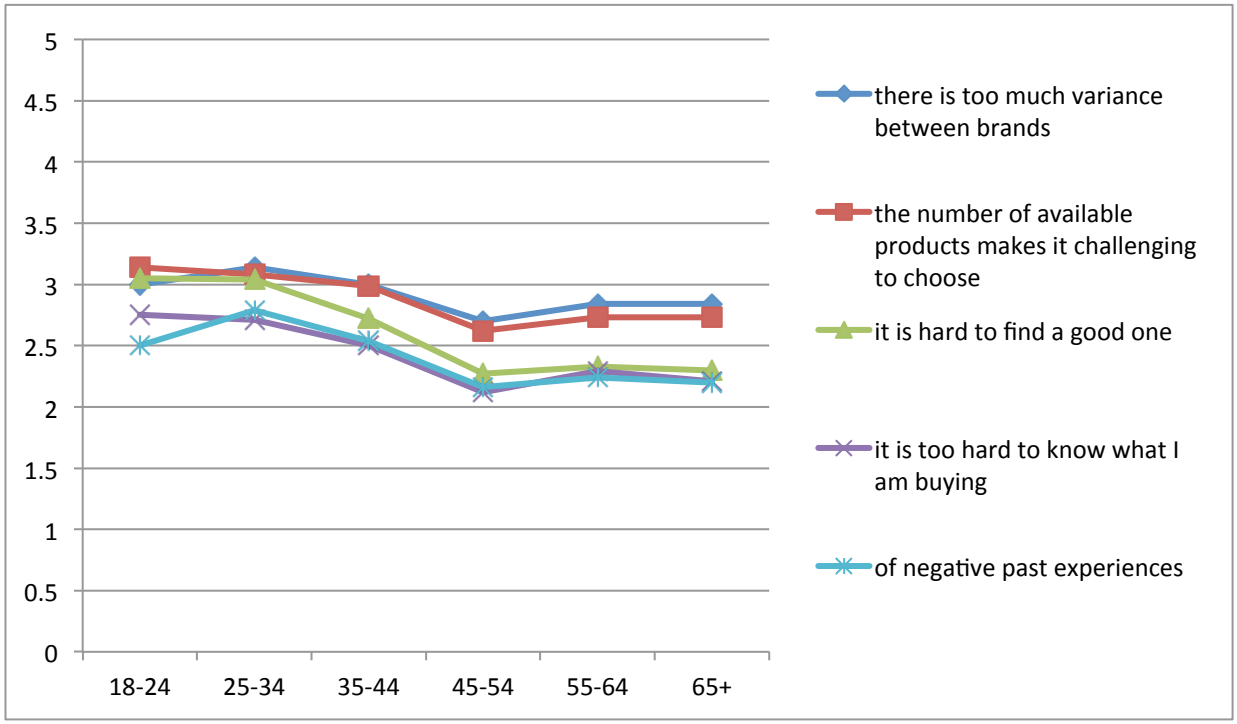


Figure 7: *Age comparison for 'I limit or avoid drinking Chardonnay because...' – Mean*

Table 6: Significant Differences for Age Comparison of *'I limit or avoid drinking Chardonnay because...'*

I limit or avoid drinking chardonnay because	**Significance**
there is too much variance between brands	F (5, 2018) = 6.92, p<.001, eta squared = .02
the number of available products makes it challenging to choose	Welch F (5, 887.5) = 10.81, p<.001, eta squared = .03
it is hard to find a good one	Welch F(5, 889.1) = 31.44, p<.001, eta squared = .07
it is too hard to know what I am buying	Welch F (5, 889.8) = 20.98, p<.001, eta squared = .05
of negative past experiences	F (5, 2018) = 22.17, p<.001, eta squared = .03

Adverse reactions to wine, such as headaches and illness, are generally associated with allergies. As such, the survey asked participants to respond on a five-point likert scale (strongly disagree = 1, indifferent = 3, and strongly agree = 5) to the item: I limit or avoid drinking Chardonnay because I have an allergy to it. Calculation of mean scores indicated that participants do not limit or avoid consumption of Chardonnay because of allergic reactions (M = 1.5, SD = 0.9).

Participants were asked to indicate which factors they believe to be characteristic of Chardonnay on a seven-point likert scale (strongly disagree = 1, indifferent = 4, and strongly agree = 7).

Figure 8 shows the overall means for each of the factors. Participants indicated that they believe Chardonnay is characterised by full flavour (M = 4.8, SD = 2.4), lingering flavour (M = 4.7, SD = 1.3), yellow colour (M = 4.5, SD = 1.5), and fruity flavours (M = 4.4, SD = 1.5). Participants disagreed with the notion of Chardonnay being characterised by bitterness (M = 3.2, SD = 1.6) or vinegar (M = 3.0, SD = 1.6).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the Chardonnay characteristic factors. In relation to gender main effects, males were more likely than females to consider Chardonnay to be characterised by vinegar (F (1, 2012) = 7.1, p=.008, partial eta squared = .004), sharpness (F (1, 2012) = 8.6, p=.003, partial eta squared =.004), bitterness (F (1, 2012) = 17.3, p<.001, partial eta squared = .01), sweetness (F (1, 2012) = 26.1, p<.001, partial eta squared = .01), fruity flavours (F (1, 2012) = 8.6, p=.003, partial eta squared = .004), and a heavy feeling in the mouth (F (1, 2012) = 10.2, p=.001, partial eta squared = .01). An interaction effect was identified for the characteristic oak in which females aged 25-54 were more likely to consider Chardonnay to be characterised by oak than females outside of this age group (Figure 9).

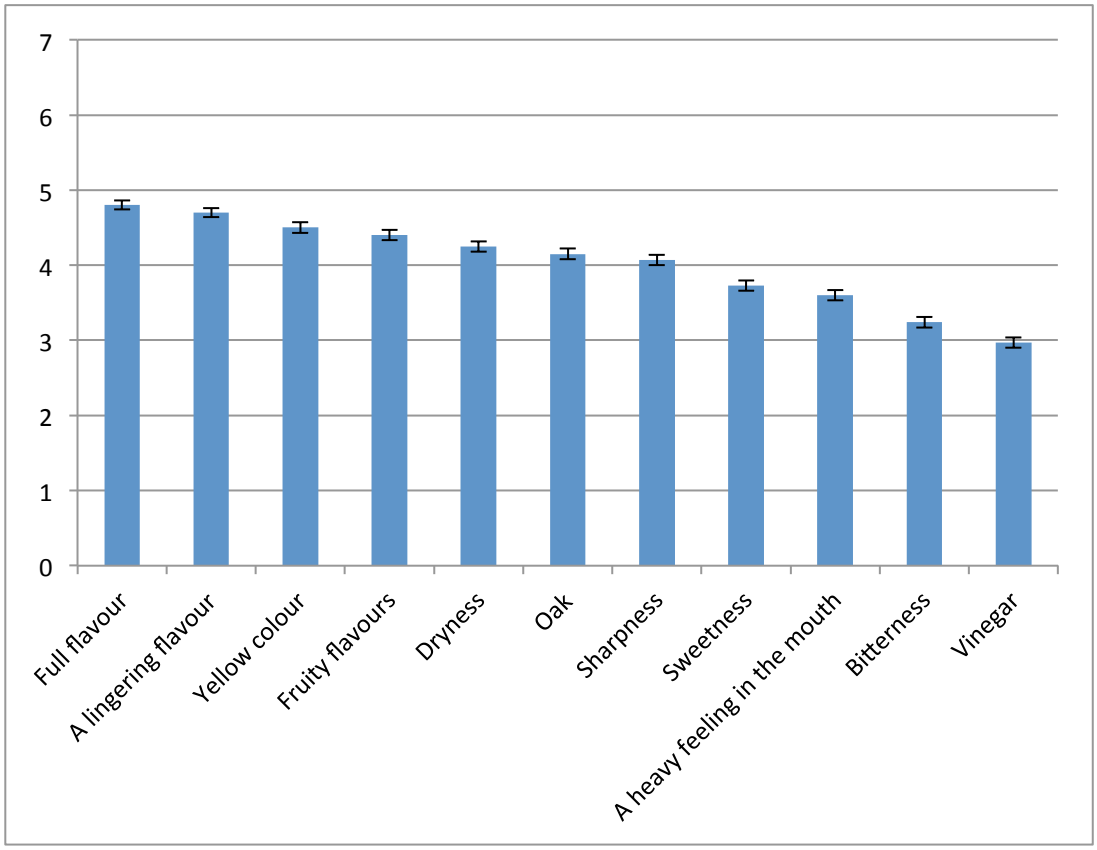


Figure 8: *Chardonnay Characteristics – Mean and 2*SE*

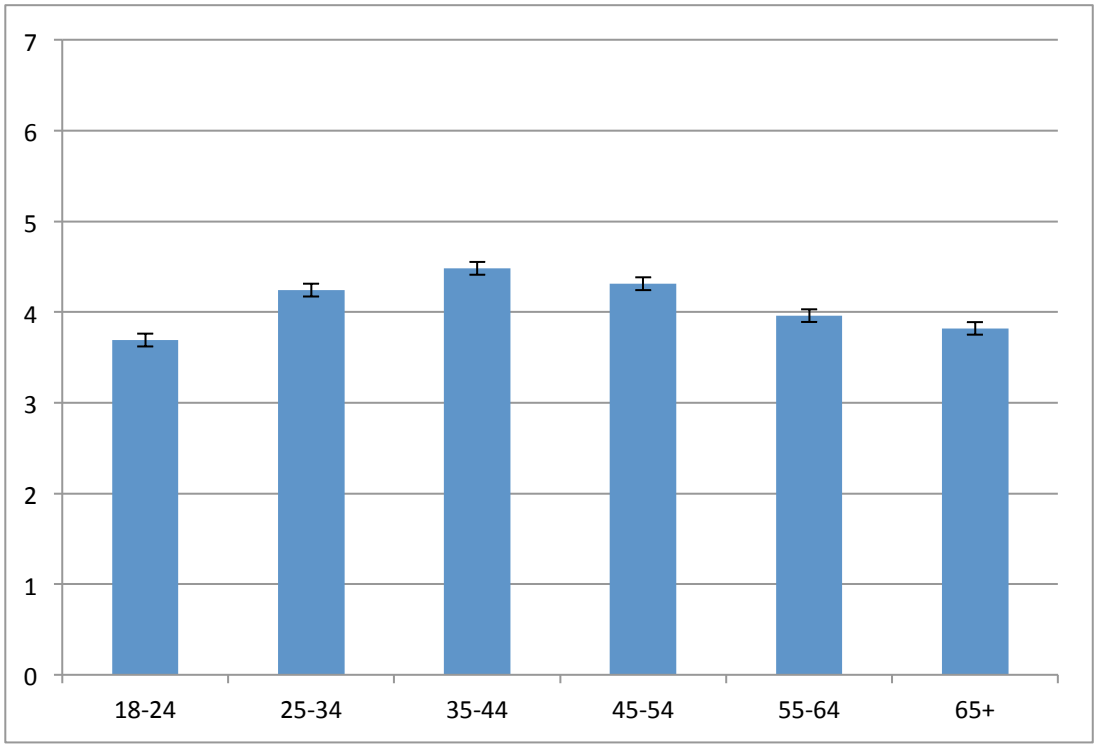


Figure 9: *Oak as Chardonnay Characteristic Based on Age – Female Means and 2*SE*

In relation to age main effects, significant differences were identified for all factors except oak, fruity flavours, and a lingering flavour (Table 7). As Figure 10 shows, there was a consistent bipolarisation between the younger age categories and the older age categories. In all factors except for dryness and full flavour, the younger participants were more likely to rate factors higher than the older participants. The opposite trend was identified for the full flavour factor. Finally, in relation to the factor dryness, participants aged 25-64 were more likely to characterise Chardonnay as dry than participants outside of this age group.

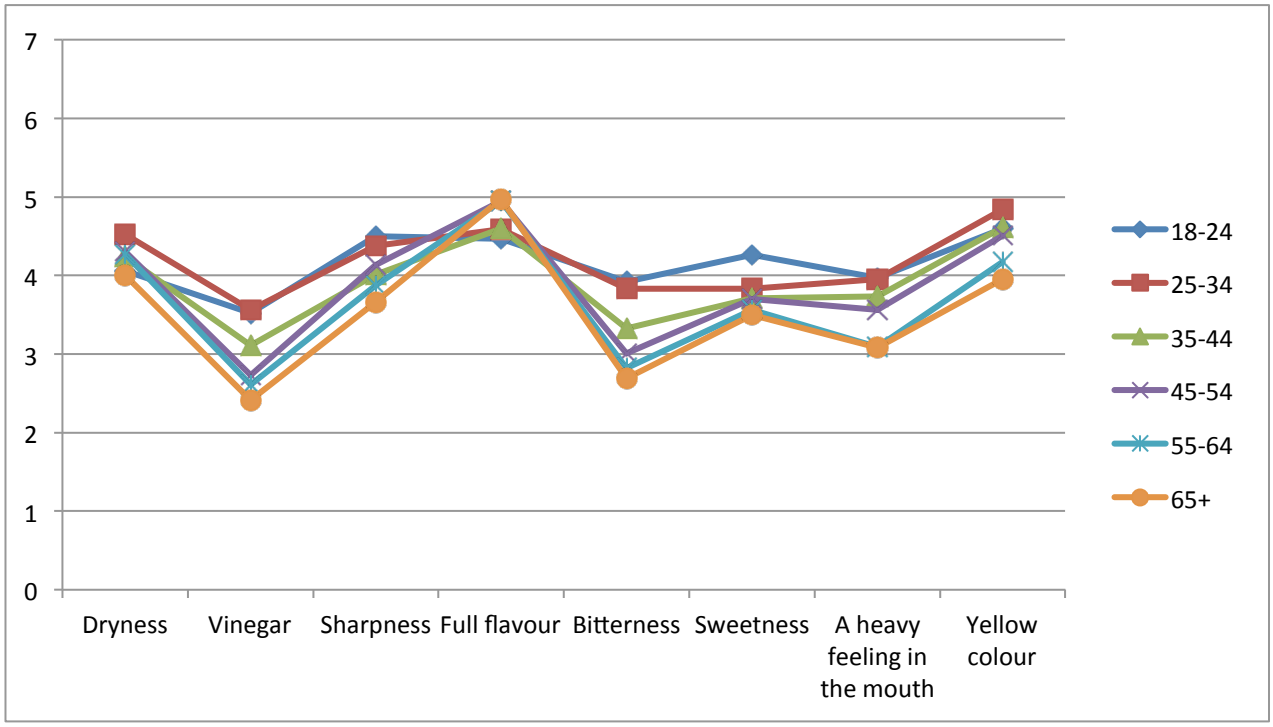


Figure 10: *Age comparison for 'I believe Chardonnay is Characterised by...'*

Table 7: Significant Differences for Age Comparison of *'I believe Chardonnay is characterised by...'*

