

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

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

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

### **Does it matter who is in your ‘consumer’ sample?**

#### **Abstract**

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

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

#### **Introduction**

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

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

One caveat of prior studies analysing the effect of wine knowledge on wine behaviour is their predominant use of convenience samples, including at least significant shares of students or

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

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

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

## **Literature review**

### *Importance of product knowledge in general*

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

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

### *The nature of wine knowledge*

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

### *Importance of wine knowledge for purchase behaviour*

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

### *Sample usage*

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

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

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

## **Research Propositions**

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

- 1) Samples which include students of wine-related university programs or wine/agricultural research institute employees are not representative of average wine consumers.
- 2) Consumers with high and low wine knowledge differ in their sensory wine preferences.
- 3) Subjective and objective wine knowledge are interdependent, but the strength of their relationship is affected by the recruitment of the sample.

## **Research Method**

### *Subjects*

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

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

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

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

*Measuring subjective and objective wine knowledge*

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

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

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

Table 1: Reliability of wine knowledge and wine involvement scales

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

*Measuring hedonic liking of wine*

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

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

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

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

## **Analysis and Results**

### *Differences between the subsamples*

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

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

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

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

Binary logistic regression recruitment against sociodemographic variables:

\*\* significant (p<0.05)

\* significant (p<0.10)

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



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

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

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

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

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

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

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

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

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

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

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

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

*Relationship between subjective and objective wine knowledge*

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

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

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

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

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

\*\* significant (p<0.01)

