The influence of vocabulary on perception of wine:

tasting tannins in Barolo and Brunello

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1. SUMMARY

Understanding of how priming can affect consumers' experience of food and wine is well developed, yet little research has been done on the effect of specific vocabulary choices when describing tannins in wine. Tastings were carried out to test the effect of quantitative tannin measurement (high/low) versus adjectival descriptors on the enjoyment and perception of Barolo and Brunello di Montalcino wines. A significant change in enjoyment was reported for the Brunello di Montalcino wines when vocabulary used to describe the tannins was changed. Furthermore, significant changes in both tannin assessment and flavour perception were recorded, highlighting the crucial impact vocabulary has on consumers' enjoyment and experience of wine.

2. INTRODUCTION

"*Language affects perception, as well as being a tool to describe that perception*"

(Goode, 2016, p168)

Human beings are visual creatures and therefore very good at describing what can be seen. As Deutscher (2010) argues, however, our skills of describing what can be smelt or tasted are far inferior to other species'. Nevertheless, in the wine trade, a specific and universal language is required to ensure we can communicate effectively. If everyone describes wine differently, it is difficult to discuss styles or regions coherently. It is even harder to educate to a national or global standard. As a result, many standardised methods for describing wine have been created, from the Wine and Spirit Education Trust's (WSET) Systematic Approach to Tasting® (SAT) to Ann Noble's Flavour Wheel (Robinson, 2015).

However, as is so effectively summarised by Goode, above, the very act of describing something can, in fact, alter it, or at least our experience of it. Furthermore, in any attempt to standardise the experience of wine, something that is closely bound to pleasure, there is the risk that something is lost in the process, and the enjoyment diminished.

This study therefore seeks to explore how much vocabulary can alter the experience and enjoyment of wine. The focus of the study will specifically be tannic red wines, often deemed difficult for consumers to appreciate, particularly if they are unfamiliar styles (Cliff et al, 2016). Given the lack of previous research on Italian

wines (Pagliarini et al, 2013) and the firm tannic structure of Barolo and Brunello di Montalcino, these two styles will be the focus.

The specific research questions the paper will address are:

- Does describing tannins rather than quantifying them affect consumers' enjoyment of wine?
- Does altering the description of tannins alter consumers' perception of wine?
- Is there a link between wine education experience and enjoyment of tannic red wines?

By investigating the effect of tannin vocabulary on consumers' experience of wine, this paper will address the extent to which descriptions of wine can affect consumers' overall enjoyment and sensory perception of a wine. The results will have important implications, not just for the specific styles of wine investigated, but for tannic wines more generally. It is hoped that the research will generate debate over how wines are described and explained to consumers, and bring recognition of the important role of vocabulary in shaping the consumer experience of a wine.

3. LITERATURE REVIEW

The framing effects of language are broadly understood (Deutscher 2010; Kahneman, 2011). Furthermore, research has addressed the role of priming in reference to both wine and foodstuffs (Spence, 2015), demonstrating that perception changes based on preconceptions, whether we are aware of them or not. Szymanski elaborates on this in the context of wine, pointing out that the words we use draw attention to some aspects of a complex picture, and, in so doing, change what we see (Szymanski, 2017). Thus it follows that by highlighting or focusing on tannins, our perception of a wine will be altered. However, no specific studies have thus far covered the role of language, priming and tannins in wine.

3.1   Tasting Approaches: Systematic or Free-Form

Using language to describe the full, multi-sensory experience of wine is nothing more than a shorthand, argues Szymanski (2017), yet nevertheless it remains the most effective way we have of communicating our experience of wine with others. Research on vocabulary content and application have proven that wine experts have both a broader and more specific vocabulary for describing wine than novices and as such are better at communicating their experiences (Herdenstam et al, 2009). This accords with Solomon's (1990) findings, that the "*more precise the language (…) the more subtle and complex are the distinctions*" (p495) between wines.

One such example of precise vocabulary applied to wine appreciation in the English-speaking world is the WSET's SAT® which, when applied correctly, should

result in all graduates of the same qualification being able to describe all structural components of a wine in the same way. Goode disagrees with this approach though, countering that whilst such approaches result in a description of the wine, they "*fail to capture its essence*" (Goode, 2016, p199). However, the literature is quite clear that, despite inconsistencies in use of systematic tasting approaches, free-form tasting is no better, with Lehrer finding little consensus on how words are applied to wine (Lehrer, 1975). Even for a single taster, she argues that it is rare to use similar words in a repeatable and accurate pattern (Lehrer, 2007, p134). In short "*free description needs careful, in-depth methodological examination if it is ever to become a useful technique*" (Sauvageot et al, 2006).

There is therefore a lack of agreement in the literature over the best way forward – between providing an accurate and repeatable description of a wine using a systematic approach, or describing the wine, and experience of it, in its entirety, without resorting to reductionist methods that fail to capture a wine's essence.

3.2   Tannin Vocabulary

Our understanding of tannins is still incomplete; whilst we know what they do, we still don't really understand why (Schuster, 2017, p22). Nevertheless, whilst the term itself is "*chemically imprecise*" it is "*used by almost all wine tasters*" (Goode, 2016, p95). For inexperienced tasters, however, Solomon discovered the term is not a meaningful one, with these tasters faring no better than chance at ranking wines based on tannin. He concluded that "*tannin as an analysable dimension does not appear to exist for novices*" (Solomon, 1990, p511).

For consumers with limited or moderate formal wine training, the simplest approach found by far is the WSET SAT®, which asks students to grade tannins on a scale from low to high. At Level 2, the scale covers Low, Medium and High, whilst at Level 3 Medium- and Medium+ are added. Only at Level 4 are students expected to, in addition, comment on the nature of tannins (WSET, 2018).

However, this is not the only approach in the English-speaking world, with the University of Adelaide's Waite campus recommending 10 different terms for describing tannins, based on Emile Peynaud (1996), whilst the Swedish Sommelier Association uses just four: soft – balanced – astringent – hard (Herdenstam et al, 2009). Interestingly, these same four words were previously used by the WSET, though in a different order (soft – balanced – hard – astringent; ibid.), showing over time an evolution from a descriptive approach to a more quantitative method.

Gawel et al (2000) attempted to support a more systematic approach to tannins by creating a "mouth-feel wheel", similar to Noble's Flavour Wheel, to aid in describing wine texture. However, King et al (2003) demonstrated that, even with clear training on how to use the wheel, consistency of tannin descriptors amongst trained judges was poor. They concluded that the lexicon for astringency needs simplification before use (ibid.). Vidal et al (2015) differ somewhat in their analysis, stating only that the mouth-feel wheel is "*not adequate*" to communicate astringency of red wine.

Herdenstam et al propose an alternative, arguing that not only should consideration be given to what a consumer might understand by terms familiar to those in the trade (p79), but that the wine trade should "*complement the existing, traditional analytical perspective with an aesthetic one*" to improve overall understanding (Herdenstam et al, 2009, p81). Clearly, further research on tannin terminology is warranted.

3.3   Italian Red Wines

Despite the lack of agreement on how to approach tannins, limited work has been carried out on enjoyment of tannic red wines. The studies that are available have been restricted mainly to international grapes such as Merlot, Cabernet Sauvignon and Pinot Noir (King et al, 2003).

Literature looking in particular at Italian wines (Belfrage, 2001; O'Keefe 2012, 2014) takes their tannic structure as given, and spends limited time considering how these wines could be interpreted or appreciated by less engaged consumers, with Pagliarini et al (2013) stating "*little previous work exists on the sensory properties of Sangiovese*". However, in addition to their high tannins, the acidity in these wines can enhance their astringency (Kallithraka et al, 1997), and wine educators confirm that students often find the more overt tannins in such wines harder to understand, with students initially disliking Barolo, as "*it's far too grippy and drying*" (Creamer, 2017, pers. comm.).

Furthermore, wines such as Barolo are finding it increasingly hard to compete in the global market given their high prices (Mullen, 2017). Given the increasing range and complexity of styles emerging from Montalcino and Barolo in particular, with varying tannins as a result of different winemaking practices, an understanding of whether more detailed vocabulary on texture will aid consumers' enjoyment of these styles is important.

3.4   Wine Education and Consumer Preference

There are very few studies of consumers' wine sensory preferences (Lockshin and Corsi, 2012, p14), though the 2015 Wine Business Survey of American Wine Consumer Preferences showed a marked dominance of fruity, semi-sweet and smooth wines (with 58%, 57% and 56% of respondents respectively preferring these styles) and only 9% preferring tannic wines (Thach and Chang, 2015).

This proportion has not been demonstrated to increase with wine education, with Rossetto and Cai (2010) finding that oenology students ranked tannic wines such as Brunello di Montalcino, Barolo and Barbaresco no differently than those with no wine education, arguing there was no link between education and taster appreciation for these wines.

Despite the rapid expansion of wine education worldwide (WSET reported 85,000 students sitting exams in 2016/17, with 12 years of double-digit growth in candidate numbers – WSET website 2018), the effect of education has not been studied in depth with respect to wines (Jackson, 2017). The research that has been

carried out has shown that whilst education can increase the enjoyment of white and rosé wines in the short term, the same cannot be demonstrated for reds over the same period (Cliff et al, 2016). The authors attribute this to greater tannin in red wines, making them harder for consumers to appreciate. However, research by Bindon et al (2014) calls into question the effect of tannin on preference, highlighting that, across a range of red wines, consumers preferred those wines from later-picked grapes with slightly higher tannin, alcohol and lower acid than those from earlier-picked grapes. This preference for higher tannin wines may be attributed to the richer, fruitier style produced by later-harvested grapes. The scarcity of research in this area would be well served by further focus on the role of education in consumer appreciation of tannic red wines.