I believe that Chardonnay is characterised by	**Significance**
Dryness	F (5, 2012) = 5.4, p<.001, partial eta squared = .01
Vinegar	F (5, 2012) = 33.3, p<.001, partial eta squared = .08
Sharpness	F (5, 2012) = 14.8, p<.001, partial eta squared = .04
Full Flavour	F (5, 2012) = 8.3, p<.001, partial eta = .02
Bitterness	F (5, 2012) = 37.4, p<.001, partial eta squared = .09
Sweetness	F (5, 2012) = 9.2, p<.001, partial eta squared = .02
A heavy feeling in the mouth	F (5, 2012) = 22.6, p<.001, partial eta squared = .05
Yellow colour	F (5, 2012) = 17.3, p<.001, partial eta squared = .4

Participants were asked to indicate their level of agreement with a series of statements starting with 'Compared to other white wine varieties, Chardonnay...'. As Figure 11 demonstrates, the most agreeable factors were Chardonnay is: liked more by women than it is by men (M = 5.1, SD = 1.3), goes well with food (M = 5.0, SD = 1.3), and is mainstream and widely recognised (M = 5.0, SD = 1.3). The least agreeable factors were Chardonnay: is easier to buy because the name is easier to pronounce (M = 3.42, SD = 1.7), and cannot compete (M = 2.5, SD = 1.4).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the above factors. In relation to gender main effects, males were more likely than females to consider Chardonnay to be; easier to buy because they can pronounce the name (F (1, 2012) = 12.1, p=.001, partial et squared = .01), and their first preference (F (1, 2012) = 9.7, p=.002, partial eta squared = .01).

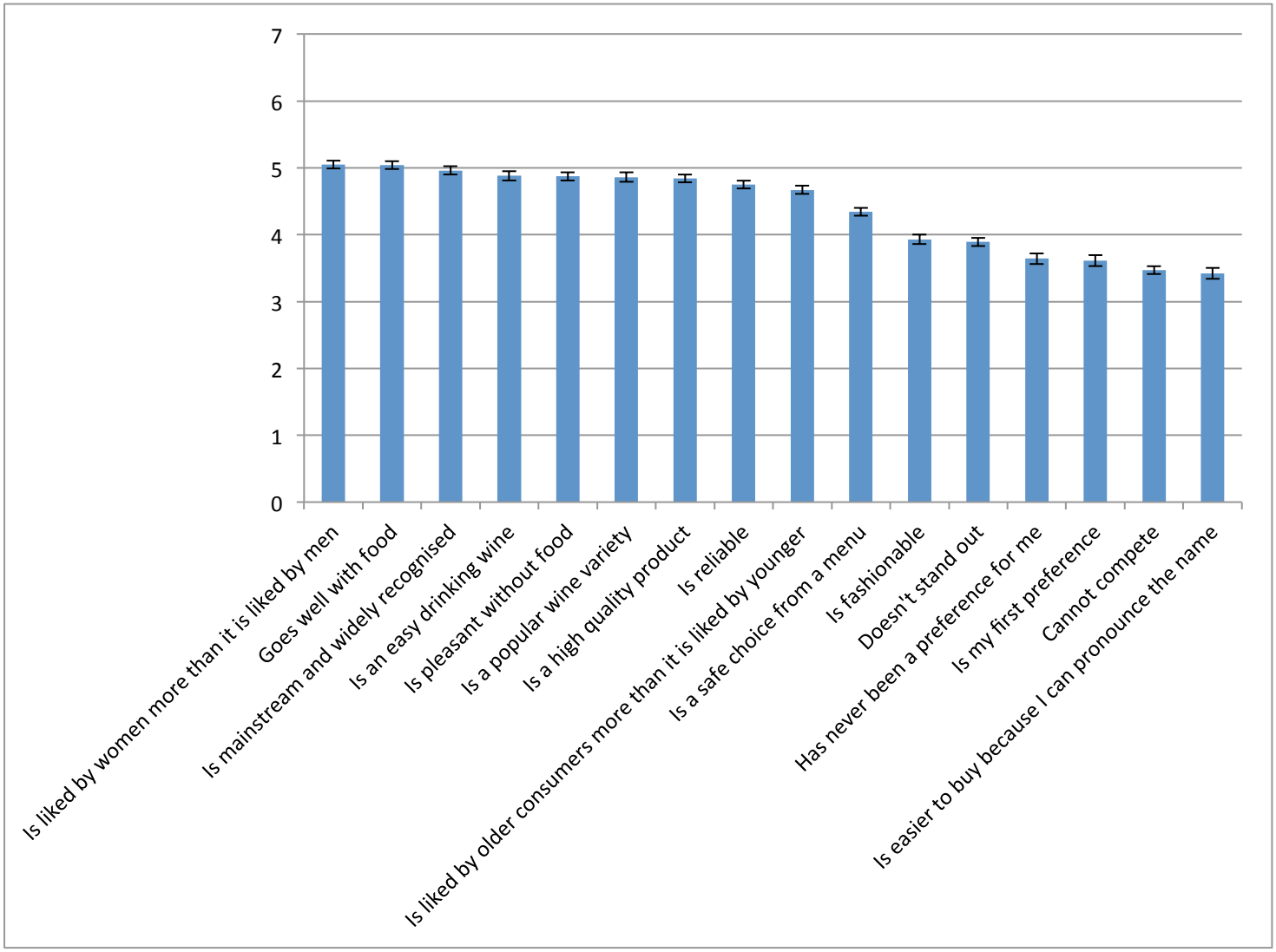


Figure 11: *'Compared to other white wine varieties, Chardonnay...' - Means and 2*SE*

Conversely, females were more likely than males to consider Chardonnay to; be liked by older consumers more than younger consumers (F (1, 2012) = 12.0, p=.001, partial eta squared = .01), be liked by women more than men (F (5, 2012) = 81.6, p<.001, partial eta squared = .04), go well with food (F (1, 2012) = 4.3, p=.04, partial eta squared =.002), and be a mainstream and widely recognised (F (1, 2012) = 25.1, p<.001, partial eta squared = .01).

An interaction effect was identified for two factors. Firstly, older male participants were more likely to consider Chardonnay to be a popular wine variety than younger male participants (F (5, 972) = 6.2, p<.001, eta squared = .03). Secondly, female participants aged 25-44 were less likely than other female participants to consider Chardonnay to be a popular wine variety (Welch F (5, 442.9) = 10.9, p<.001, eta squared = .05) or a safe choice from a menu (F (5, 1040) = 6.3, p<.001, eta squared = .03).

In relation to age main effects, significant differences were identified for 11 of the 16 factors (Table 8 below). As Figures 12 and 13 show, 10 of the 11 factors were characterised by polarisation between the younger age categories and the older age categories. Figure 12 shows the factors in which younger participants were significantly more likely to agree than older participants, and Figure 13 shows factors in which older participants were significantly more likely to agree than younger participants. Finally, participants aged 25-34 were more likely to consider Chardonnay to be liked by older consumers than participants aged 65+ (F (5, 2012) = 2.6, p=.02, partial eta squared = .01).

Table 8: Significant Differences for Age Comparison of *'Compared to other white wine varieties, Chardonnay...'*

Compared to other white wine varieties, Chardonnay	**Significance**
Is liked by older consumers more than younger consumers	F (5, 2012) = 2.6, p=.02, partial eta squared = .01
Is reliable	F (5,2012) = 10.2, p<.001, partial eta squared = .03
Goes well with food	F (5, 2012) = 18.8, p<.001, partial eta squared = .05
Is pleasant without food	F (5, 2012) = 10.9, p<.001, partial eta squared = .03
Is a high quality product	F (5, 2012) = 11.5, p<.001, partial eta squared = .03
Is an easy drinking wine	F (5, 2012) = 15.7, p<.001, partial eta squared = .04
Is easier to buy because I can pronounce the name	F (5, 2012) = 13.8, p<.001, partial eta squared = .03
Has never been a preference for me	F (5, 2012) = 13.3, p<.001, partial eta squared = .03
Doesn't stand out	F (5, 2012) = 7.5, p<.001, partial eta squared = .02
Is mainstream and widely recognised	F (5, 2012) = 4.8, p<.001, partial eta squared = .01
Cannot compete	F (5, 2012) = 7.0, p<.001, partial eta squared = .02

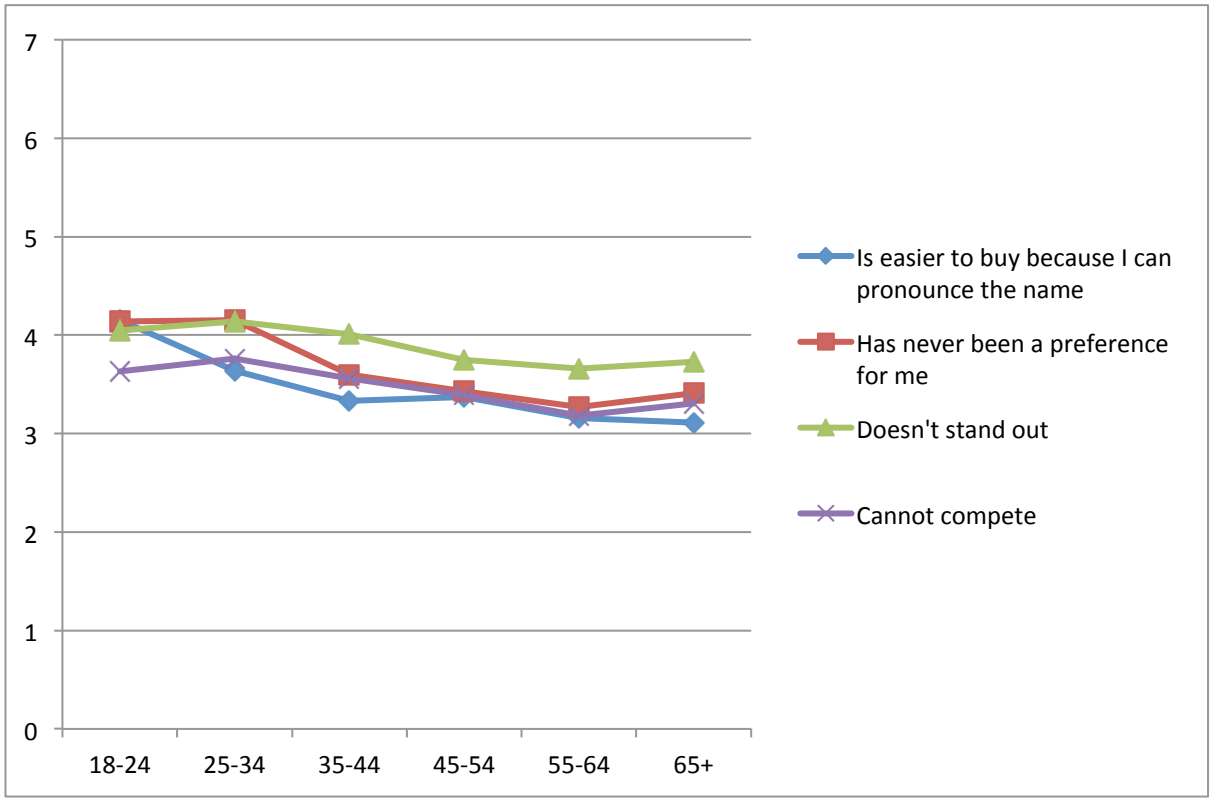


Figure 12: *Chardonnay factors that younger participants are more likely to agree with*

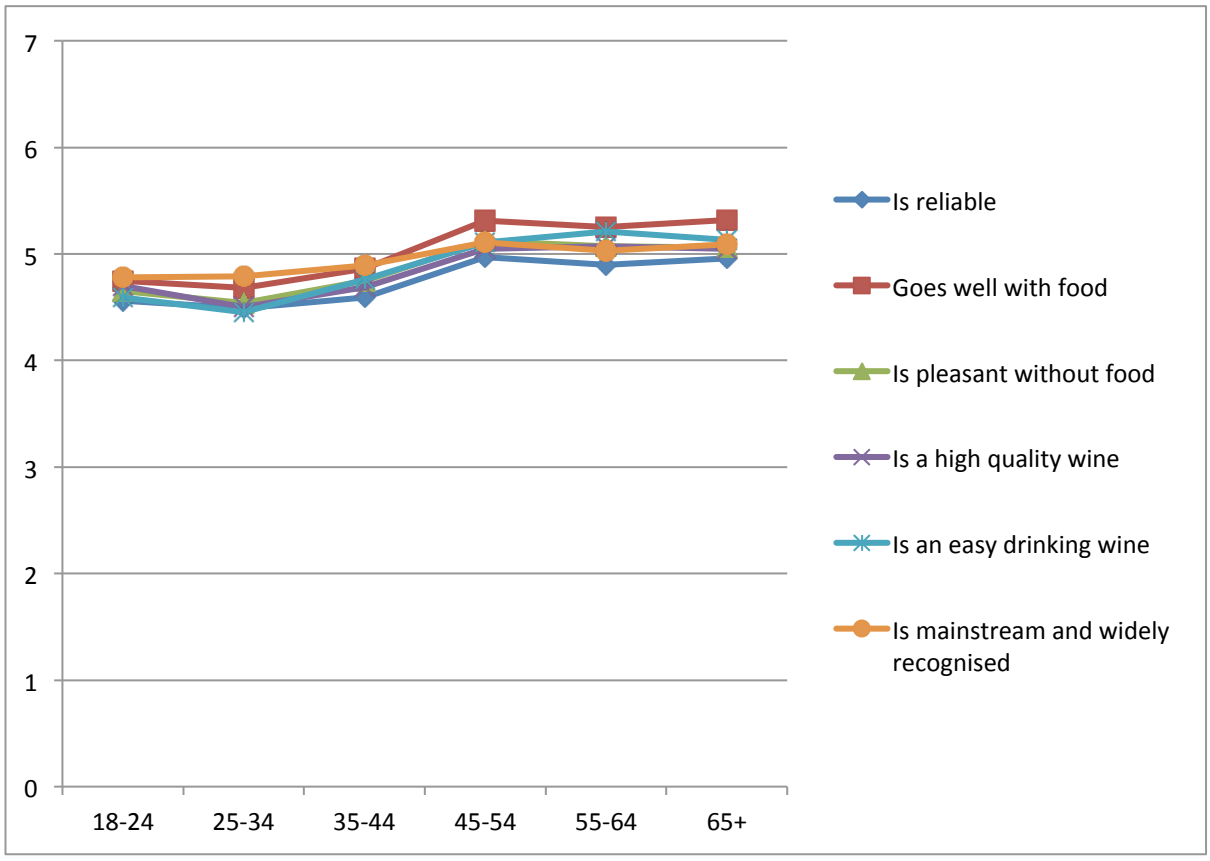


Figure 13: *Chardonnay factors that older participants are more likely to agree with*

The results indicated that 31% of consumers are unaware that Chardonnay is used in sparkling wines. Of the 69% of participants who were aware that Chardonnay is used in sparkling wines, participants indicated they believe that 49.6% of all sparkling wine contains Chardonnay. They also indicated that within sparkling products containing Chardonnay, Chardonnay accounts for 49.6% of the contents.