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

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

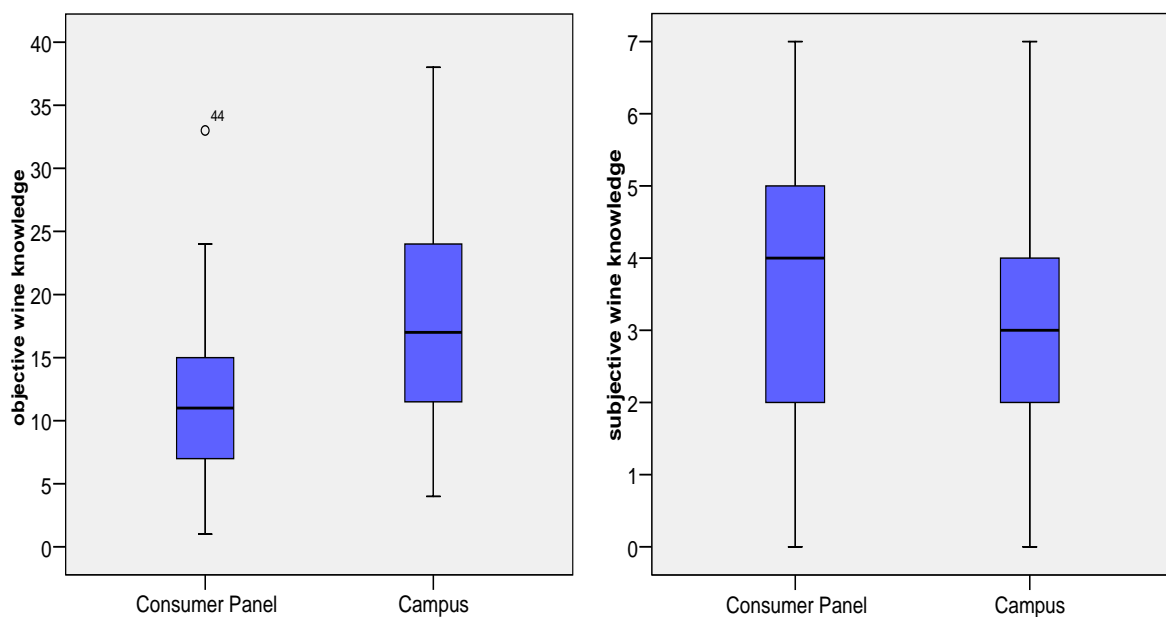


Figure 1: Box-Plots of objective and subjective wine knowledge for sub-samples

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

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

*Consumer segments of different hedonic liking*

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

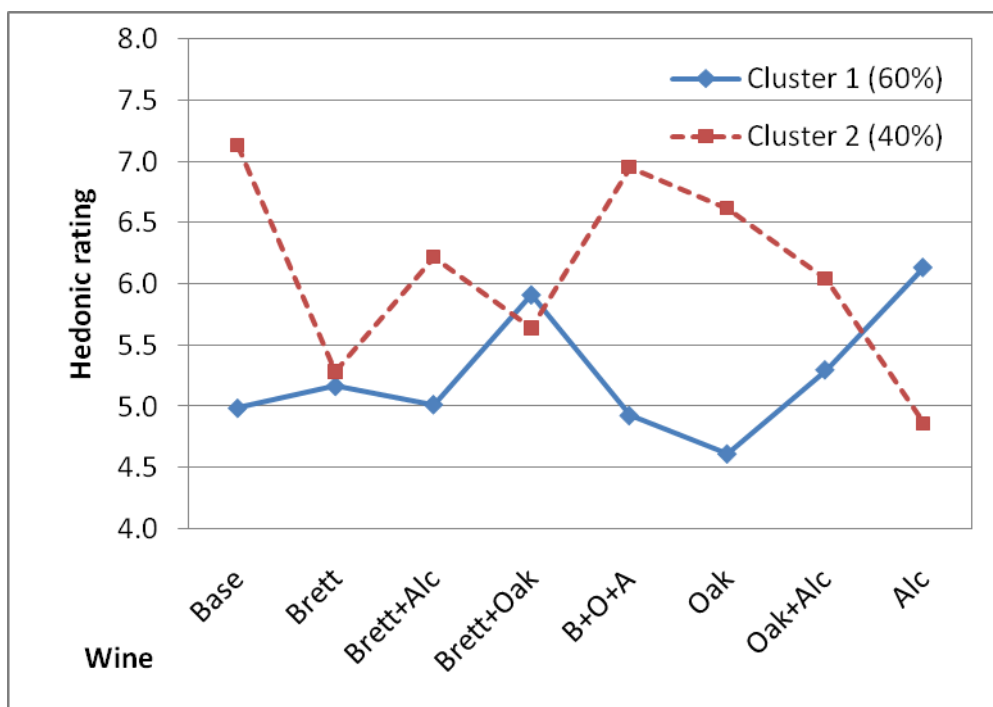


Figure 2: Hedonic liking for the eight wines for both preference clusters

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

*Wine knowledge and sensory liking*

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

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

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

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

Our results are also robust for other segmentation methods. We found similar results when applying Ward Clustering to mean centred hedonic ratings. Furthermore, an analysis of scale

usage revealed that campus respondents used significantly lower average ratings for evaluating the wines ( $B=-.52$ ,  $Wald=7.69$ ,  $p=0.006$ ). In absolute ratings especially the Brett ( $B=-.184$ ,  $Wald=3.21$ ,  $p=0.07$ ) and the oak+alc ( $B=-.20$ ,  $Wald=3.65$ ,  $p=0.056$ ) wines were rated significantly lower by campus respondents than by panel respondents.

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

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

-2LL: 133.99;  
 Nagelke  $R^2$ : 0.19

-2LL: 82.05;  
 Nagelke  $R^2$ : 0.23

-2LL: 47.82;  
 Nagelke  $R^2$ : 0.15

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

## Conclusion

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

We found that objective and subjective knowledge measures better agree when sampling influences are taken into consideration, which has not been the case in previous research

literature. Nevertheless, their relationship remains still far from perfect. This suggests that both constructs should be measured separately in consumer research.

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

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

### **Managerial implications**

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

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

### **Further research**

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

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

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

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