4. METHODOLOGY

The heart of the project comprised a series of 11 experimental tastings, carried out over two weeks with over 200 volunteer participants, to test the effect of wine descriptors on tasters' enjoyment and perception of wines. Since the literature review indicated that tannins are not well tolerated by consumers, and highlighted an absence of research on Italian wines, two classic Italian styles – Barolo and Brunello di Montalcino – were selected for the research. The tastings were supplemented by discussions with wine educators, to add context to the results.

The tastings and subsequent analysis were designed to test three main hypotheses that emerged from the literature review:

- **Hypothesis One:** There is a statistically significant difference in hedonic ratings of wines when the vocabulary used to describe tannins is changed
  [*Null Hypothesis One: There is no significant difference in hedonic ratings of wines when the vocabulary used to describe tannins is changed]*

- **Hypothesis Two:** There is a statistically significant difference in perception of wines (both tannin measurement and flavour assessment) when tannin vocabulary is changed
  [*Null Hypothesis Two: There is no significant difference in perception of wines when tannin vocabulary is changed]*

- **Hypothesis Three:** There is a positive correlation between hedonic ratings of tannic Italian reds and wine education experience

  [**Null Hypothesis Three:** *There is no positive correlation between hedonic ratings of tannic Italian reds and wine education experience*]

4.1 Materials

The wines were selected to be classic examples of high tannin, high alcohol, high acid Italian wines (acidity increasing the sensation of tannin, Kallithraka et al, 1997). To maximise commercial relevance of the results, as well as availability of wines, Barolo and Brunello di Montalcino were selected at the proposal stage as widely commercially available wines representative of this style.

Pre-selection research was carried out to discover traditional and modern producers of Barolo, and representative high- and low-altitude examples of Brunello di Montalcino, to illustrate a range of flavour profiles and tannic expressions. To ensure consistency between the wines and ensure that any differences in preference were not to do with differences in maturity, the same very good recent vintage was selected for each wine – 2012. The 2010 vintage was also considered, but availability of wines and high prices made this unfeasible within the scope of the project. A shortlist of producers was selected, in collaboration with Italian specialists and buyers, and wines were tasted throughout October and November 2017 at trade tastings to confirm their typicity. The final selection was made in late November 2017, based on tastings, availability and pricing.

The wines selected were:

- **Wine A:** 2012 Giacomo Fenocchio, Barolo

- **Wine B:** 2012 Elio Altare, Arborina, Barolo

- **Wine C:** 2012 Eredi Fuligni, Brunello di Montalcino

- **Wine D:** 2012 Sesti, Brunello di Montalcino

Wines were purchased by the researcher from independent wine merchants, at full retail price. Full details of each wine are available in Appendix 2.

During December, a panel tasting of one MW and three Diploma graduates tasted the wines to:

- Confirm typicity and quality

- Decide on tannin descriptors (both positive and negative) for each wine, and discuss the aroma/flavour profile

- Decide on glassware for the tastings

It was concluded that all four wines were representative of their type and of good to excellent quality. Regarding glassware, the wines were tasted in:

- ISO glass

- Riedel Spiegelau glass

- Berry Bros. & Rudd (BB&R) bespoke John Jenkins tasting glass

It was agreed that the ISO glasses were too small to capture the full aroma of the wine, whilst the John Jenkins glasses were too large, resulting in a noticeable change in texture of some of the wines after 30 minutes in the glass. It was agreed

that the Spiegelau glass provided a similar level of aroma as the John Jenkins glass, but with less noticeable change in wine characteristics throughout the tasting, and therefore was selected as the best option.

Regarding the descriptors for tannins and aromas, there was some discussion over what constituted a "negative" tannin descriptor, but eventually the below were agreed upon for the wines.

Wine	Positive descriptors (+)	Negative descriptors (-)
A (traditional Barolo)	Firm, forward	Austere, angular
B (modern Barolo)	Ripe, powdery	Chewy, taut
C (high-altitude Brunello)	Fine, supportive	Dusty, drying
D (low-altitude Brunello)	Easy-going, round[1]	Large, chalky

Table 4a: Agreed tannin descriptors for the wines

For the flavour and aroma descriptors, it was decided for ease of analysis to offer participants a selection of words, rather than free-form writing. As Sauvageot et al (2006) argued, free description of wine needs careful methodological analysis if it is to be a useful technique[2]. A mixture of aroma and structural descriptors was decided upon, for two reasons: firstly, the structural descriptors (*"grippy", "coarse"*) would act as a proxy for tannin measurement, allowing for cross-checking of results; secondly, the flavour descriptors offered a rough measure of how fruity, or otherwise, participants thought a wine was. With an awareness that the flavours were very

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[1] Initially one of the positive descriptors for Wine D was also "*ripe*" – however, it was agreed for clarity in the results that there should be no overlap in descriptors, so this was replaced with "*easy-going*".
[2] Sauvageot et al (2006) discovered that offering participants completely free choice in how to describe wine resulted in no participants of a study being able to match descriptions to wines. Providing some limitations allowed for some matches of wines to descriptions to be made.

much UK-focused, those in Table 4b, below, were agreed upon, offering an accurate, but broad selection that could describe each of the four wines.

Structural	Fruit/Sweet	Non-Fruit
Bitter	Black fruit	Earthy
Coarse	Floral	Herbal
Grippy[3]	Red Fruit	Leather
Rounded	Sweet[4]	Smoky
Smooth	Vanilla	Spice
Sour		

Table 4b: Range of descriptors agreed upon at panel tasting for tasting sheets, grouped by type

4.2   Location and Timing

The tastings took place in the first two weeks of January 2018, in the Pickering Cellar at BB&R in the heart of London. The cellar is used throughout the year for wine tastings and is well equipped for the purpose. Tastings took place at 12.30pm and 6.30pm on test days. These timings not only increased the likelihood that participants would be able to attend a tasting session, but also ensured that most attendees would be experiencing the tasting before a main meal (either lunch or dinner). The panel tasting (conducted 2pm Monday 11th December 2017) concluded that wines should be tasted before a main meal for maximum effect of tannins and acidity, and this was borne out by the pilot studies, which took place at 11am and 12noon, and showed a marked increase in perception of tannin and acidity in the wines versus the panel tasting.

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[3] "*Grippy*" replaced "*astringent*" after the pilot tasting, as some testers were unsure as to the meaning of astringent.
[4] Although technically a structural component (a taste, rather than a flavour) given its close association with ripe fruit and vanilla, it was agreed that sweet would be better analysed along with fruity flavours.

4.3   Participants

The target population was consumers with some previous wine tasting experience (minimum one wine tasting attended previously, so that they were familiar with the concept of tannin). For convenience purposes, and to ensure some consistency in style of teaching, students of BB&R's wine school over the past three years were targeted, a population of approximately 7,000 students. Only those who had agreed to receive emails were contacted, bringing the pool down to approximately 1,600 students. Students were emailed in December 2017 and invited to take part in the tastings in January 2018, with the opportunity to win a case of wine from a country of their choice as an inducement.

A desired sample size of around 200 was necessary to ensure the number of responses in each of the sub-sets of data was suitably large for application of standard statistical analysis. Conventionally this is suggested to be a minimum of 30 (Corder and Foreman, 2009); a target of 50 was therefore set for the experimental sub-sets to allow for incomplete responses, resulting in a desired sample of 200. In total 262 students agreed to take part, with 222 attending and completing the tastings. The table below shows the breakdown of participants by gender and age.

Age Range	Female	Male	Total
18-29	22	17	39
30-39	38	32	70
40-49	15	17	32
50-59	11	27	38
60+	8	18	26
Total	94	111	205

Table 4c: Breakdown of tasting participants by gender and age. Note that 17 participants made errors on the tasting sheets – these sheets were discarded, so only 205 complete results sets were used

4.4 The Tastings

Once all participants had responded and most had assigned themselves to a tasting, it was possible to observe the distribution of gender between the tastings as well as gain an approximate idea of wine education (based on the highest WSET course participants had taken with BB&R). Some participants were happy to be allocated to a time slot, and this allowed for an approximately even distribution of gender and age to be achieved across the sessions. At each tasting, 50% of the question papers were Control and 50% were Experiment. This ensured that any slight bottle variation (though none was detected by the researcher) would affect both Control and Experiment responses evenly.

Wines were opened and tasted by the researcher half an hour before participants were due to arrive. One bottle of Wine A was discarded due to cork taint. Temperature of the wine at opening was noted using a probe, and time of opening was also noted. Wines were then put into blind tasting socks, numbered 1 to 4. Finally, bottle numbers (1 to 12) were noted on each question paper, to ensure that any outlier results could be traced back to faulty bottles once the raw data were later analysed. A control set of the four wines was poured out, aroma intensity assessed and temperature taken just before participants arrived.

Participants were welcomed into the tasting room and invited to sit anywhere. Each place setting had four glasses set up on a numbered tasting mat (to reduce any confusion about wine order), a spittoon, water glass and bottle of purified water. Participants also had a question sheet in front of them (question sheets were laid out around the room in random order), with cover sheet explaining how the tasting would

run, explaining confidentiality protocol, and asking for a signature to confirm agreement to the conditions of the tasting.

The pourers then checked the question paper number against a master document, which showed which order the wines needed to be poured in for that paper, and poured the wines accordingly. This way, wines were always poured in the correct, bespoke order for each participant, and were also freshly poured for each participant.

Question sheets were designed to answer the key research questions and fell into Control or Experiment. For each wine there was a short description:

- **Control: *Wine 1 is a full-bodied red wine with high tannins* OR**
- **Experiment:** The adjectives agreed upon at the panel tasting were used to describe the wine, for example ***Wine 1 is a full-bodied red wine with ripe, powdery tannins.***

Participants were then asked to rate the wine on a 1-9 scale for enjoyment and do the same for level of tannins[5]. Finally, for each wine, participants had to circle descriptors from a word cloud that they felt best suited the wine. The order of the words in the word cloud was randomised for each participant, to cancel out effects of optimal viewing position and right visual field advantage (O'Regan and Jacobs,

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[5] Given the controversial nature of statistical treatment of Likert-type data, Carifio and Perla (2007) were considered in the design of the questionnaire. The response sheet was created with equally spaced numerical scores for respondents, in order to ensure the resulting data could be treated as interval data.