Participants were asked to indicate whether they had a positive or negative perception of various white wine varieties on a seven-point likert scale (negative = 1, neutral = 4, and positive = 7). As Figure 14 shows, participants indicated neutral perceptions for the majority of varieties. However, participants indicated relatively positive perceptions toward three of the varieties; Sauvignon Blanc (M = 5.2, SD = 1.5), Sparkling (M = 5.0, SD = 1.7), and Chardonnay (M = 4.8, SD = 1.8).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the white wine varieties. In relation to gender main effects, females were more likely than males to have positive perceptions of Pinot Gris/Grigio (F (5, 2012) = 9.6, p=.002, partial eta squared = .01), Sauvignon Blanc (F (1, 2012) = 6.8, p = .009, partial eta square = .00), and Sparkling (F (1, 2012) = 81.4, p<.001, partial eta squared = .04).

In relation to age main effects, significant differences were identified for all varieties except Riesling. As Figures 15 shows, Chardonnay (F (5, 2012) = 6.7, p<.001, partial eta squared = .02) was more likely to be perceived positively by older participants, whilst Sparkling (F (5, 2012) = 14.4, p<.001, partial eta squared = .3), Viognier (F (5, 2012) = 6.2, p<.001, partial eta squared = .02), and Savagnin (F (5, 2012) = 2.6, p=.03, partial eta square = .01) were more liked to be perceived positively by younger participants.

As Figure 16 shows, participants aged 45-54 had more positive perceptions toward Chardonnay blends than those aged 25-34 and 65+ (F (5, 2012) = 3.6, p=.003, partial eat squared = .01). Participants aged 25-44 perceived Pinot Gris/Grigio more positively than those aged 55-64 (F (5, 2012) = 6.8, p<.001, partial eta squared = .02). Participants aged 35-44 perceived Semillon more positively than those aged 55-64 (F (5, 2012) = 3.8, p=.002, partial eta square = .01). Finally, participants aged 25-34 perceived Sauvignon Blanc more positively than those aged 55-64 (F (5, 2012) = 2.6, p=.03, partial eta square = .01).

Participants were asked to indicate the extent to which they associate various factors with Chardonnay consumption on a seven-point likert scale (1 = strongly disagree, 4 = indifferent, and 7 = strongly agree). As Figure 17 shows, dinner parties (M = 4.5, SD = 1.3) and at home consumption (M = 4.5, SD = 1.4) were the only factors considered to be associated with Chardonnay consumption.

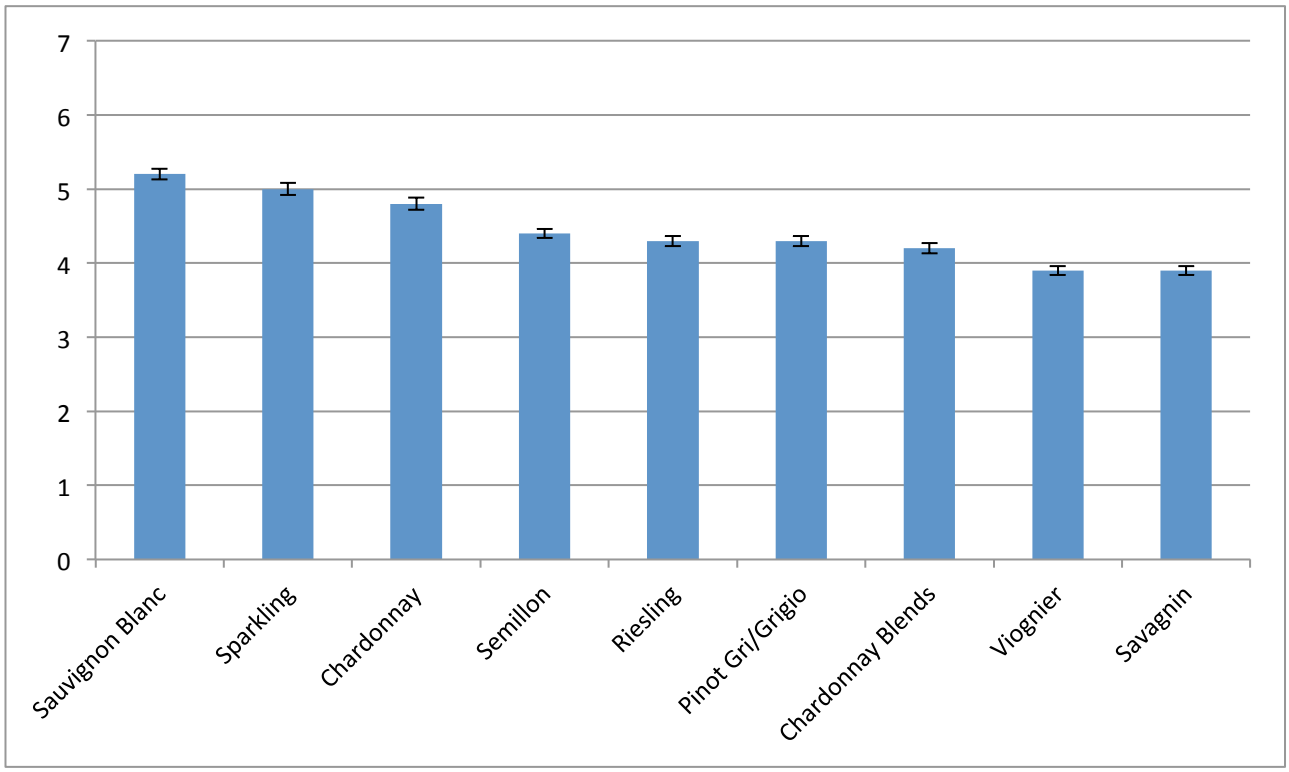


Figure 14: *Attitudes toward white wine varieties - Mean and 2*SE*

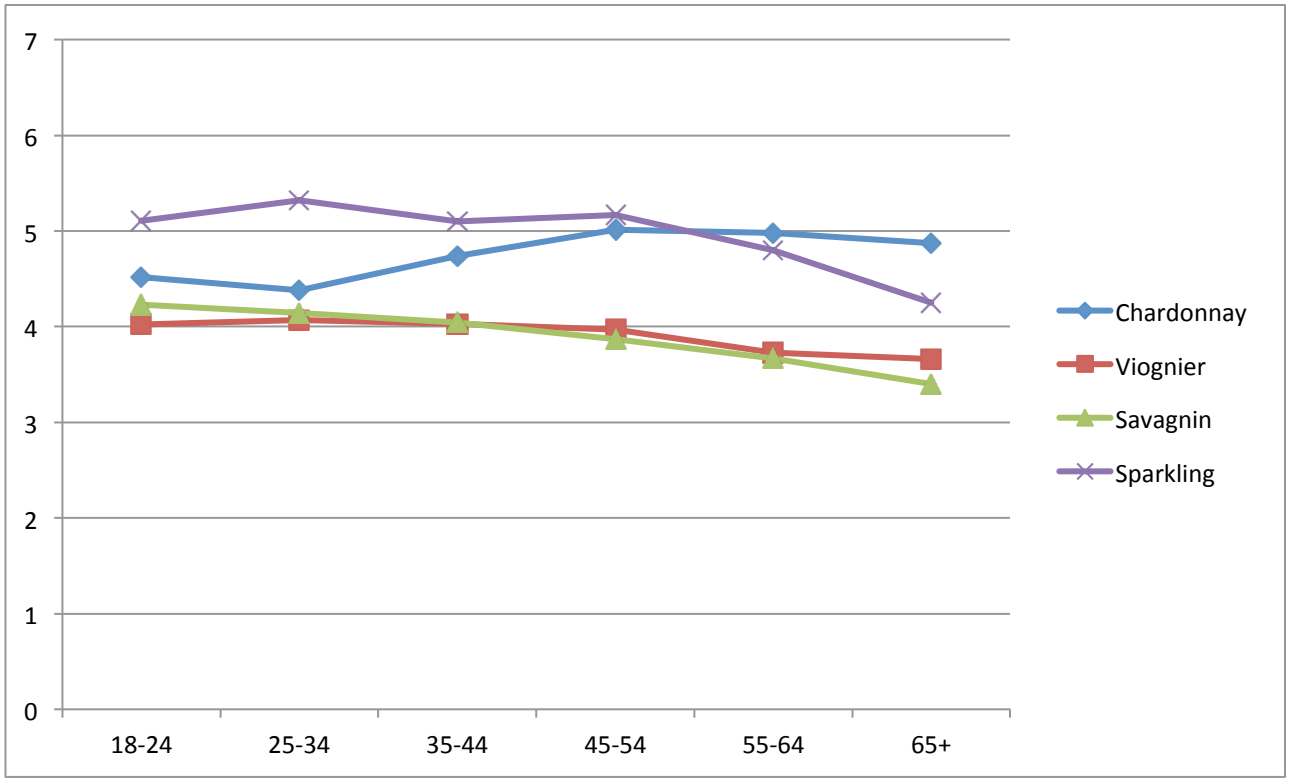


Figure 15: *Perception of Sparkling, Chardonnay, Viognier, and Savagnin*

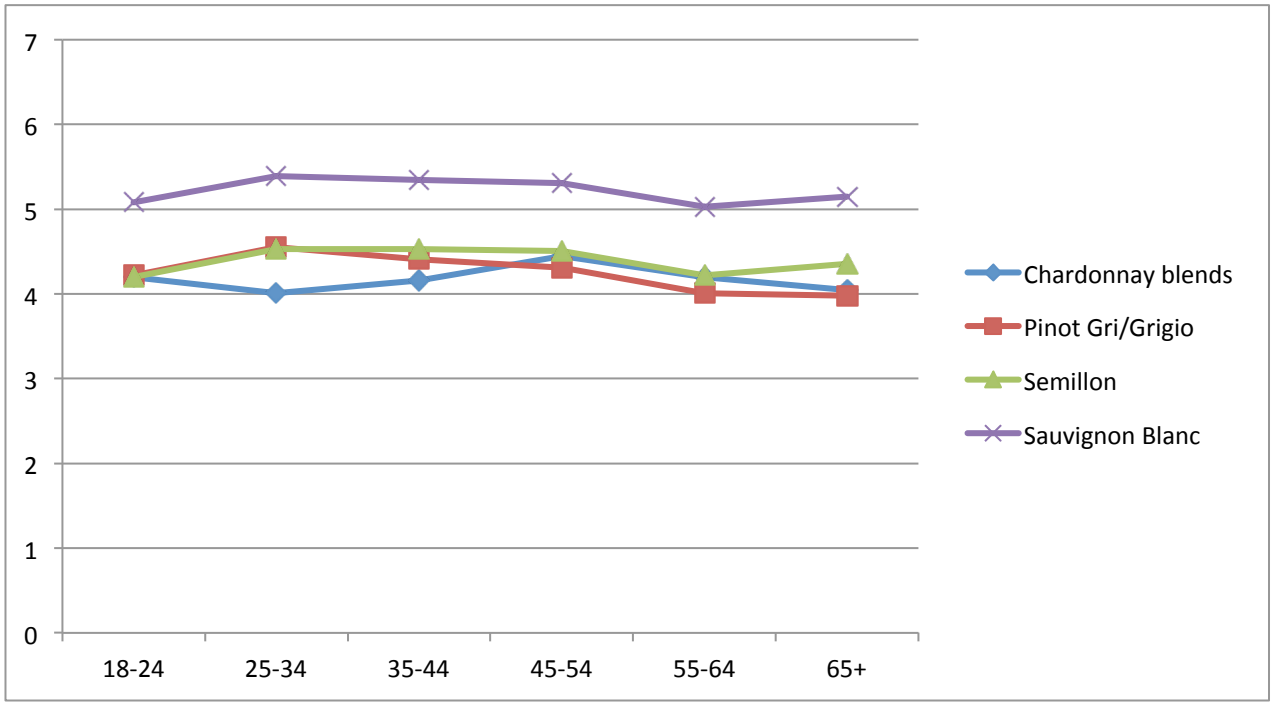


Figure 16: *Perceptions of other white wine varieties*

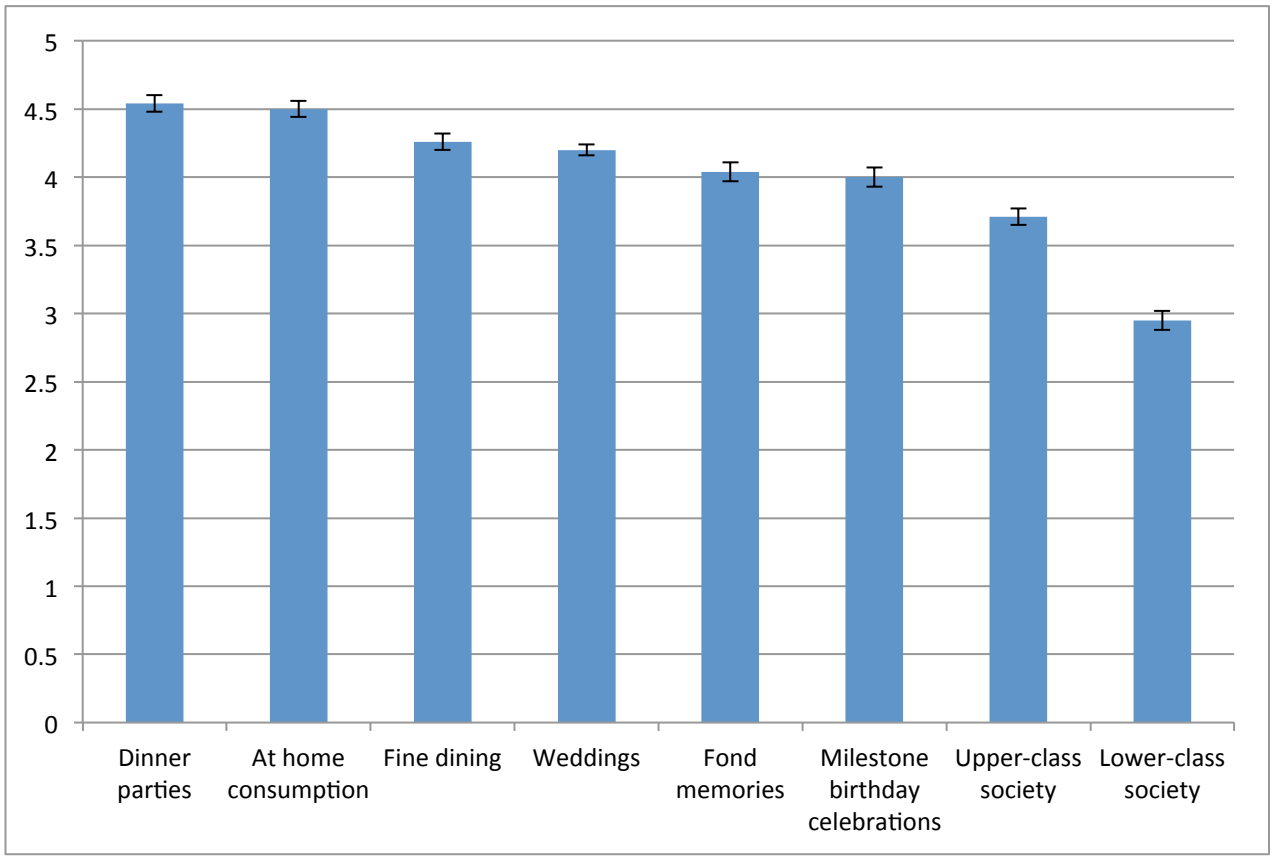


Figure 17: *Factors associated with Chardonnay consumption*

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the above factors. No main effect was identified for gender. In relation to age main effects, significant differences were identified for all factors except weddings and milestone birthdays. As Figure 18 shows, both the factors lower-class society ($F (5, 2012) = 27.6$, $p<.001$, partial eta squared = .06) and upper-class society ($F (5, 2012) = 9.2$, $p<.001$, partial eta squared = .02) were more likely to be agreeable to younger participants than to older participants. The opposite was true for the factor at home consumption ($F (5, 2012) = 4.6$, $p<.001$, partial eta squared = .01).

Participants aged 45-64 were more likely to associate Chardonnay consumption with fine dining than to those aged 25-44 ($F (5, 2012) = 3.9$, $p=.002$, partial eta squared = .01). Participants aged 25-34 were less likely than participants aged 45+ to associate Chardonnay consumption with dinner parties ($F (5, 2012) = 3.4$, $p=.004$, partial eta squared = .01). Finally, participants aged 45-54 were more likely to associate Chardonnay consumption with fond memories than were younger participants ($F (5, 2012) = 3.8$, $p=.002$, partial eta squared = .01).

Participants were asked to respond to a series of four preference statements on a seven-point likert scale (1 = strongly disagree, 4 = indifferent, and 7 = strongly agree). The results indicate that participants were indifferent to three of the four, but showed some level of disagreement with the notion that Chardonnay had failed to match their expectations ($M = 3.5$, $SD = 1.6$)(Figure 19).

A series of Two-way ANOVA showed no effect for gender but indicated that younger participants were more likely to agree with the statement than older participants ($F (5, 2012) = 6.2$, $p<.001$, partial eta squared = .02)(Figure 20). Older participants were more likely than younger participants to agree with the notion of their wine preference changing from sweeter to drier wine ($F (5, 2012) = 3.1$, $p = .008$, partial eta squared = .01). Whilst the opposite effect was true for the notion of Chardonnay failing match expectations ($F (5, 2012) = 13.6$, $p<.001$, partial eta squared = .03) and never having been a preference ($F (5, 2012) = 13.9$, $p<.001$, partial eta squared = .03).

Participants were asked an open-ended question asking them to indicate what they think of when they hear the word 'Chardonnay'. Figure 21 is a word cloud representing the most frequently used words in participant responses. The larger the word, the more frequently it was used in participant responses.