1992; Brysbaert et al, 1996). Participants then had to answer some demographic questions. A sample question sheet can be viewed in Appendix 3.

To generate the test papers, an Excel spreadsheet was created. The first 100 lines were allocated as Control papers, and wines were ordered randomly for each of these participants, to eliminate effects of serial order preference (Mantonakis et al, 2009[6]). For the test subjects, again random wine order, combined with a mix of positive and negative descriptors was used, to ensure that each wine was tasted with 50 positive and 50 negative descriptors throughout the series of tastings.

The spreadsheet was linked to a mail merge, so that 200 unique question papers were generated, each with a unique identifying number, linked to a master document showing the order the wines needed to be poured in for each participant. All papers had the wines ordered randomly. For participants 201-222, duplicates of papers 101-122 were generated, so in total 100 Control and 122 Experiment papers were completed.

Participants were invited to spend as long as they wished carrying out the tasting, but asked not to go back and re-taste. Participants were given no time limit on the tasting, but advised it would take approximately 20 minutes. Most completed within 20 minutes and over 95% within 30 minutes.

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[6] Mantonakis et al (2009) discovered a large primacy effect in wine tastings – if participants were asked to choose their favourite wine in a tasting, the first wine was often favoured.

Once all participants had completed the tasting, the researcher collected all question papers, noted the time, and re-tasted the four control glasses on the side, to ensure no noticeable change had occurred in intensity of aromas or texture of tannins.

4.5 Statistical Analysis

Of the 222 responses, 17 were incomplete, with papers missing enjoyment level data, tannin data or with no descriptors circled. To minimise any additional complexity in the analysis from partial data entry, these 17 responses were all discarded. The remaining 205 complete data sets were entered into Excel (2016, Version 1803) by the researcher, in batches of 20, over two weeks, to minimise input errors. They were then cross-checked. All analysis was performed in Excel.

To test whether the data fit a normal distribution (to allow appropriate statistical analysis to be conducted), enjoyment and tannin ratings were formatted in a bar chart, and skew and kurtosis assessed. Whilst some skew was expected for the tannin assessment (as these wines were more tannic than many red wines), for both enjoyment and tannin level, skew and kurtosis were well within the -2.0 to 2.0 range[7] suggested as suitable for parametric analysis (George and Mallery, 2010). There were no outliers or unusual data points that needed to be removed.

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[7] For enjoyment data, kurtosis was -0.37, and skew was -0.39, whilst for tannin data kurtosis was -0.35 and skew was -0.44.

Data for tannin and enjoyment were analysed for significance against the hypotheses using two-tailed two-sample t-tests[8] (Snedecor and Cochran, 1989). The t-test compares the means of data sets and assesses the probability that differences between the sample means have occurred by chance. A two-tailed test considers the probability that the Experiment data set may result in either an increase in enjoyment or a decrease in enjoyment, as compared with the Control data set, thereby reducing the risk of Type I[9] error. As an additional precaution, a Mann Whitney U-test[10] was applied to check for significance on a number of sub-sets of the data, and in all cases agreed with the outcome of the t-test.

Finally, to assess changes in choice of flavour/aroma descriptors in Part 3 of the tasting sheet, Chi-squared analysis was performed. This is a method of assessing all the adjectives circled across all the tasting papers, and then comparing the selected data set (positive descriptors, negative descriptors, or Control) with this baseline, to assess whether deviations in the distribution of descriptors were significant or not. This analysis therefore accounted for the fact that participants knew how to taste wine, and the distribution of descriptors was not equally distributed across the different wines.

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[8] Whilst it was expected that positive vocabulary would result in an increase in enjoyment, and vice versa, the two-tailed t-test also assesses the likelihood of a reduction in enjoyment occurring by chance. It is a more stringent test than the one-tail test, essentially allowing just 2.5% probability that any result has occurred by chance at the 95% significance level – as the 5% chance probability is split between any possible increase OR decrease. A two-sample test was used as Experiment data points were compared against the Control data set, and each set consisted of different participants.

[9] A false positive result.

[10] Like a t-test, a Mann Whitney U test compares the difference in sample means to determine whether the difference is statistically significant, using ordinal, rather than interval data as an input. Whilst the tasting sheets were carefully designed so that parametric tests could be applied, for additional rigour, an equivalent non-parametric test (Mann Whitney U-test) was also applied to the data for Hypothesis One and Two. No difference was observed compared with the results of the t-test.

5. RESULTS AND STATISTICAL ANALYSIS

The results were analysed using the statistical methods outlined in **4.5 Statistical Analysis**. The key findings relating to vocabulary and its influence on enjoyment and perception are highlighted here. All averages expressed in the results are arithmetic means. P values in tables show the probability that a result occurred by chance. P values of 5% and below indicate the results are statistically significant at the 95% confidence level and are highlighted in red and underlined. P values of 10% and below indicate results are statistically significant at the 90% confidence level and are highlighted in pale pink.

5.1   Hypothesis One

"There is a statistically significant difference in hedonic ratings of wines when the vocabulary used to describe tannins is changed"

The hedonic ratings for all wines were tabulated, the mean and standard deviation calculated and a two-tail t-test run to compare the sample means of the Experiment against the Control data for each of Wines A-D. The table overleaf shows the results for enjoyment, with the second column showing the difference from the mean enjoyment of the Control wine and the third the P value. A- refers to responses where negative descriptors were used for Wine A, and A+ where the positive descriptors were used.

Wine	Mean hedonic rating (enjoyment)	Change in enjoyment compared with Control	P Value
Wine A (traditional Barolo)	**5.61**		
A-	5.38	-0.23	**46%**
A+	5.72	0.11	**72%**
Wine B (modern Barolo)	**5.75**		
B-	5.74	-0.01	**97%**
B+	5.76	0.01	**95%**
Wine C (high-altitude Brunello)	**5.95**		
C-	5.32	-0.63	**4%**
C+	5.96	0.01	**96%**
Wine D (low-altitude Brunello)	**5.72**		
D-	6.21	0.49	**8%**
D+	5.70	-0.02	**95%**

Table 5a: Change in mean hedonic rating of Experiment wines compared with Control wines

As the table highlights, Wine C shows a significant reduction in enjoyment in the case of the negative descriptors (Wine C-). For Wine D, by contrast, the negative descriptors in fact resulted in increased enjoyment of the wine, not significant at 95% but significant at the 90% confidence level. For Wines A and B, the two Barolos, the change in preference was not sufficient to be statistically significant, but nonetheless there was a small positive correlation between vocabulary used and increased enjoyment of the wine.

5.1.1 Understanding What Drove the Significance

Segmenting the data for Wines C and D and comparing those participants who selected "full-bodied red wine" as one of their preferences for wine at the end of the tasting, with those who didn't, it can be seen that each group has had a specific impact on the results.

Wine	Change in enjoyment compared with Control	P Value
Wine C		
C-	-0.33	**31%**
C+	-0.07	**82%**
Wine D		
D-	0.56	**8%**
D+	0.02	**96%**

*Table 5b: Change in average hedonic rating of Experiment wines compared with Control wines for participants who **like** Full-Bodied Red Wine*

Wine	Change in enjoyment compared with Control	P Value
Wine C		
C-	-2.00	**0%**
C+	0.30	**62%**
Wine D		
D-	0.24	**69%**
D+	-0.12	**90%**

*Table 5c: Change in average hedonic rating of Experiment wines compared with Control wines for participants who **did not like** Full-Bodied Red Wine*

Those preferring full-bodied red wines clearly drove the increased enjoyment of Wine D-, (described as having "*large, chalky tannins*") whilst those who do not normally enjoy full-bodied red wines contributed to the marked reduction in enjoyment of Wine C- ("*dusty, drying tannins*"). There was no significant interaction for the Barolos when observing the data in this manner.

Summary of Results for Hypothesis One: Partially Supported	• Significant change in enjoyment for Brunello di Montalcino wines when description of tannins is changed • Difference between "positive" and "negative" descriptors is not clear cut; negative descriptors may cause an increase in enjoyment • Initial preference for a style of wine can drive a particular response

5.2   Hypothesis Two

"There is a statistically significant difference in perception of wines (both tannin measurement and flavour assessment) when tannin vocabulary is changed"

5.2.1 Changes in Tannin Measurement

There was a clear difference in assessment of tannins across the four wines, with the single-vineyard Barolo (Wine B) standing out as the most tannic, and the lower-altitude, riper Brunello di Montalcino (Wine D) as the least. The change in vocabulary from neutral (Control) to positive or negative (Experiment) triggered changes in how participants rated the tannins, as Table 5d below highlights.

Wine	Mean tannin rating	Change in tannin rating compared with Control	P Value
Wine A (traditional Barolo)	**6.51**		
A-	6.45	-0.06	**86%**
A+	6.22	-0.29	**34%**
Wine B (modern Barolo)	**6.93**		
B-	7.13	0.20	**47%**
B+	6.61	-0.32	**25%**
Wine C (high-altitude Brunello)	**6.43**		
C-	6.53	0.10	**75%**
C+	6.60	0.17	**49%**
Wine D (low-altitude Brunello)	**5.84**		
D-	5.70	-0.14	**62%**
D+	5.15	-0.69	**2%**

Table 5d: Change in average assessment of tannin levels in Experiment wines compared with Control wines

As seen above, as with the enjoyment data, it is the Brunello di Montalcino wines where there is a significant difference, but this time Wine D shows the largest change; Wine D+ showing an average reduction in tannin measurement of 0.69 with

the positive descriptors, statistically significant at the 95% confidence level. Wines A and B also show a sizeable, but not significant, reduction in tannins measured with positive descriptors. For negative descriptors there is less of a pattern, with the change in measured tannins being small and varying from positive to negative.