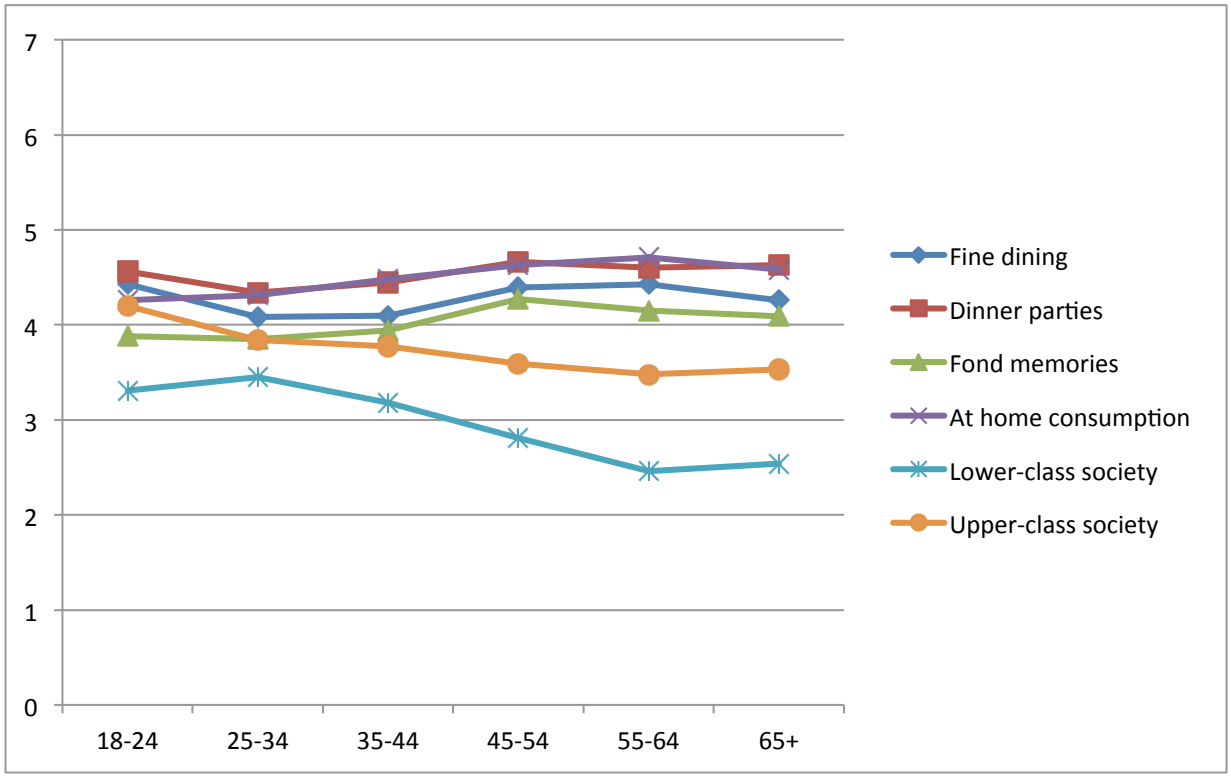


Figure 18: *Age comparisons for factors associated with Chardonnay consumption*

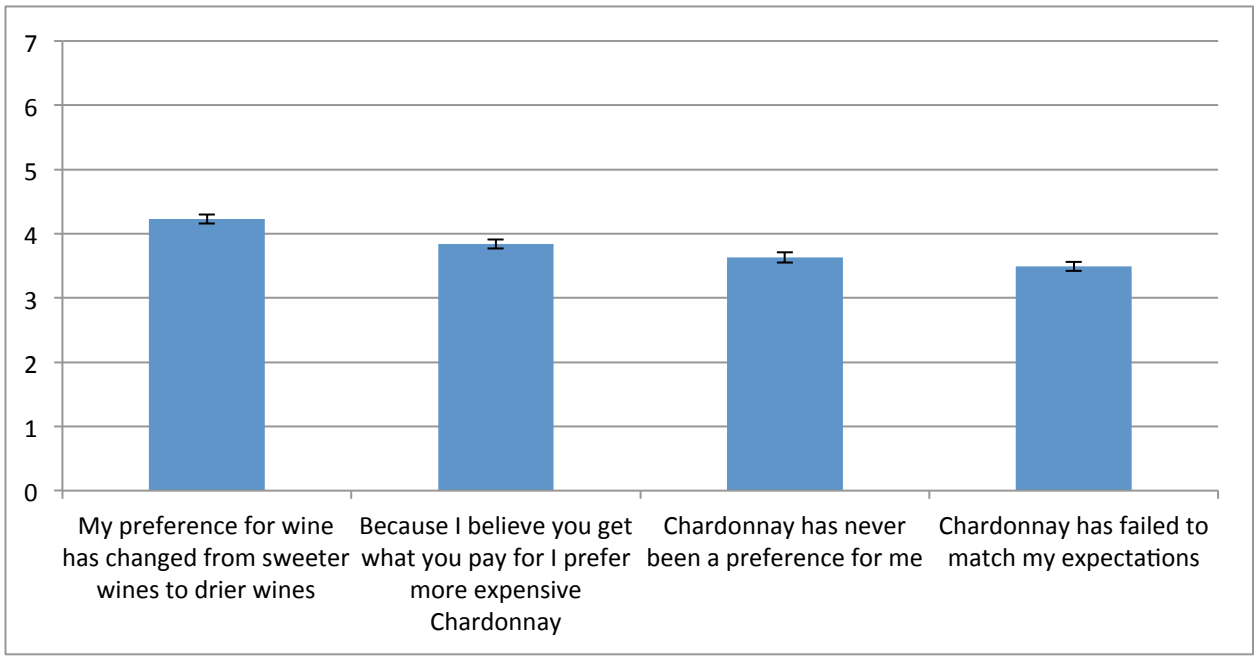


Figure 19: *Preference statements – Means and 2*SE*

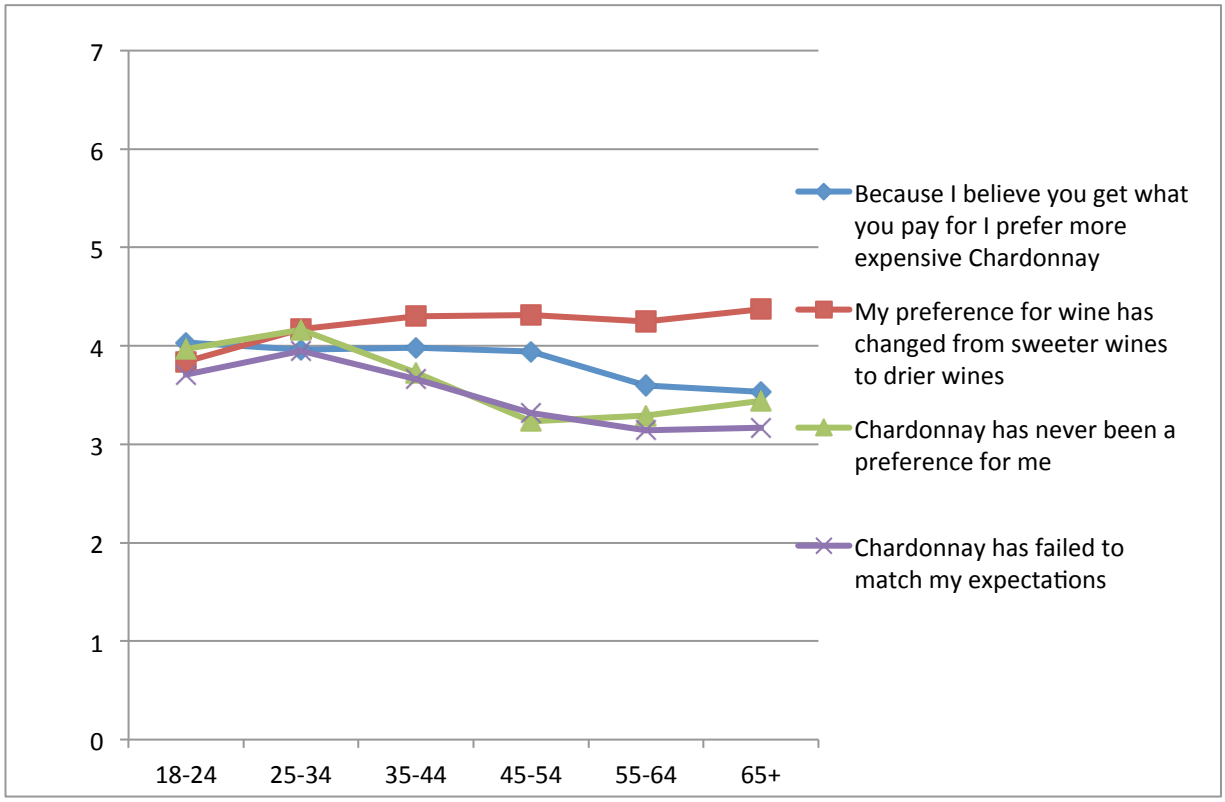


Figure 20: *Age comparison for preference statements*

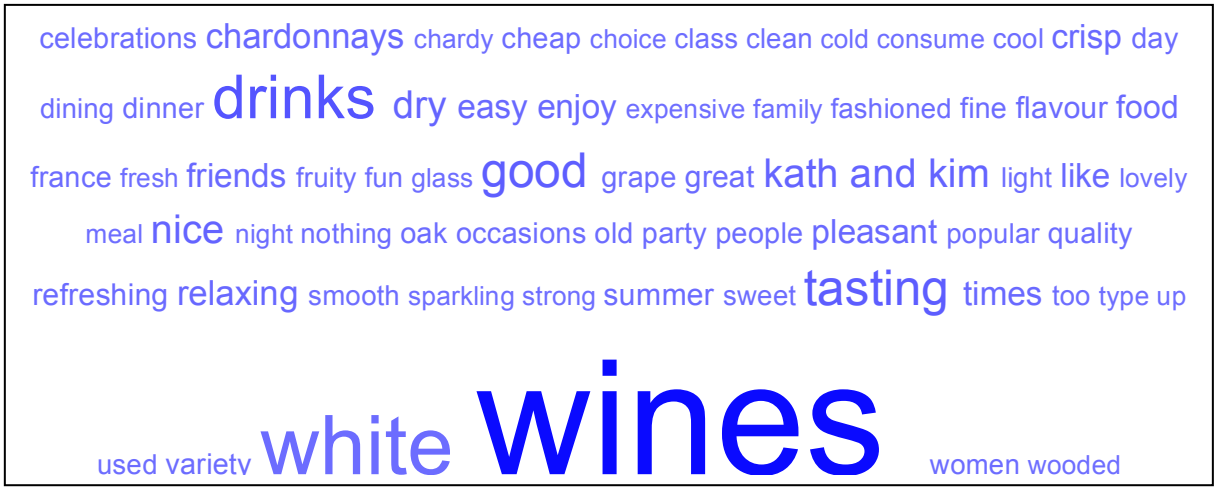


Figure 21: *'When you hear the word 'Chardonnay' what do you think of?' – Word Cloud*

Sources of Current Perceptions of Chardonnay

Participants were asked to indicate their level of agreement with a series of statements starting with 'My attitudes toward Chardonnay have been influenced by...'. As Figure 22 demonstrates, the only agreeable item was associated with the role of personal experience with Chardonnay products (M = 4.9, SD = 1.7). Participants disagreed most with the notion of T.V. and film, such as 'Kath and Kim', influencing their Chardonnay attitudes (M = 2.6, SD = 1.7).

Two-way ANOVA was used to assess significant mean differences based on age and gender for factor. In relation to gender main effects, males were more likely than females to consider their Chardonnay attitudes to have been influenced by; their spouse or significant other (F (1, 2012) = 34.1, p<.001, partial eta squared = .02), the locations where they purchase Chardonnay (F (1, 2012) = 6.8, p=.01, partial eta squared = .003), and wine magazines (F (1, 2012) = 11.3, p=.001, partial eta squared = .01). Conversely, females were more likely than males to consider their Chardonnay attitudes to have been influenced by their own personal experience with wine (F (1, 2012) = 8.4, p=.004, partial eta squared = .004).

An interaction effect was identified for the factor concerned with the influence of work colleagues. Firstly, older male participants were less likely to consider their attitudes toward Chardonnay to have been influenced by work colleagues than younger males (Welch F (5, 421.4) = 23.6, p<.001, eta squared = .10). Secondly, female participants aged 25-34 were more likely than female participants aged 55+ to consider their attitudes to have been influenced by their work colleagues (F (5, 2012) = 3.5, p=.004, eta squared = .02)

In relation to age main effects, significant differences were identified for 10 factors, excluding the influence of work colleagues (Table 9). All 10 factors were characterised by a bipolarisation between the younger age categories and the older age categories. Figures 23 and 24 show that personal experience was more likely to be rated higher by older participants as opposed to younger ones, all other factors demonstrated the opposite effect.

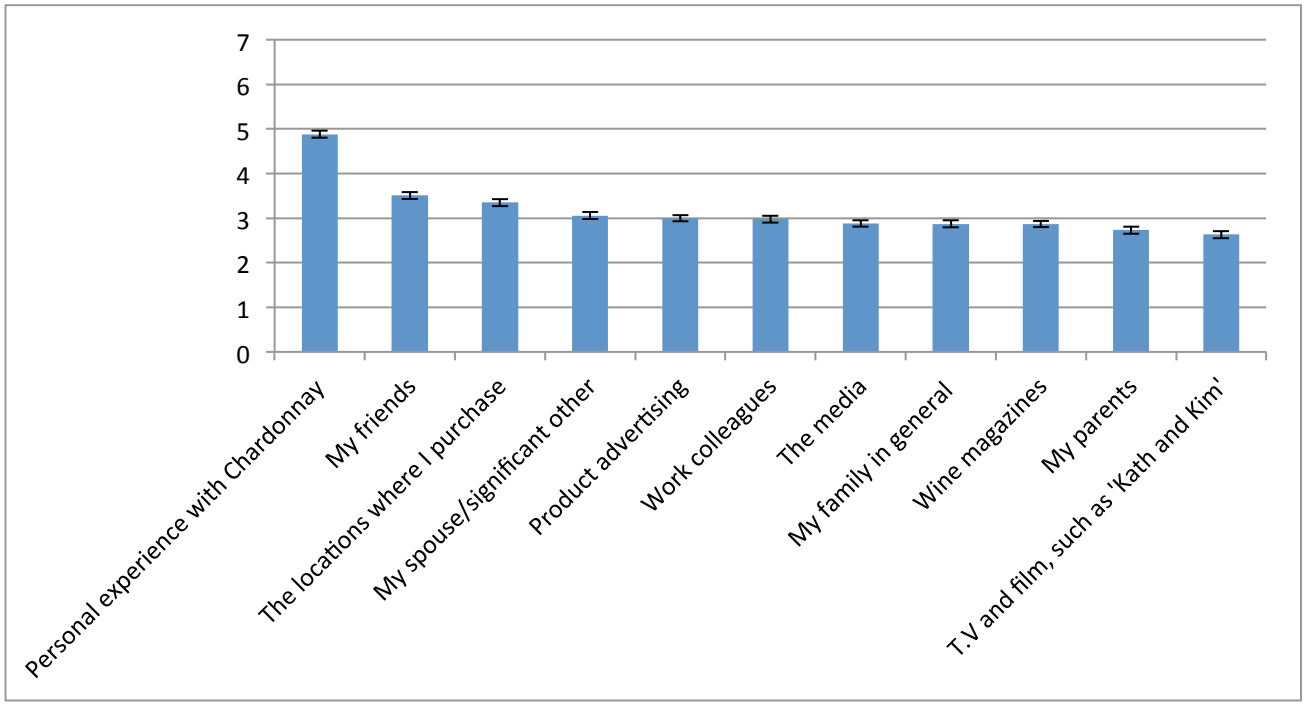
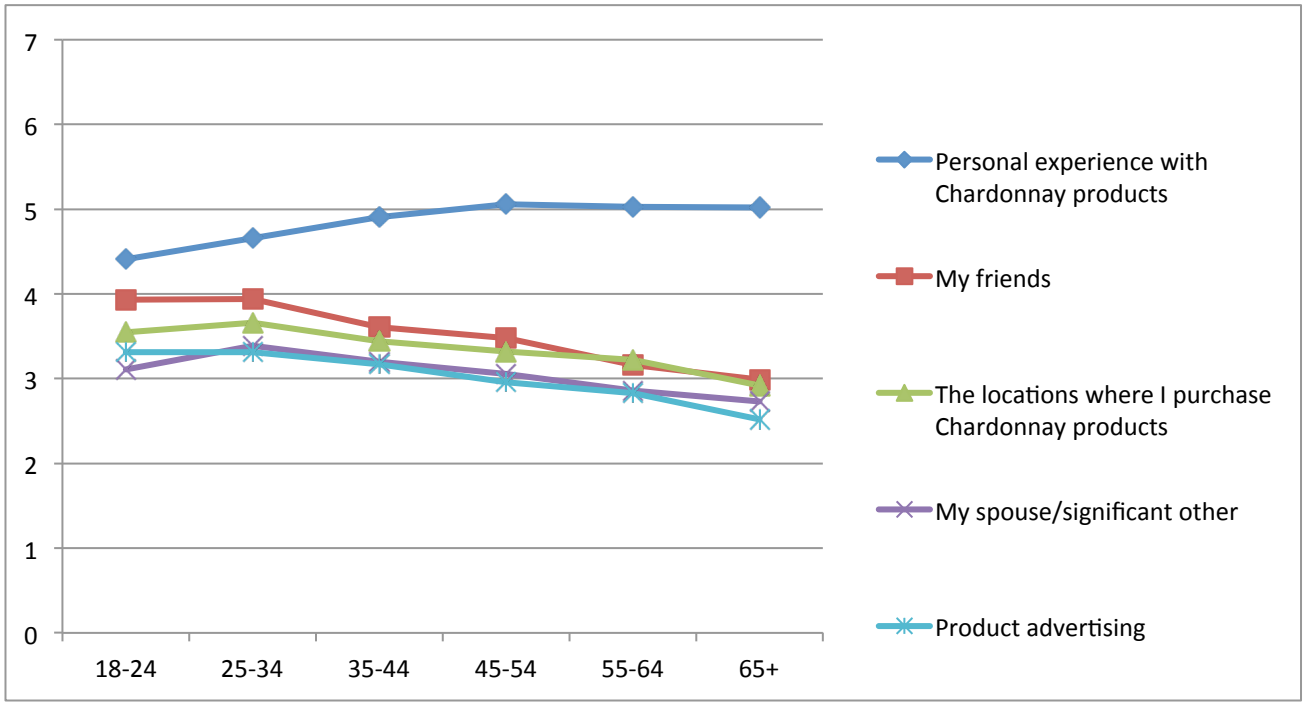
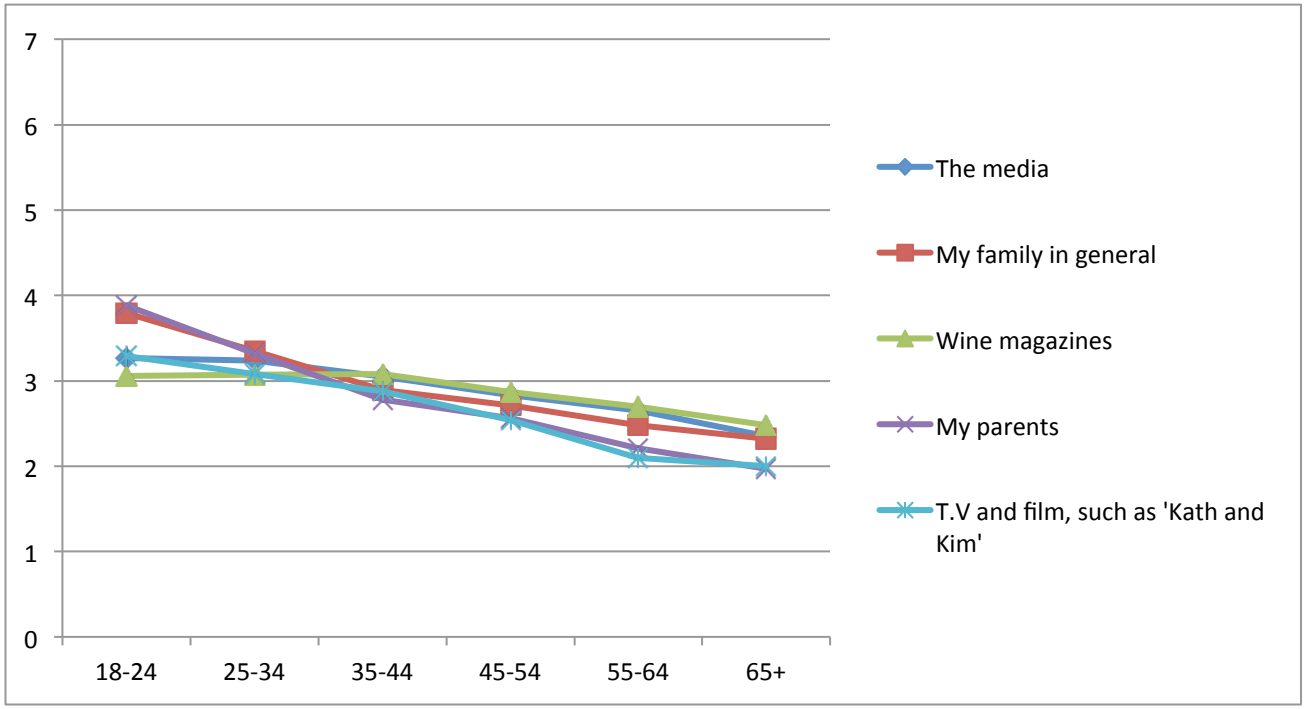


Figure 22: *'My attitudes toward Chardonnay have been influenced by...' – Means and 2*SE*

Table 9: Significant Differences for Age Comparison of 'My attitudes toward Chardonnay have been influenced by...'