5.2.2 Word Cloud Descriptors: Texture

The analysis of the word-cloud descriptors (outlined in Table 4b) was two-fold. Firstly, it was used as a proxy for tannin measurement, with the descriptors "*coarse*" and "*grippy*" indicating a more tannic experience, and "*round*" and "*smooth*" indicating a less tannic experience for the participant. Secondly, it also considered whether the actual flavour experience for participants was different depending on the descriptors used. Figure 5a, below, is the simple sum of all of the adjectives for all wines.
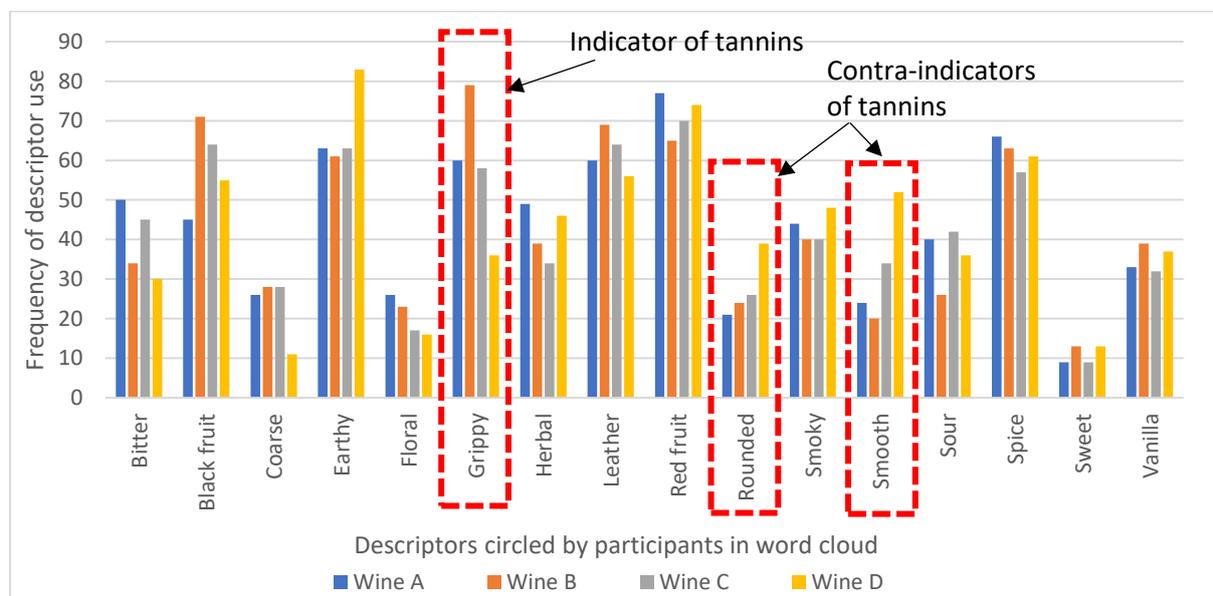

Figure 5a: Instances of word cloud descriptors used across all wines

This shows a wide spread in how the wines were described, however some clear patterns emerge: Wine B was described as "*grippy*" 79 times, suggesting this was seen as the most tannic wine[11] and indicates "*grippy*" is a good proxy measurement for tannin. By contrast, Wine D is described as "*rounded*" 39 times and "*smooth*" 52 times (versus 26 and 34 for Wine C, the next highest scorer on these words). This correlates with the low tannin score for Wine D.

A Chi-squared analysis of these word cloud descriptors (relative to the full data set) corroborates this, showing that for Wine B, there was a statistically significant increase in the use of "*coarse*" or "*grippy*" in both the Control and the negative Experiment group (see Table 5e below). In other words, Wine B+ (positive descriptors) was felt to be significantly less grippy when described as having "*ripe, powdery*" tannins. Chi-squared analysis on "*rounded*" and "*smooth*" showed the obverse, with a significant increase in use of these descriptors for Wines C and C+, i.e. Wine C- was deemed significantly less smooth when described as "*dusty, drying*".

Wine	P value for "coarse", "grippy"	Wine	P value for "coarse", "grippy"	Wine	P value for "coarse", "grippy"
A	23%	A+	35%	A-	31%
B	**2%**	B+	76%	B-	**1%**
C	27%	C+	51%	C-	10%
D	38%	D+	19%	D-	43%

Table 5e: P values from Chi-squared test on texture adjectives "coarse" and "grippy" across all wines, as a proxy for tannin measurement

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[11] This is consistent with the tannin scores noted in Table 5d.

Wine	P value for "rounded", "smooth"	Wine	P value for "rounded", "smooth"	Wine	P value for "rounded", "smooth"
A	13%	A+	32%	A-	20%
B	13%	B+	46%	B-	12%
C	**2%**	C+	**2%**	C-	50%
D	19%	D+	9%	D-	21%

Table 5f: P values from Chi-squared test on adjectives "round" and "smooth" across all wines, as a contra-indication for tannin

5.2.3 Word Cloud Descriptors: Flavour

As there were 16 descriptors in total, individual analysis on flavours gave too varied a pattern to pick out any trends. However, analysing the results for flavour descriptors by themed groups highlighted a significant change for Wine B[12]. An analysis on non-fruit flavours in the wines (*"earthy", "herbal", "leather", "smoky", "spicy"*) shows the below.

Wine	P value for "earthy", "herbal", "leather", "smoky", "spicy"	Wine	P value for "earthy", "herbal", "leather", "smoky", "spicy"	Wine	P value for "earthy", "herbal", "leather", "smoky", "spicy"
A	29%	A+	23%	A-	18%
B	**4%**	B+	96%	B-	**2%**
C	14%	C+	6%	C-	86%
D	54%	D+	27%	D-	64%

Table 5g: P values from Chi-squared test on non-fruit adjectives "earthy", "herbal", "leather", "smoky", "spicy" across all wines

Wine B was described as significantly more savoury in the Control and negative cases (when the wine was described as either "*high*" in tannins, or having "*chewy, taut*", rather than "*ripe, powdery*" tannins). However, there was no significant

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[12] See Table 4b in "Methodology" for flavour groupings.

change across the fruity descriptors (*"black fruit", "floral", "red fruit", "sweet", "vanilla"*) for any of the wines, with the distribution of flavour descriptors here being no better than random compared with the data set as a whole.

Summary of Results for Hypothesis Two: Partially Supported	• Positive language can reduce tannin perception in wines – this was statistically significant in Wine D • Assessing tannin proxies ("*coarse*" and "*grippy*") demonstrated a significant occurrence of these words with negative or neutral vocabulary for Wine B. There was a significant occurrence of "*round*" and "*smooth*" with positive and neutral vocabulary in Wine C • Changing tannin vocabulary can change how the flavour of a wine is perceived. There was a significant shift to "non-fruit" flavour descriptors in Wines B and B-, as compared with Wine B+

5.3   Hypothesis Three

"There is a positive correlation between hedonic ratings of tannic Italian reds and wine education experience"

5.3.1 Enjoyment with Respect to Wine Education

To assess the effect of wine education on enjoyment of these wines, the data were broken down by the highest level of wine qualification studied for. This was supplemented by questions on the number of wine tastings or courses attended over the past year. For the purpose of creating a single, cohesive data set, those

participants who had not undertaken formal WSET qualifications were assigned an "equivalent" WSET level, based on the number of wine tastings they had attended. This mapping was carried out as below[13].

Number of tastings attended in past year	Number of participants who had attended tastings, but not WSET courses	WSET qualification "equivalent", for purposes of results analysis
0	23	NONE
1	20	NONE
2-3	29	Level 1
4-6	15	Level 2
7-10	9	Level 2
11+	6	Level 3

Table 5h: Mapping of number of tastings onto equivalent WSET qualifications for the purposes of data analysis

An assessment of average enjoyment of the wines was carried out, using the mapping above, incorporating all participants. The results are shown in Figure 5b, overleaf.

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[13] Whilst participants with previous wine tasting experience were sought for the experiment, some brought friends with them to the tastings who had not previously participated in formal wine tastings, hence the 23 participants with no qualifications or formal wine tasting experience. For an outline of limitations of this methodology, see **6.4 Limitations and Further Research**
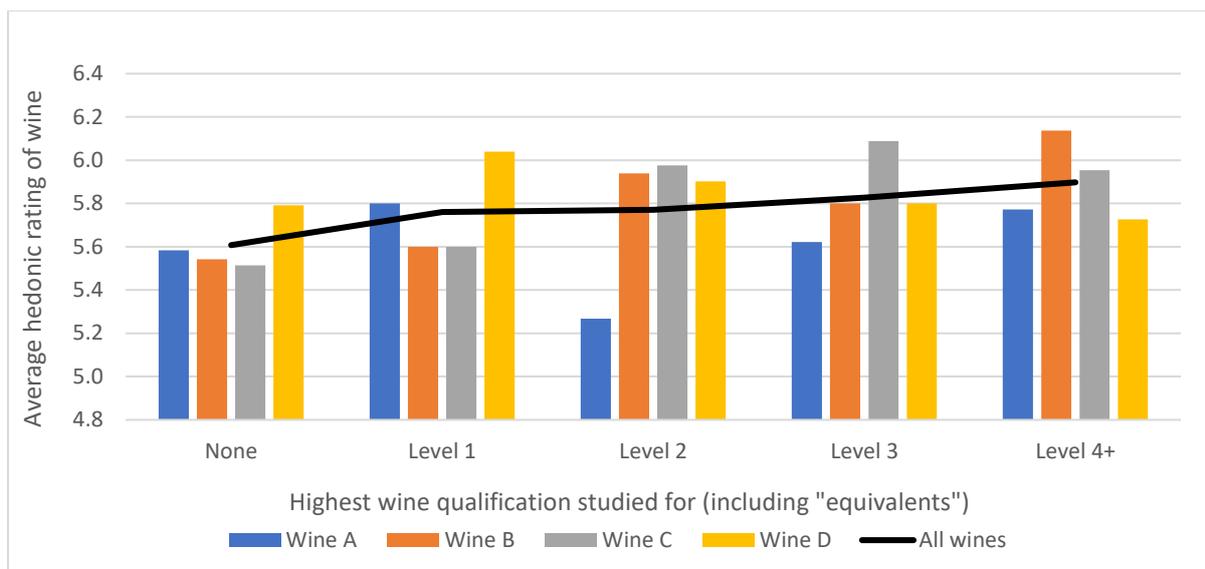
Figure 5b: Enjoyment of the wines with respect to wine qualification

As can be seen, there is a trend for enjoyment of the wines to increase with wine tasting experience. Furthermore, Wine D, the least tannic, was clearly preferred at lower wine education levels. This was overtaken by a preference for Wines B and C, at higher wine education levels.

Breaking this down to look at changes in enjoyment highlighted that WSET Levels 1, 2 and 3, or equivalent, showed significant change in enjoyment from Control to Experiment groups, as Table 5i shows, opposite.

Wine	WSET Level 1		WSET Level 2		WSET Level 3	
	Change in enjoyment	P value	Change in enjoyment	P value	Change in enjoyment	P value
C-	0.64	48%	-0.90	23%	-0.73	30%
C+	1.29	**4%**	-0.79	26%	0.66	19%
D-	-1.03	18%	2.27	**0%**	0.67	26%
D+	-0.76	28%	0.79	23%	-1.55	**3%**

Table 5i: Change in enjoyment versus Control wines, broken down by wine education level

- Level 1 students showed a statistically significant increase in enjoyment of Wine C+

- Level 2 students showed a significant increase in enjoyment of Wine D-

- Level 3 students showed a significant drop in enjoyment of Wine D+

- At Level 4, and for those participants with no previous wine qualifications, there was no significant change in enjoyment

These results were significant looking at both WSET-qualified participants alone, and when combined with the WSET-equivalent data.

5.3.2 Wine Trade Participants

Narrowing the focus even more, and just looking at those participants involved in promoting or selling wine, the average enjoyment of all wines was 5.80, versus 5.73 for those not working in the wine trade. Crucially there was a broader range of enjoyment (0.61 versus 0.26 for the data set as a whole), and the least-favoured wine by the whole data set (Wine A) was second favourite for wine trade participants.

Wine	Enjoyment for whole data set	Enjoyment for wine trade	Tannin for whole data set	Tannin for wine trade
A (traditional Barolo)	5.58	6.03	6.42	6.71
B (modern Barolo)	5.75	5.45	6.90	**_7.48_**
C (high-altitude Brunello)	5.79	6.06	6.50	7.03
D (low-altitude Brunello)	5.84	5.65	5.62	5.45
Average for all wines	**5.74**	**5.80**	**6.36**	**6.67**

Table 5j: Average enjoyment and tannin levels for all types of each wine (Control, positive and negative) across whole data set, versus only those participants employed in the wine trade

Ranking of the wines in order of level of tannin was the same for both the general data set and the wine trade[14], suggesting there is sufficient understanding of what tannins are (despite the range of experience across participants) for the data to be valid. However, the assessment of tannin level by the wine trade was higher in Wines A, B and C, and significantly so for Wine B, suggesting an important mismatch in how consumers and the trade assess tannins.

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[14] From highest to lowest: Wine B (modern Barolo), Wine C (high-altitude Brunello di Montalcino), Wine A (traditional Barolo), Wine D (low-altitude Brunello di Montalcino)

Summary of Results for Hypothesis Three: Hypothesis Supported	• Trend for increasing enjoyment of the wines with increasing wine tasting experience • Complete novices and highly experienced tasters were less influenced by changes in wine descriptions. Those with a moderate level of wine education showed significant changes in enjoyment for the Brunello di Montalcino wines. • Broader spectrum of enjoyment across wine trade members than general population, and significantly higher measurement of tannin by trade members for the most tannic wine

6. INTERPRETATION AND LIMITATIONS

The aim of the research was to test the three hypotheses, linked to the research questions:

- **Hypothesis One:** There is a statistically significant difference in hedonic ratings of wines when the vocabulary used to describe tannins is changed

- **Hypothesis Two:** There is a statistically significant difference in perception of wines (both tannin measurement and flavour assessment) when tannin vocabulary is changed

- **Hypothesis Three:** There is a positive correlation between hedonic ratings of tannic Italian reds and wine education experience

There was evidence in the results to support all three hypotheses, underlining the important role of vocabulary in both consumers' enjoyment of wine, and also in how they perceive that wine. Furthermore, there was a positive link between wine education experience and enjoyment of these tannic Italian red wines. Within these results there were considerable variations though, between the differing styles of wine, and among data sets. These differences will be explored here, and possible explanations for, and implications of, these results considered.

6.1   Hypothesis One

The aim of this hypothesis was to test whether qualitative descriptions of tannins affect consumers' enjoyment of wines. Whilst there was no significant difference for Wines A and B (the Barolos), for Wine C (high-altitude Brunello di

Montalcino), the null hypothesis was rejected where negative descriptors were used to prime participants. Given that all other variables remained the same, this result proves that consumers' enjoyment of a wine can be changed simply by altering the vocabulary used to describe that wine.

6.1.1 Choice of Vocabulary

In the case of Wine C, the negative description was "Wine 1 is a full-bodied red wine with dusty, drying tannins". The Control replaced "*dusty*, *drying*" with "*high*". The results show that, subconsciously or otherwise, participants felt that "*dusty*" and "*drying*" were negative descriptors, which diminished their enjoyment of the wine.

Despite this change in enjoyment though, there was no significant change in tannin assessment for this wine, i.e. participants did not automatically rate a wine described as "*dusty, drying*" as more tannic than one described as having "*high*" tannins. However, the choice of descriptive vocabulary, with all else in the experiment staying constant, was sufficient to reduce consumers' enjoyment of Wine C-. Furthermore, this reduction in enjoyment was entirely driven by participants who did not like full-bodied red wines, indicating that the terms "*dusty, drying*" are only viewed as negative by consumers who do not like this style of wine. For those who do, "*dusty, drying*" tannins are in no way pejorative.

This lack of a clear division of vocabulary into "positive" and "negative" is also evident when looking at the other Brunello di Montalcino, Wine D. There was an

increase in enjoyment of this wine with the terms "*large, chalky*" and it was participants who enjoyed full-bodied red wines driving this increase. This increase came about despite these words being selected in the panel tasting by four experienced wine trade members as "negative" adjectives. This unexpected result highlights quite clearly that:

- Vocabulary can have a significant effect on consumers' enjoyment of wine as compared with a quantitative approach to tannins (high/low)
- Arguably more importantly though, consumers and trade may not see eye-to-eye on which adjectives are deemed positive or negative. Indeed, even among consumers there is variation as to what the desirable characteristics of a wine may be, depending on the styles of wine they prefer to drink

Discussions with communicators and educators in the wine trade underline this debate over choice of vocabulary, particularly with reference to tannins. According to Jeremy Cukierman MW (2018, pers. comm.) *"for me, chalky and chewy are not negative terms when used to describe tannins. Chalky is probably the best descriptor for the tannins of Nebbiolo, yet I love Nebbiolo".* Lehrer also proposes that "*velvety, silky, firm and round*", among others, can all be viewed as positive tannin descriptors (Lehrer, 2007, p129). Nevertheless, though Wine D+ was described as "*round*", there was no significant change in enjoyment for Wine D+. It is therefore apparent that whilst the wine industry may ascribe positive or negative meaning or connotations to adjectives, there is some inconsistency within the trade on these terms. More importantly, however, there is a disconnect between the trade and consumers as to what these terms mean, and a lack of understanding as to the effect they will have. Considerable further research is therefore needed on specific

tannin descriptors, to develop a better understanding of which descriptors will result in a positive experience for consumers.

6.1.2 Changes in Enjoyment in Barolo Versus Brunello

Looking at the different styles of wine, whilst the Barolos showed a small increase in enjoyment with positive vocabulary, it was the Brunello di Montalcino wines where the significant interactions occurred. This suggests that participants' liking of the Barolos was more set, and their enjoyment harder to alter with pre-tasting priming, whether they enjoyed this style of wine or not.

Anne McHale MW reports that when teaching, she finds students like Brunello di Montalcino more, whereas Barolo is often more divisive, an observation she attributes to its tannins and acidity (McHale, 2017, pers. comm.). One explanation for these results is that due to the slightly softer and rounder nature of Brunello di Montalcino, it is easier to change participants' perception of it. Overall the Brunello di Montalcino wines were enjoyed more than the Barolos (and the modern Barolo more than the traditional), which supports Frøst and Noble's idea that both high levels of tannins and earthier wines are harder for consumers to appreciate than fruitier wines (Frøst and Noble, 2002).

This theory is supported further by the result that those not liking full-bodied red wines drove the reduction in enjoyment for Wine C-, suggesting that vocabulary can enhance an effect that is already present. This wine was the more savoury and

grippy of the two Brunello di Montalcino wines, with less apparent fruit flavour than Wine D. One possible explanation for this result is that with less fruit, the tannins and alcohol provide the main characteristics of the wine. For those participants who enjoy this style, highlighting the structure of the wine more with vocabulary will have little effect on their enjoyment of the wine. For consumers who are less keen on this style, priming with key descriptors such as "*dusty*" and "*drying*" may highlight the tannins more, and therefore result in a reduction of enjoyment. This chimes with the results for Wine D, with participants who preferred full-bodied red wines causing the increase in enjoyment in Wine D-, again pointing to choice of vocabulary accentuating a natural tendency (enjoyment of the wine) but not completely altering it.