Factors	**Significance**
Personal experience with Chardonnay products	F (5, 2012) = 6.5, p<.001, partial eta squared = .02
My friends	F (5, 2012) = 15.1, p<.001, partial eta squared = .04
The locations where I purchase Chardonnay products	F (5, 2012) = 8.3, p<.001, partial eta squared = .02
My spouse/significant other	F (5, 2012) = 8.0, p<.001, partial eta squared = .02
Product advertising	F (5, 2012) = 12.9, p<.001, partial eta squared = .03
The media	F (5, 2012) = 17.8, p<.001, partial eta squared = .04
My family in general	F (5, 2012) =33.4, p<.001, partial eta squared = .08
Wine magazines	F (5, 2012) = 9.0, p<.001, partial eta squared = .02
My parents	F (5, 2012) = 59.4, p<.001, partial eta squared = .13
T.V and film, such as 'Kath and Kim'	F (5, 2012) = 29.0, p<.001, partial eta squared = .07





Figures 23 and 24: *Age effect for 'My attitudes toward Chardonnay have been influenced by...' factors*

'Stickiness' of Current Perceptions of Chardonnay

Participants were asked to indicate their level of agreement with various statements starting with: 'I think that there is potential for my attitudes regarding Chardonnay to improve in the future because...' (strongly disagree = 1, indifferent = 4, and strongly agree = 7). As Figure 25 indicates, participants believe there is potential for the attitudes toward Chardonnay to improve because: they are willing to try Chardonnay products recommended to them (M = 5.1, SD = 1.4), they enjoy trying wines they have not tried before (M = 5.0, SD = 1.4), and Chardonnay is a popular wine (M = 4.9, SD = 1.4). Participants disagreed with the notion that their attitudes could improve because they already dislike Chardonnay so much that they could not get worse (M = 2.7, SD = 1.7).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each factor. In relation to gender main effects, males were more likely than females to think that there is potential for their Chardonnay attitudes to improve because of having a broad palette and enjoying most wines they try (F (1, 2012) = 13.8, p<.001, partial eta squared = .01).

Conversely, females were more likely than males to think that there is potential for their Chardonnay attitudes to improve because they are willing to try Chardonnay products recommended to them (F (1, 2012) = 22.2, p<.001, partial eta squared = .01). An interaction effect was identified in which older female participants were more likely than younger females to consider Chardonnay being popular as a reason that their attitudes may improve in the future (F (5, 1040) = 8.9, p<.001, eta squared = .04).

In relation to age main effects, significant differences were identified for 4 factors. As Figure 26 shows, 'I dislike Chardonnay so much that my attitudes can only improve' (F (5, 2012) = 13.3, p<.001, partial eta squared = .03) and 'As my experience with wines improves so too will my attitudes toward Chardonnay' (F (5, 2012) = 6.6, p<.001, partial eta squared = .02) were characterised by a trend in which younger participants were more likely than older participants to agree.

In relation to the factor 'I enjoy trying wines I haven't tried before' (F (5, 2012) = 7.4, p<.001, partial eta squared = .02), participants aged 18-24 were significantly less likely to agree than those aged 25-54, and participants aged 45-54 were significantly more likely than any other age group to agree. Finally, in relation to the factor 'I am willing to try Chardonnay products recommended to me' (F (5, 2012) = 2.5, p=.03, partial eta squared = .01), participants aged 45-54 were significantly more likely to agree than those aged 18-24.

Participants were asked to respond on a seven-point likert scale to various reasons why their attitudes to Chardonnay are unlikely to change in the future (1 = strongly disagree, 4 = indifferent, and 7 = strongly agree). As Figure 27 shows, participants considered none of the reasons agreeable.

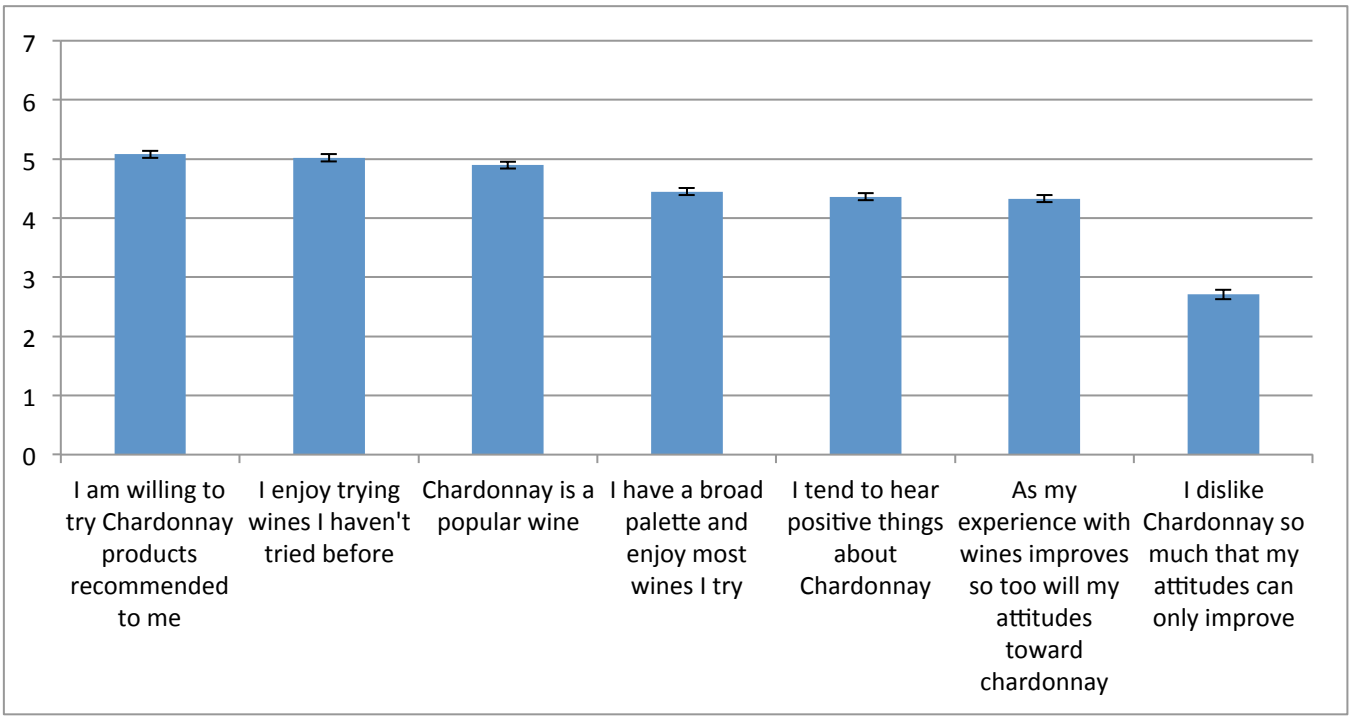


Figure 25: *'I think that there is potential for my attitudes regarding Chardonnay to improve in the future because...' – Means and 2*SE*

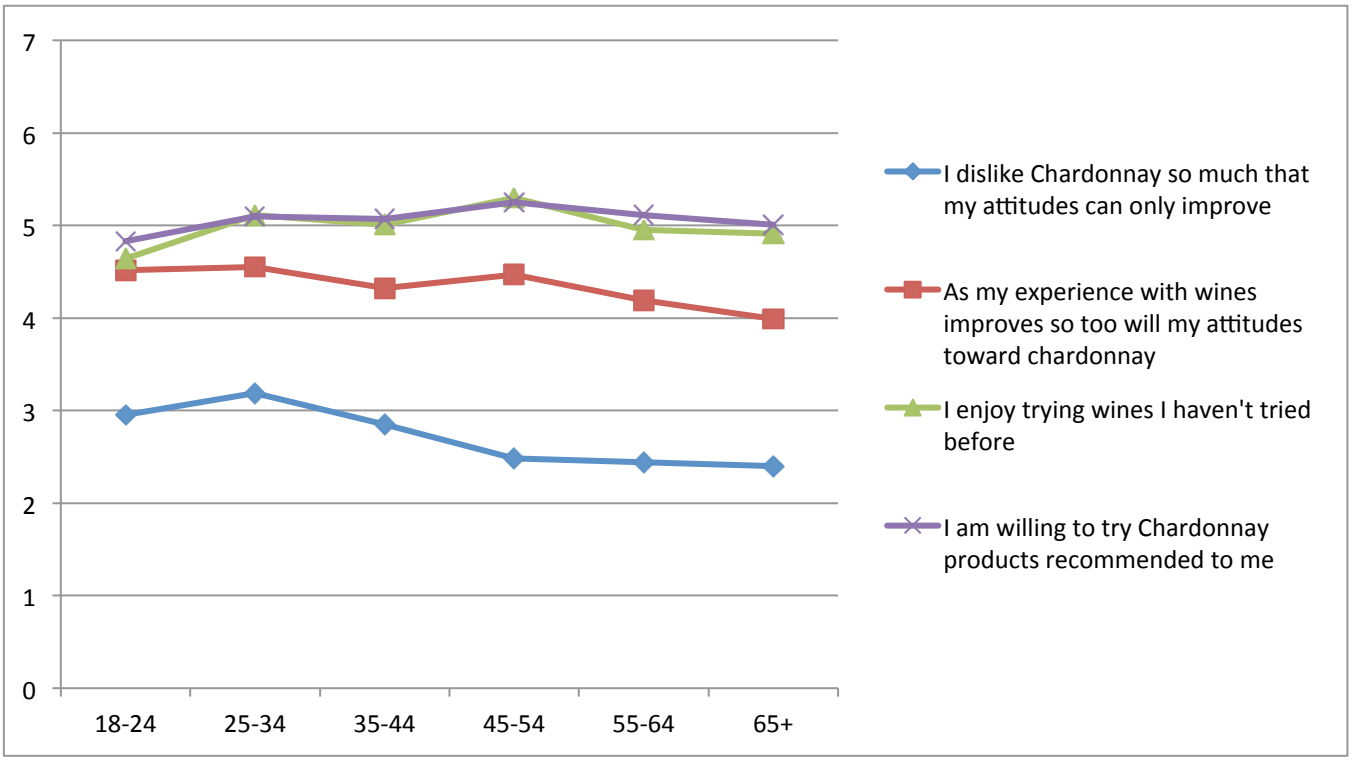


Figure 26: *Age comparisons for 'I think that there is potential for my attitudes regarding Chardonnay to improve in the future because...'*

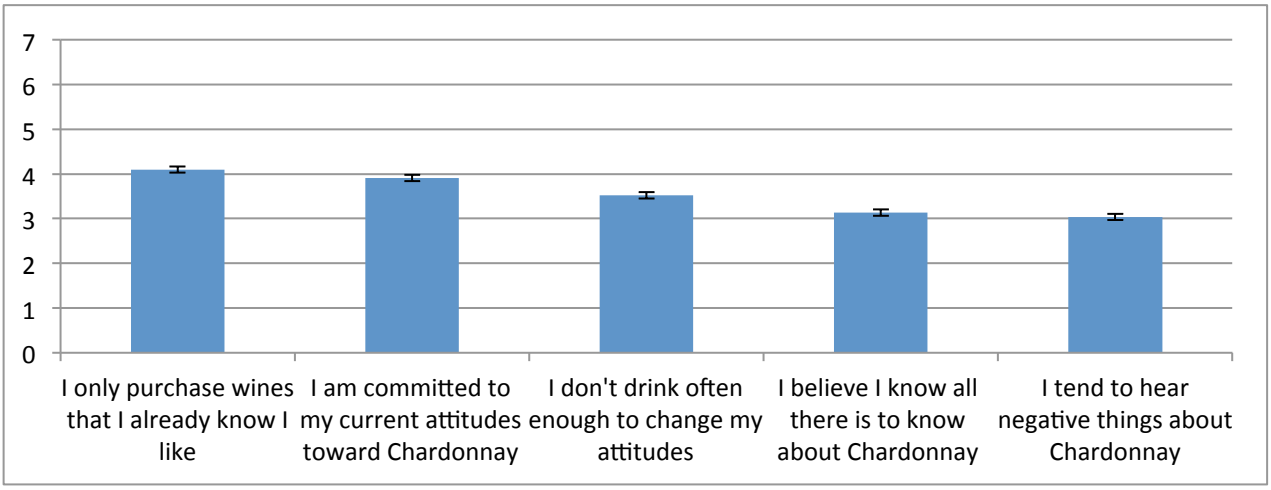


Figure 27: *Reasons why attitudes are unlikely to change – Means and 2*SE*

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of the above factors. In relation to gender main effects, males were more likely than females to indicate that they believe they know all there is to know about Chardonnay (F (1, 2012) = 36.7, p<.001, partial eta squared = .02), tend to hear negative things about Chardonnay (F (1, 2012) = 10.0, p=.002, partial eta squared = .01), and are committed to their current attitudes (F (1, 2012) = 13.2, p<.001, partial eta squared = .01). An interaction effect was also identified indicating that female participants aged 65+ are more likely to believe they don't drink often enough to change their attitudes as compared to those aged 35-64; the same is true of participants aged 18-24 as compared to the 35-44 group (Welch F (5, 434.6) = 5.9, p<.001, eta squared = .03).

In relation to age main effects, significant differences were identified for three factors. As Figures 28 shows, older participants are more likely than younger participants to only purchase wines they already know they like (F (5, 2012) = 6.3, p<.001, partial eta squared = .02). The opposite is true for the factor 'I tend to hear negative things about Chardonnay (F (5, 2012) = 15.7, p<.001, partial eta squared = .04). Finally, participants aged 25-34 are more likely than those aged 18-24 and 55-64 to believe they know all there is to know about Chardonnay (F (5, 2012) = 36.7, p=.001, partial eta squared = .01).

Participants were asked to indicate their level of agreement with the statement 'I would try Chardonnay even if someone said it was bad' on a seven-point likert scale (1 = strongly disagree, 4 = indifferent, 7 = strongly agree). The results indicate that participants were indifferent to this statement (M = 3.7, SD = 1.7). No age or gender effects were identified from a two-way ANOVA.