6.2   Hypothesis Two

6.2.1 Reduction in Perception of Tannin

There was a statistically significant reduction in measurement of tannins with Wine D+ ("*easy-going, round*"). This was unexpected, as the data for enjoyment indicate that in fact vocabulary for Wine D+ led to a reduction in enjoyment of the wine. This highlights that tannin and enjoyment levels are not automatically correlated, despite the literature review indicating that it is tannins that make such wines unapproachable to many consumers (Thach and Chang, 2015).

It can also be seen that there was a notable uptick in Wine C being described as "*round*" and "*smooth*" in the word cloud, both with the Control wine, and also for

Wine C+. However, in the Experiment papers, it was Wine D+ that was described as "*easy-going, round*" in the pre-tasting priming, not Wine C. This counter-intuitive result shows that participants felt free to describe the wines as they wished, and although the change in vocabulary did, in some cases, cause a significant change in how participants experienced the wines, the mechanism was not as simple as participants merely repeating the words they had already been exposed to.

This evidence therefore strongly argues for a subconscious effect of vocabulary on perception of tannin; Labroo et al (2008) demonstrated quite clearly in their studies that subconscious priming can be a powerful influencer on opinions. The most likely mechanism here is that the descriptors cause the mind to focus on other aspects of the wine, meaning the tannin is less noticeable[15].

6.2.2 Change in Tannin in Barolo Versus Brunello

As with the enjoyment data, it was with the Brunello di Montalcino wines, not the Barolos, where the largest perceived change in tannins occurred. This perceived drop in tannins could well be to do with the structure of tannins in Brunello di Montalcino – with Alessandra Fedi describing Sangiovese tannins as "*medium+*" (Fedi, 2017, pers. comm.), whilst Michelle Cherutti-Kowal MW comments that, due to

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[15] Due to the design of this experiment, it was not possible conclusively to confirm whether the priming effect was conscious or subconscious. Labroo et al (2008) concluded that subconscious priming can take hold in as little as 16 milliseconds. Given the wines in this experiment were tasted blind and given the lack of context participants were provided before the tasting, it is likely most of the effect was subconscious. The speed with which most participants completed the tasting also supports this theory, as few will have had time to ponder any negative connotations of any of the adjectives. Testing this assertion is far beyond the scope or means of this project; there is however much potential here for further research, and the possibility of developing a hierarchy of positive or negative vocabulary for priming wine-drinking consumers.

the time in barrel, these tannins always feel softer than those of a Barolo (Cherutti-Kowal, 2017, pers. comm.). This may give the taster more leeway on measurement of tannin, as the wine seems less extreme. As with the enjoyment data, this points to an upper limit on tannin measurement, and whilst priming can "nudge" a consumer, it cannot outright change their view of the wine. For those who found the wines very tannic, vocabulary was insufficient to change that view. For those who found the wines slightly less tannic, positive vocabulary could alter that perception slightly.

6.2.3 The Link Between Tannin and Flavour

Whilst the distribution of descriptors across the wines was broad, Wine B was significantly more savoury in Wines B and B- in the Chi-squared analysis, when compared with Wine B+. This exactly matches the significant increase in the use of "*coarse*" or "*grippy*" in these wines. This suggests that the change in perceived tannin in a wine also has a knock-on effect on the flavour profile of that wine, resulting in an increase in savoury flavours such as "*earth*" and "*leather*".

Wine B was the most modern in style of all wines, with pronounced fruit flavours. These results indicate that with negative tannin vocabulary (for this wine, the negative adjectives were "*chewy, taut*"), the influence switches away from the fruit, resulting in more savoury descriptors. For those wines which were clearly dominated by earthy and leather flavours already (e.g. Wine A, Wine C), the change in flavour perception triggered by the priming was not sufficient to be noticeable.

This mechanism of flavour affecting structural components of a wine has been observed with sweetness and acidity, with fruitier flavours increasing perception of sweetness and suppressing sensation of acidity (Stevenson et al, 1999). Furthermore, Frøst and Noble (2002) demonstrated that wines high in vanilla and berry aromas are liked significantly more than wines high in either leather aromas and/or with a sour taste. This was shown across participants with a range of wine knowledge. Little work exists though on the effect of flavour changing tannin perception, and vice versa; further research into this effect is warranted.

This result was only evident in one of the four wines in this tasting. However, if it can be demonstrated again, in a larger study focusing on the interactions between different components in wine, that tannins are correlated with savoury flavours, this would have important implications for the wine trade. It may be that those consumers who dislike tannins actually associate such wines with savoury, or earthy flavours. One approach therefore would be for the trade to focus more on the fruit flavours in these wines, or point such consumers towards fruitier examples, (for example, the glossy fruit and oak of the Elio Altare Barolo rather than the leather flavours of the Giacomo Fenocchio Barolo).

6.3   Hypothesis Three

6.3.1 Wine Education and Experience

The results showed a trend for enjoyment of these wines to increase with increasing wine education and experience. This supports Alba and Williams' general

theory (2012) that "*expertise increases hedonic enjoyment*", though this is the first time it has been demonstrated with regards to tannic red wines.

Looking at the nuances, there were significant changes in enjoyment across the experiment for students at WSET Levels 1, 2 and 3. Students with no previous formal wine qualifications showed no significant change in hedonic ratings between the Control and Experiment wines. This indicates that some understanding of tannins or structure is required for priming to be effective. At the other end of the spectrum, WSET Level 4 students also showed no significant difference in enjoyment from the Control group to the Experiment group. This indicates that after a certain level of education, consumers approach wine in a more objective fashion, or rate their enjoyment differently, again making priming less effective in changing their opinion of the wine.

Instead, it is the middle ground of moderately experienced consumers where the greatest change in enjoyment and perception is likely to occur. This is relevant to the trade, as this is often where consumers are spending more money per bottle of wine (Jackson, 2017[16]), in addition to starting to explore more unusual styles of wine. Positioning region-specific and more esoteric styles of wine correctly for these consumers is therefore crucial.

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[16] Tim Jackson found that at least a two-hour course can increase spend on wine by up to 12%, but more in-depth courses such as WSET can lead to an increase of up to 49% on wine spend.

It is also these middle qualification levels (WSET 1, 2 and 3) where tannins are measured objectively but not adjectivally. At Level 4, students are encouraged to describe tannins using adjectives such as "*coarse, chalky, fine*". It may be that, already being familiar with such an approach, Level 4 students are less suggestible when faced with a range of vocabulary focusing on tannins. At the lower qualification levels, the quantitative approach of "*high*", "*medium*" etc for tannins may in fact leave consumers more open to being swayed by textural descriptions of a wine.

Michelle Cherutti-Kowal MW agrees, arguing that at WSET Level 3, some discussion of the nature of tannins is warranted (2017, pers. comm.). Whilst this may seem as though it is complicating the tasting process, it could be that additional information will help consumers to understand the style of wine they can expect.

6.3.2 The Wine Trade

Taking the link between wine education and enjoyment further, a comparison was done on those participants in the wine trade, versus the sample as a whole. Overall, participants working in the wine trade enjoyed the wines slightly more on average as compared with the whole data set, and crucially had a much wider range of enjoyment for these wines. This highlights that the wine trade must be careful to adjust its view to take account of consumers' different preferences or possible reduced appreciation for such styles of wines. This is underscored by the reversal in preference by those working in the trade, preferring Wines A and C (traditional Barolo and high-altitude Brunello di Montalcino), instead of the fruitier, softer Wines

B and D, (modern Barolo and low-altitude Brunello di Montalcino) preferred by the data set at large. Whilst this could be due to a greater exposure to less fruity wines for those in the trade, the key inference here is that preferences do differ between the trade and consumers. Although this is recognised and acknowledged, it should always be borne in mind when discussing wines with consumers.

What was more apparent between the two groups though was the contrast in tannin measurement. Wine trade participants rated Wine B as significantly more tannic than consumers. This was a modernist single-vineyard Barolo, with very high levels of tannins, but also plenty of primary fruit and new oak.

Once again, this highlights that tannins are closely intertwined with the flavour profile of a wine. Whilst the trade may well be able to detect tannins more readily (partly due to being well trained to detect tannins as an indicator of style, longevity and quality), there is a risk that these are overemphasised to consumers. In fact, in fruitier wines, consumers may find tannins far less noticeable than those in the trade, and so less off-putting. This accords with the work done by Bindon et al (2014), demonstrating that consumers prefer wines with higher tannins, if the grapes are picked later, so balancing the tannins with more fruit and alcohol.

6.4   Limitations and Further Research

Whilst every effort was made to ensure a truly blind tasting and broad sample of attendees, the participants were by no means representative of the wine-

consuming population of the UK. Whilst the research targeted consumers with some wine tasting experience, and targeting previous attendees of BB&R's wine school ensured some consistency in teaching, attendees were generally limited to those living and working in London and BB&R customers. This meant participants were likely to have greater exposure to a wider range of wines than is available in the UK at large, and were also likely to have higher-than-average income compared with the rest of the UK. The very act of inviting participants to take part in a wine tasting also likely self-selected for participants who were interested in wine and wine tasting. A repeat of the experiment on a truly representative sample across the UK population at large may well have yielded different results, in particular lower average ratings for enjoyment of the wines.

The design of the research was very much focused on English-speaking consumers and a UK-focused vocabulary. The words offered for the descriptors were typical British English words used to describe these types of wines and generated in the panel tasting. The panel for the tasting were all native English speakers (though not all British born). However, of the research participants, 41 were non-native English speakers, and additional written comments on the papers and discussions with the researcher illuminated some issues with the methodology for these participants. It was noted by some non-native English speakers for example that phrases such as "*black fruit*" have no significance in the West Indies (participant number 177) despite this being a commonly used descriptor in the UK and for WSET qualifications.

This highlights a key issue, which is that much of the language used within the wine trade is very Western-focused, with few English-language tasting notes replicating the smells and flavours of the Caribbean, Nordics or Far East. Whilst investigating different languages or vocabulary use in different cultures was beyond the scope of this project, it offers an interesting avenue for further research, particularly as wine qualifications become increasingly popular worldwide[17].

The grouping of participants for analysis by level of wine education also had limitations. Whilst attending two-to-three wine tastings may provide roughly equivalent exposure to wine as taking WSET Level 1, the method of teaching is often very different between formal qualifications and casual wine tastings. Casual tastings often focus on a wider range of descriptive vocabulary (fruits, flowers, smoke) whereas WSET qualifications focus more on the structure of the wine. That said, the pattern of preference was not significantly different with WSET qualifications analysed separately, as with them included with the WSET "equivalents", therefore for the purposes of a more comprehensive analysis they were kept together.

The correlation between increased enjoyment of tannic red wines with wine education was also loosely mirrored by a general increase in enjoyment of these wines with age. This pattern is supported by recent studies on the phenomenon of enjoyment changing with lifecycle, and drier red wines becoming more appealing with age (Thach et al, 2018). There was an exception to the age correlation however;

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[17] WSET qualifications are now taught in 73 countries, as of 2016/17 (WSET website, 2018).

namely that the youngest group of participants (18-29) enjoyed the wines as a whole far more than the 30-39 age group or 40-49 age group, which is contrary to what would be expected in Thach's model (ibid.). This suggests that in fact wine education is the more powerful driver in this correlation, though further work would be required ultimately to confirm this. Finally, whilst there was a slight variation in enjoyment between men and women, there were no statistically significant interactions when breaking down by gender. However, this is an area ripe for further research, especially given the often gender-specific approach of many wine marketers.

7. CONCLUSIONS AND RECOMMENDATIONS

The study aimed to investigate the influence of vocabulary on perception of wine. Specifically, it focused on three aspects:

- Whether describing tannins rather than quantifying them affects consumers' enjoyment of wine

- Whether altering the description of tannins can alter consumers' perception of wine

- Whether there is a link between wine education experience and enjoyment of tannic red wines

In all cases the results either partially or significantly supported the research hypotheses, highlighting the crucial role of vocabulary in consumers' experience of wine.

7.1   Using Vocabulary to Change Consumers' Experience of Wine

The research demonstrated that vocabulary can significantly affect consumers' enjoyment of a wine, and this occurs regardless of consumers' initial preference for that wine. This result was especially true for the less austere Brunello di Montalcino wines, indicating that the trade has a better chance of adjusting consumers' opinions with less extreme red wine styles.

The research also demonstrated that vocabulary can change how tannic consumers feel a wine is, and that this is not directly correlated to enjoyment.

Furthermore, the results showed that tannins and savoury flavours seem to be linked in many consumers' minds. Much of the conversation around tannins so far has focused on how to make tannic wines more approachable. In fact, these results underline that a focus on flavours in these wines may be just as important as discussions of their structure.

7.2   Understanding the Role of Wine Education and the Trade

As expected, enjoyment of the Experiment wines increased with wine education. However, as more consumers and trade members undertake WSET and other formal qualifications, it is worth questioning the approach to describing wines, and tannins in particular. Until students tackle WSET Level 4, tannins are only described in terms of level, not nature. Yet it was those consumers with moderate wine education experience (WSET Levels 1-3) who were most susceptible to priming and changing their enjoyment and perception of the wine. Whether this is due to their training, and the fact that tannins are not discussed in detail at these levels, is a subject for further investigation.

Members of the wine trade also need to bear in mind their own preferences and assessments. Whether due to increased exposure to more unusual styles of wine, or due to years of formal training, the results highlighted that the trade assess wines as far more extreme than consumers and may, as a result, inadvertently overstate the tannic nature of a wine for a consumer. Care must be taken to see both viewpoints and make more effort to understand how consumers experience wine.

That could take the form of ensuring a range of different training levels within a retail team, or holding regular tasting sessions with consumers, for trade members to re-calibrate their palates.

Furthermore, whilst it is a responsibility in the trade to educate consumers – to increase their enjoyment and engagement with wine – it must not be forgotten that for most consumers wine is pleasure. A purely objective or quantitative approach to wine may, in some cases, do the wine a disservice and ensure consumers do not get maximum pleasure from it. Just as blind tasting is rarely relevant for consumers enjoying wine, so assessing a wine on a standardised scale and measuring tannins relatively and quantitatively holds little value for most drinkers of Italian red wines. Instead, it is suggested the trade work to describe wines accurately, but creatively, using a wider and more evocative range of vocabulary, tailoring it to consumers' interests and education level.

The trade does need to be cognisant of the possibility of making a wine seem less appealing by using vocabulary with negative connotations – for example "*dusty*", "*drying*" – but rather that than lose the varied landscape of description altogether. As Skilleås argues "*we learn to taste, talk about and judge wine from others*" (Skilleås, cited in Goode, 2016, p147). It is vital that members of the wine trade understand their part in this, and, in exploring and expanding the crucial role of vocabulary in enjoyment, continue to improve consumers' understanding and experience of wine.

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Approved Research Paper Proposal

Proposed Title
The influence of vocabulary on perception of wine: tasting tannins in Barolo and Brunello

Research Questions: Define the subject of your Research Paper and specify the specific research questions you plan to pursue. (No more than 200 words)

"Language affects perception as well as being a tool to describe that perception" (Goode, 2016, p168).

This study seeks to address Goode's statement, and consider to what extent the wine trade's choice of vocabulary can alter consumers' perception of wines.

Specifically, the research aims to examine whether treating tannins in a quantitative way (low – medium - high) can affect a consumer's enjoyment of a wine with a marked tannic structure such as Barolo and Brunello di Montalcino, when compared with a more descriptive approach.

Specific areas of investigation:
- To what extent (if at all) does describing tannins with more descriptive adjectives (such as smooth, firm, silky) rather than quantifying them (low, medium, high) affect consumers' enjoyment of wine?
- To what extent (if at all) does changing the description of tannins in a wine alter consumers' perception of that wine?
- Is there a link between consumers' wine education experience, and their enjoyment of tannic wines?

Background and Context: Explain what is currently known about the topic and address why this topic requires/offers opportunities for further research. (No more than 200 words)

Although the priming effects of language have been widely studied (Kahneman, 2011) these have rarely been applied to wine. Furthermore, there is little consistency in how tannins are described around the English-speaking world. The UK-based WSET uses a quantitative scale from low to high; the University of Adelaide uses ten different tannin descriptors. Vidal et al (2015) concur that research on vocabulary when applied to astringency is lacking.

Whilst education can increase the enjoyment of white and rosé wines in the short term, the same cannot be demonstrated for reds over the same period (Cliff et al, 2016). After a 12-week wine course students were not only better able to describe, but also showed greater enjoyment of white and rosé wines. However, though their confidence in describing red wines increased, there

was no corresponding increase in enjoyment of red wines. The authors attribute this to greater tannin in red wines, making them harder for consumers to appreciate if unfamiliar with them. Taylor et al (2008) first found this effect, though noticed that men did report an improved enjoyment of red wines after a short (three-week) wine education course, whilst women did not. Goode concurs that an increase in the prevalence of off-dry red wines is a result of tannins making wines difficult for less knowledgeable consumers to enjoy. A focus on the role vocabulary can play in consumer appreciation of tannic reds may therefore provide valuable insight into this area.

Previous hedonic studies on red wines have focused on Merlot, Pinot Noir and Cabernet Sauvignon (King et al, 2003). However, as perceived astringency increases at low pHs (Kallithraka et al, 1997a) and little previous work exists on the sensory properties of Sangiovese (Pagliarini et al, 2013) a focus on red wines based on Sangiovese and Nebbiolo is both original and relevant in the context of consumer appreciation of tannic red wines.

Sources: Identify the nature of your source materials (official documents, books, articles, other studies, etc.) and give principle sources if appropriate. (No more than 150 words)

Initial literature review looking at books and peer-reviewed journal articles to set the research context. Particular focus on:

- Effects of language on perception and description of wine, and other multi-sensory products. Works including:
Cliff et al, (2016), "Influence of Wine Education on Wine Hedonic and Confidence Ratings by Millennial Wine Consumers of Different Ethnicities"
Goode (2016), "I Taste Red"
Kahneman (2001), "Thinking Fast and Slow",
Taylor et al, (2008), "Impact of Wine Education on Developing Knowledge and Preferences"

- Investigation of current state of terminology for describing tannins in red wines. Papers including:
Herdenstam et al, (2009), "The professional language of wine: perception, training and dialogue"
Kallithraka et al, (1997a), "Effect of pH on astringency in model solutions and wines"
King et al, (2003), "Effectiveness of the 'Mouth-feel Wheel' for the evaluation of astringent subqualities in British Columbia red wines"
Pagliarini et al, (2013), "Sensory descriptors, hedonic perception and consumer's attitudes to Sangiovese red wine deriving from organically and conventionally grown grapes"
Vidal et al, (2015), "How do consumers describe wine astringency?"
In addition to research into different institutes' approaches for describing tannins (WSET, UC Davis, University of Adelaide, Sommelier Associations)

- Methodology for tastings:
Drawing on work done by Charles Spence among others, creating blind tastings and assessing participant's responses when one or more factors that could affect perception of the wine is altered. Papers including:
Burt, (2015), "Does glassware have an impact on the sensory perception of Champagne?"

Spence et al, (2013), "Looking for crossmodal correspondences between classical music and fine wine"

This background work will support primary research in the form of blind tastings for consumers.

Research Methodology: Please detail how you will identify and gather the material or information necessary to answer the research question(s) and discuss what techniques you will use to analyse this information. (No more than 500 words)

The core of the project will be tastings carried out to test the effect of vocabulary on perception and enjoyment of wines.