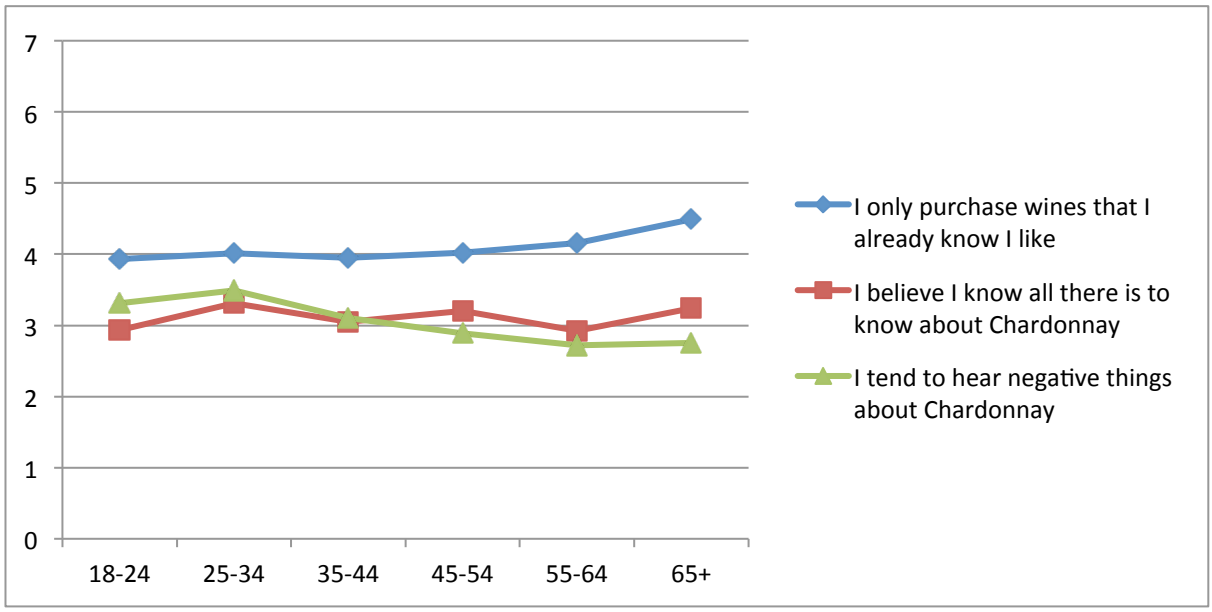


Figure 28: *Age comparison for reasons why attitudes are unlikely to change*

Participants were also asked if, and in what direction, their attitudes toward Chardonnay has changed from five years ago (M = 4.3, SD = 1.4), as well as from 10 years ago (M = 4.5, SD = 1.5), on a seven-point likert scale (1 = much less positive, 4 = the same, 7 = much more positive). The results indicate that participants have not experienced either a positive or a negative change in their attitudes toward Chardonnay.

Potential Means of Change in Perceptions of Chardonnay

Participants were asked to indicate their level of agreement with various statements starting with: 'I could be more likely to consume Chardonnay if it were...' (strongly disagree = 1, indifferent = 4, and strongly agree = 7). Figure 29 indicates that participants were indifferent to the idea of plastic or cask packaging as compared to glass (M = 4.0, SD = 2.0 respectively) and to whether or not the Chardonnay they consume is domestically produced or imported (M = 4.1, SD = 1.9). The results indicate that participants disagreed with all other factors.

Two-way ANOVA was used to assess significant mean differences based on age and gender for each factor. In relation to gender main effects, males were more likely than females to rate the factors higher. Males rated the following factors significantly higher than females: more available at sporting events (F (1, 2012) = 21.9, p<.001, partial eta squared = .01), more available at live music events (F (1, 2012) = 10.7, p=.001, partial eta squared = .01), more accepted by people my own age (F (1, 2012) = 15.0, p<.001, partial eta squared = .01), featured positively in the media (F (1, 2012) = 7.7, p=.006, partial eta squared = .004), and more prominent in popular films

and television shows (F (1, 2012) = 18.8, p<.001, partial eta squared = .01). An interaction effect was also identified indicating that younger males would be more likely than older males to consume Chardonnay if it had a lower alcohol content (F (5, 972) = 12.3, p<.001, eta squared = .06).

In relation to age main effects, significant differences were identified for seven of the ten 'I could be more likely to consume Chardonnay if it were...' factors (Table 10). As Figure 30 shows, six factors were characterised by bipolarisation between the younger age categories and the older age categories in which younger participants were significantly more likely to agree than older participants. Finally, in relation to the factor 'I could be more likely to consume Chardonnay if it were an Australian product as opposed to an imported one', participants aged 45 and older were more likely to agree than those aged 35-44 (F (5, 2012) = 3.5, p=.004, partial eta squared = .01).

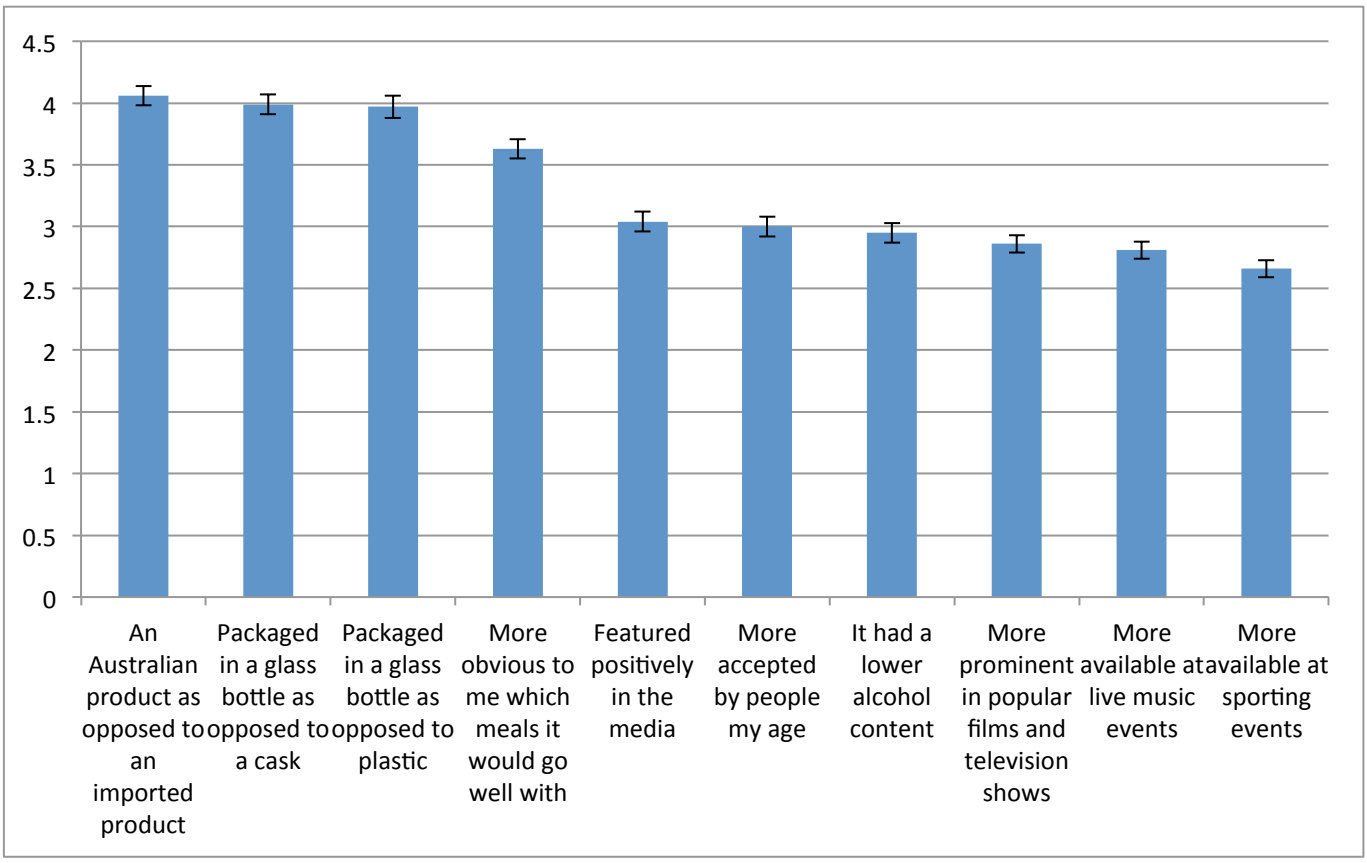


Figure 29: *'I could be more likely to consume Chardonnay if it were...' – Means and 2*SE*

Table 10: Significant Differences for Age Comparison of '*I could be more likely to consume Chardonnay if it were...'*

I could be more likely to consume Chardonnay if it were...	**Significance**
More available at sporting events	F (5, 2012) = 18.9, p<.001, partial eta squared = .05
More available at live music events	F (5, 2012) = 25.0, p<.001, partial eta squared = .06
More accepted by people my own age	F (5, 2012) = 36.3, p<.001, partial eta squared = .08
Featured positively in the media	F (5, 2012) = 26.0, p<.001, partial eta squared =.06
More obvious to me which meals it would go well with	F (5, 2012) = 20.0, p<.001, partial eta squared = .05
More prominent in popular films and television shows	F (5, 2012) = 33.1, p<.001, partial eta squared = .08

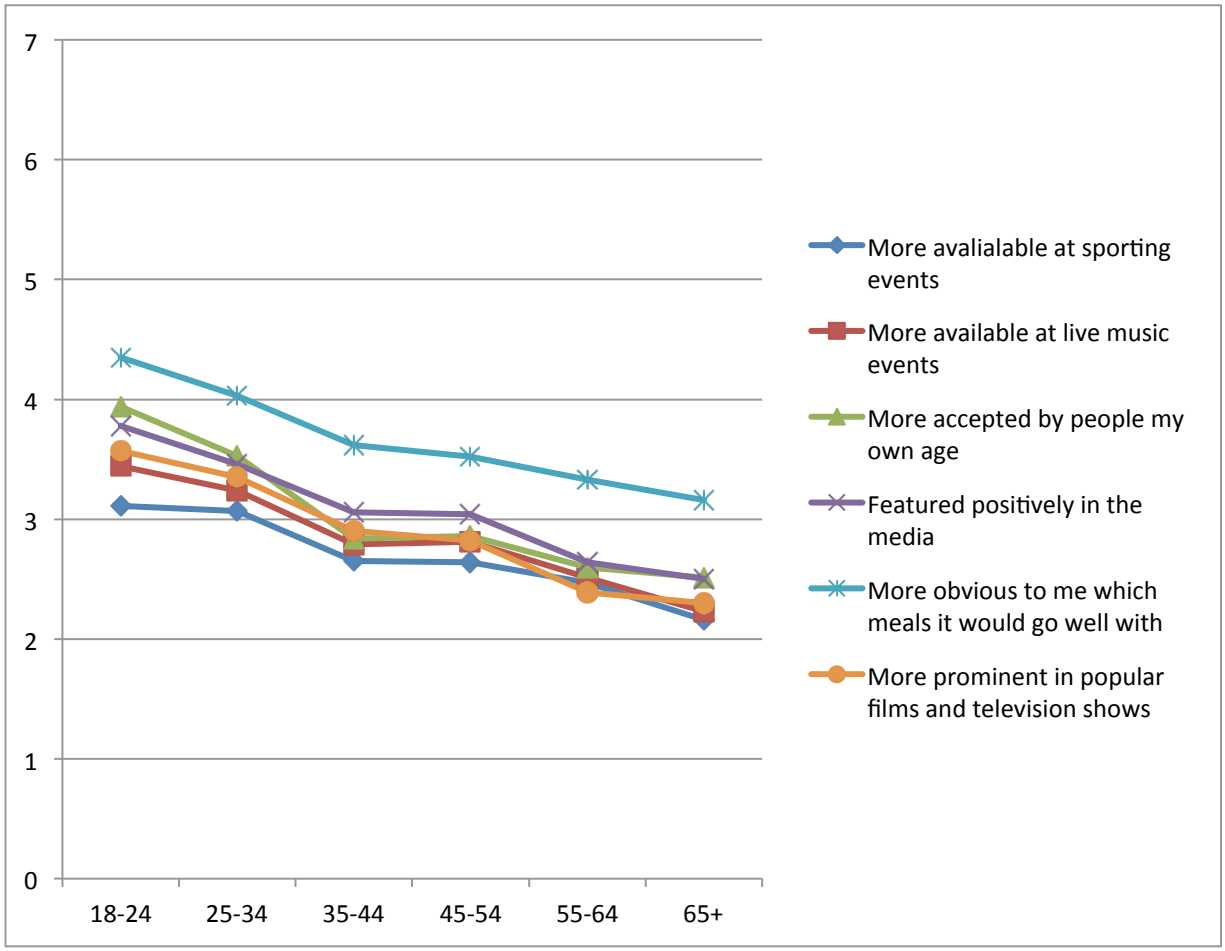


Figure 30: *Age effect for 'I could be more likely to consume Chardonnay if it were...' factors*

Participants indicated that Chardonnay did not need to be the only available variety (M = 3.2, SD = 1.8), mixed with something (M = 2.4, SD = 1.7) or carbonated (M = 2.8, SD = 1.7) for them to consume it, again on the seven-point likert scale from strongly disagree to strongly agree (Figure 31).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of these factors. No gender main effects were identified. In relation to age main effects, significant differences were identified for all three factors in which younger participants were significantly more likely to agree than older participants (Figure 32); it is the only available variety (F (5, 2012) = 13.1, p<.001, partial eta squared = .03), it is carbonated (F (5, 2012) = 28.0, p<.001, partial eta squared =.07), and it is mixed with something (F (5, 2012) = 19.6, p<.001, partial eta squared = .05).

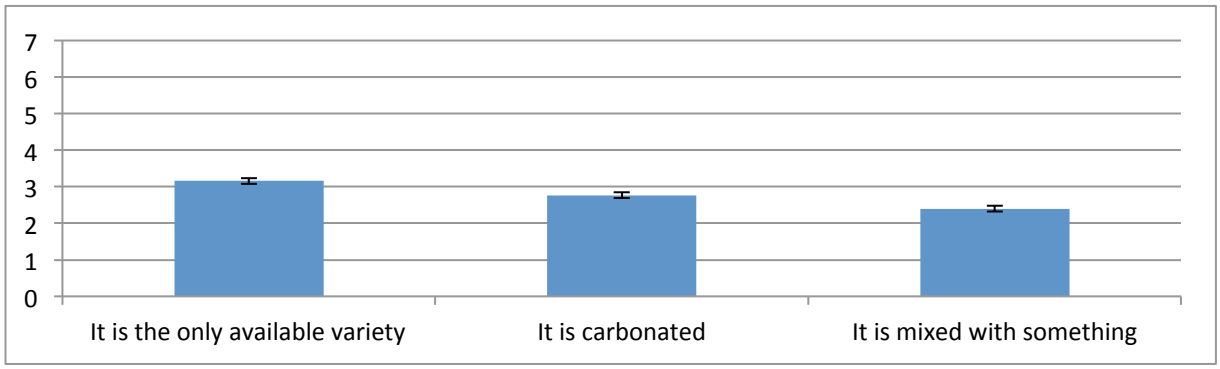


Figure 31: *'I will not consume Chardonnay unless...' – Means and 2*SE*

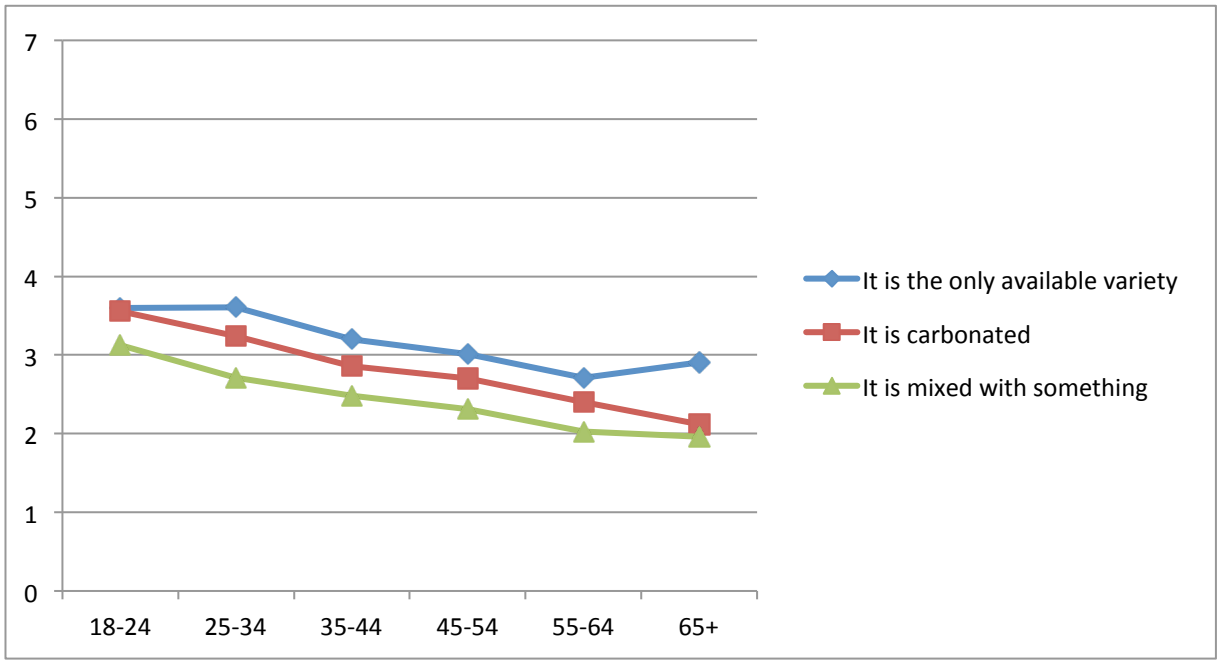


Figure 32: *Age effect for 'I will not consume Chardonnay unless...' factors*

Participants were asked to indicate their level of agreement for a number of statements starting with 'I would be more likely to consume Chardonnay if it were recommended to me by...' on a seven-point likert scale. Participants were indifferent to most factors (Figure 33), however disagreed with the factors: someone younger (M = 3.5, SD = 1.7), someone from another culture (M = 3.2, SD = 1.6), a waitress as opposed to a waiter (M = 3.1, SD = 1.6), and a non-wine drinker (M = 2.5, SD = 1.6).

Two-way ANOVA was used to assess significant mean differences based on age and gender for each of these factors. In relation to gender main effects, males were more likely than females to produce higher mean values for the factors: a waitress as opposed to a waiter (F (1, 2012) = 26.0, p<.001, partial eta squared = .01), someone their own age as opposed to younger (F (1, 2012) = 9.1, p=.003, partial eta squared = .01), and someone from another culture (F (1, 2012) = 7.3, p=.007, partial eta squared = .004).

An interaction effect was identified for the factor 'someone who doesn't drink wine', in which younger males were more likely to agree than older males (Welch F (5, 419.0) = 23.6, p<.001, eta squared = .01), and the same trend was recognised for female participants (Welch F (5, 435.5) = 6.4, p<.001, eta squared = .03). In relation to age main effects, younger participants were significantly more likely than older participants to agree with all factors, except for the non-wine drinker factor (Figures 34 and 35 below).

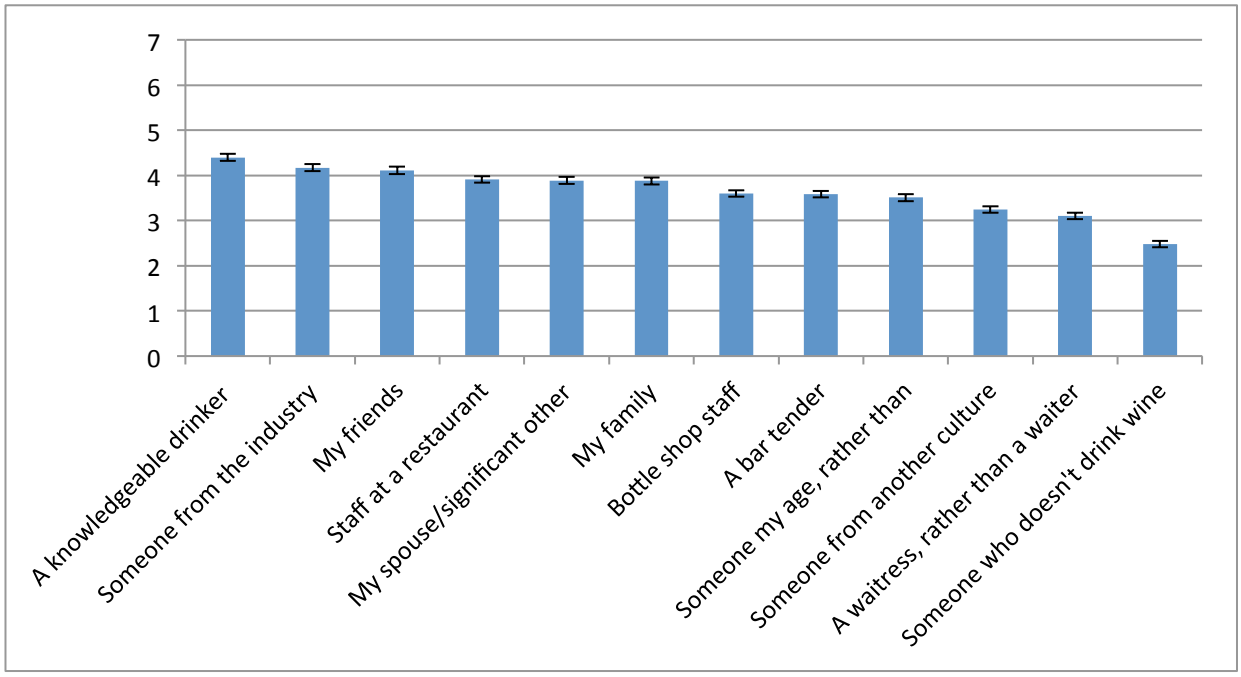
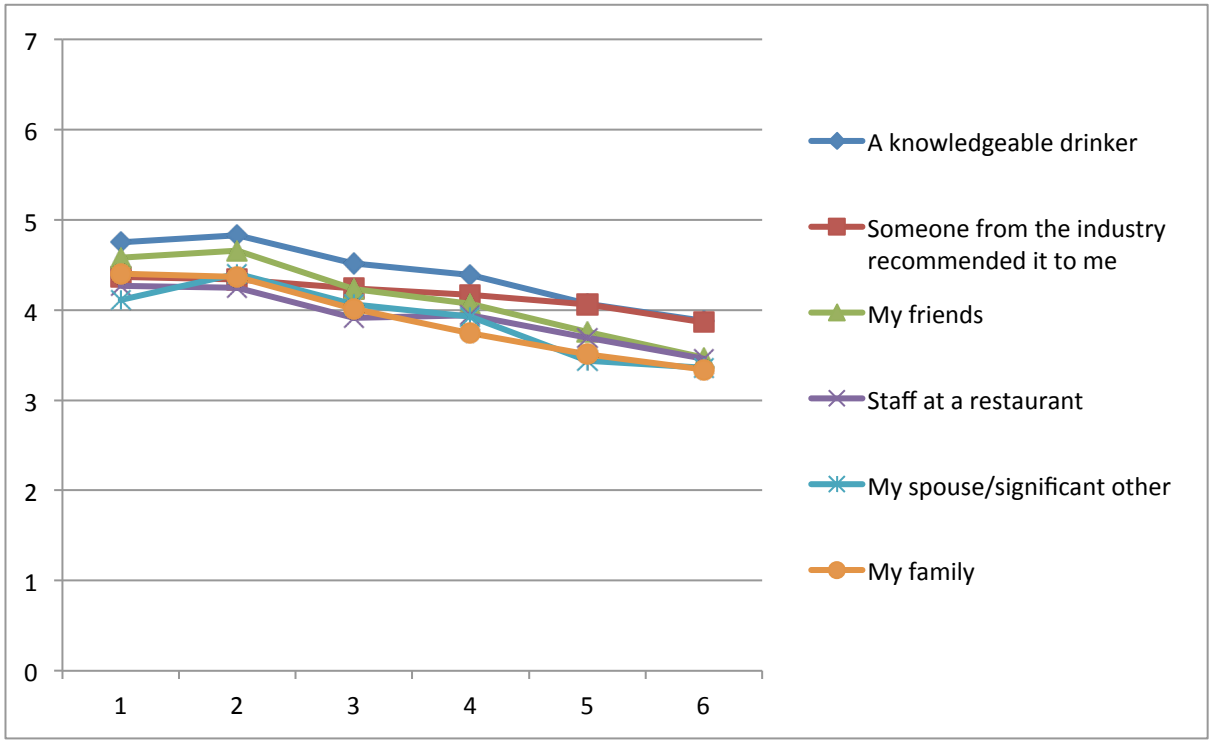
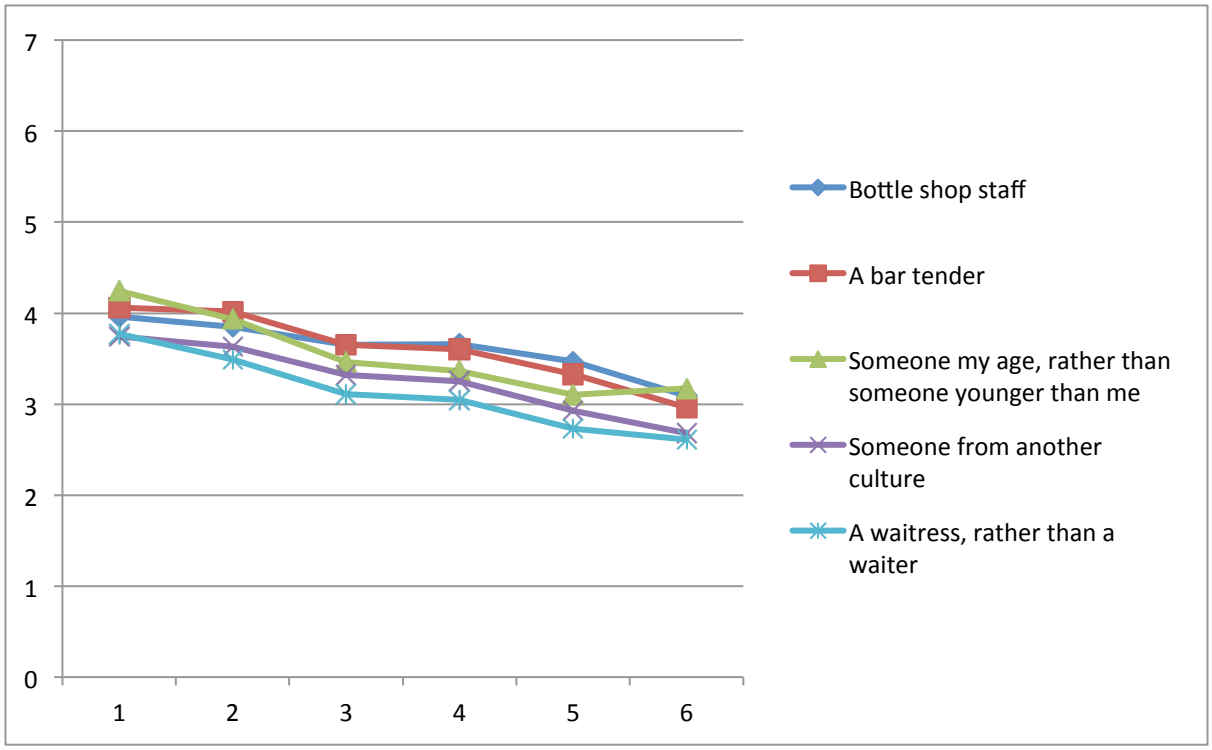


***Figure 33**: 'I would be more likely to consume Chardonnay if it were recommended to me by...' – Means and 2*SE*





Figures 34 and 35: *Age effect for 'I would be more likely to consume Chardonnay if it were recommended to me by...'*