The target population will be consumers with previous wine tasting experience (sufficient at least to know what tannins are). I will therefore target consumers who have undertaken at least one taught wine class, up to and including WSET Diploma, in the past three years. For convenience purposes and to ensure a consistent style of teaching, students of BB&R's wine school will be targeted (a population of over 7,000 students). Students will be invited to take part in a short blind tasting, and entered into a draw for a case of wine as an inducement. To eliminate bias, participants will not be told the purpose of the tasting. Tastings will take place over a period of two weeks to maximise convenience for participants. To allow statistical tests to be carried out on the data with confidence levels of 95%, a sample of minimum size 200 students will be utilized.

The tasting will consist of two Barolos and two Brunellos, illustrating low pH, high tannin wines. They will be selected by a panel tasting of Diploma graduates and MWs (max 5 participants) to represent different flavour characteristics and tannic structures – this will provide a range of styles in the experiments to ensure differences in preference are not solely to do with participants disliking a particular flavour profile. The different tannic expressions will provide scope for a broader range of vocabulary to be used in the tastings.

The Brunellos will come from the same recent (past 7 years) vintage and cover a high altitude and a low altitude producer, giving a contrast in texture (one wine more grippy with a dusty texture, and one with a slightly smoother, riper style). The Barolo pair will also come from the same recent vintage, one from a modern producer and one traditional; again these will represent tannic wines, but one wine will have glossier fruit and more overt oak versus the other with more dried fruit and old oak character.

Participants will be divided into groups – a pre-screening process will ensure that each group is representative of the sample as a whole in terms of gender and age split, as well as wine education:
- One group will taste the wines with quantitative tasting notes describing the wines as high in tannins.
- The second group will be given descriptors of the wines that will focus on the style and nature of the tannins.
- Each wine will have associated "positive" descriptors, such as "smooth, silky tannins", and also more negative descriptors, such as "coarse, grippy tannins".". Participants in the second group will be allocated positive or negative descriptors across the set of wines at random.

All participants will rate wines on a scale of 1-9 for liking, as well as describing the wine using a pre-prepared tasting grid, in terms of aroma/flavour clusters, and structural components. Tasting order will be randomised for each participant, to cancel out effects caused by build-up of tannin and recency. Participants will also complete a short questionnaire after the tasting detailing their wine tasting experience and wine preferences.

The data provided from these experiments will be analysed using appropriate statistical tests to determine:

- Whether there is a statistically significant difference in hedonic ratings of the wines when the vocabulary used to describe tannins is changed.

- Whether there is a statistically significant difference in perception of the wines (both tannin measurement and flavour assessment) when tannin vocabulary is changed.

- Whether there is a positive correlation between hedonic ratings of tannic Italian reds and wine education experience.

A pilot study will be carried out in December to highlight any issues in methodology and a selection tasting will be conducted by a panel of MWs and Diploma graduates to agree on the appropriate adjectives to describe the tannins in each of the wines.

Potential to Contribute to the Body of Knowledge on Wine: Explain how this Research Paper will add to the current body of knowledge on this subject. (No more than 150 words)

Wine education increases spend on wine in both the on and off-trade (Jackson, 2017), by up to 49% in some cases. However, research demonstrates that fruity and semi-sweet styles of wine are preferred by US consumers, with just 9% of respondents in the 2015 Survey of American Wine Consumer Preferences preferring tannic wines. Even with focused wine education, consumers take longer to appreciate and enjoy tannic red wines than whites (Cliff et al, 2016). An increased understanding of the role vocabulary plays in both perception and enjoyment of tannic reds may help the trade accelerate consumers' understanding and appreciation of this style, and therefore increase their spend in this segment.

Given the increasing range and complexity of styles emerging from Montalcino and Barolo, with varying tannins as a result of changing winemaking practices, an understanding of whether more detailed and descriptive vocabulary can help consumers enjoy and differentiate these wines is timely. It is hoped the research will assist retailers, restaurateurs and educators in considering how best to present wines of this style to consumers, for greatest enjoyment and uplift in sales.

Proposed Time Schedule/Programme: This section should layout the time schedule for the research, analysis and write-up of the Research Paper and should indicate approximate dates with key deliverables. *Dates of submission to both Advisors and the IMW must be those specified by the IMW.*

November 2017
Finalise literature review
Finesse research methodology, including sourcing wines.
Interviews with wine educators to investigate how they approach tannins in wines with their students.

December 2017
Contact sample group and ensure participants are aware of what is involved.
Panel tasting to select wines, and decide on appropriate tannin descriptors.
Pilot experiment to test design.

January 2018
3rd to 27th January - Experiments and collecting data.
27th January - All data to have been collected.

February 2018
Data collation, entry, analysis and write-up of results.

March 2018
Further analysis and write up of analysis.

April 2018
9th April - Send analysis to advisor for feedback.
Write up of conclusions and introduction.
30th April - Send first draft to advisor

May 2018
1st May 2017 – Notify IMW of intent to submit.
Rewrites, updates and proofing.
20th May - Send second draft to advisor.

June 2018
1st June - Final RP sent to advisor
Further amendments, if required, throughout June.
29th June - Final submission to Institute.

APPENDIX 2

The Wines

After tasting a range of Barolo and Brunello di Montalcino wines and discussing with Italian buyers to ensure typicity of style, the below wines were selected. 2012 was chosen as the vintage due to its excellent quality, availability and pricing.

All wines were purchased by the researcher at their own expense at the start of December and stored in BB&R's temperature-controlled London cellars until the tastings. All prices are retail price paid, including duty and VAT, but excluding any delivery charges.

Wine A

2012 Giacomo Fenocchio, Barolo

Production zone: Monforte d'Alba

Altitude: 350m

Approximate age of vines: 20 years old

Vinification: Traditional, with long maceration. Natural fermentation with wild yeast over 40 days in stainless steel tanks.

Maturation: 6 months in inert vessels, then 30 months in Slavonian botti (25-35hl in size)

Alcohol: 14.0%

Purchased from: Petersham Cellar

Price: £25.67/bottl

Wine B

2012 Elio Altare, Arborina, Barolo

Production zone: La Morra

Approximate age of vines: 64 and 23 years old

Vinification: Maceration on the skins for approximately four to five days in rotary fermenters with temperature control.

Maturation: 24 months in French barrique

Alcohol: 14.5%

Purchased from: Justerini and Brooks

Price: £54.60/bottle

Wine C

2012 Eredi Fuligni, Brunello di Montalcino

Altitude: 380-450m

Approximate age of vines: 12-30 years

Vinification: Traditional vinification, approx. 18 days, in stainless steel.

Maturation: 24-36 months in Slavonian oak barrels and Allier oak tonneaux (35/40 hl. and 5/7.5 hl. respectively) and 4 months in bottle before release.

Alcohol: 14.5%

Purchased from: Lea and Sandeman

Price: £49.95/bottle

Wine D

2012 Sesti, Brunello di Montalcino

Altitude: Up to 350m

Approximate age of vines: 20 years

Vinification: Traditional vinification in stainless steel

Maturation: 39 months in 30hl oak botti, followed by 12 months bottle ageing

Alcohol: 14.5%

Purchased from: Armit wines

Price: £47.60/bottle

APPENDIX 3

The Tasting Sheets

Each participant received a copy of a tasting sheet, as below, to complete. These were linked to an Excel spreadsheet, and a mail merge, which created 200 tasting documents, all with a unique identifying tasting number. The first 100 documents were Control documents, where all wine descriptions were the same. The second 100 documents had either positive or negative descriptions for each wine (or a mix across the tasting sheet). Wine order was randomised for each participant and the word cloud for each wine was also randomised, to ensure location on the page was not a determinant in which words were selected. A master data sheet was also generated, which linked each tasting document to the order in which wines should be poured.

- Firstly, thank you for committing the time to take part in this research project. Your help is invaluable.
- You will be required to

(1) taste, and spit out, four red wines;

(2) rate them in terms of liking;

(3) describe the wines, and finally;

(4) answer a small number of background questions about yourself.

- This tasting should take you no more than 20 minutes to complete; however, there is no time limit so please take as long as you need.
- If you need further information at any point during the tasting, please raise your hand. If you have any questions or concerns after the tasting, please contact the researcher on the details below.
- You have the right to withdraw from this tasting at any time without reason.
- Your responses will be kept confidential and will only be used for the purposes of this research paper. At no point will you be identified by name in the final research, and only the researcher will have access to your complete responses.
- It is important, for the purposes of the research, to keep the format and content of the tasting confidential, so as not to influence other participants. For this reason, the identity of the wines will not be disclosed at the end of the tasting.
- If you would like to know more about the tasting, and results, as well as the wines shown, please enter your email address below, and you will be contacted at the end of April with the list of wines and a short summary of the findings.

◯ I confirm that I have read and understood the information provided above, and am willing to participate in the research.

Signed: _____

◯ Please let me know further information about this research project, and the wines tasted:

Email address: _____

<u>Researcher contact details:</u>

<u>Tasting #: 101</u>

Please taste wine number 1 and then answer the questions below for this wine:

Wine 1 is a full-bodied red wine with easy-going, round tannins.

a. On a scale of 1 to 9, 1 being strongly dislike and 9 being strongly like, how much do you like Wine 1? Please circle one number only.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Strongly Dislike				Neutral				Strongly Like

b. On a scale of 1 to 9, 1 being extremely low and 9 being extremely high, how tannic do you think Wine 1 is? Please circle one number only.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Low tannin				Medium tannin				High tannin

c. Please circle the descriptors below that you think best describe Wine 1; please circle a MAXIMUM of FOUR descriptors.

Black fruit	Spice	Rounded	Herbal
Vanilla	Sour	Leather	Red fruit
Coarse	Smoky	Earthy	Smooth
Grippy	Bitter	Floral	Sweet

Tasting #: 101

Please taste wine number 2 and then answer the questions below for this wine:

Wine 2 is a full-bodied red wine with dusty, drying tannins.

a. On a scale of 1 to 9, 1 being strongly dislike and 9 being strongly like, how much do you like Wine 2? Please circle one number only.

1	2	3	4	5	6	7	8	9
Strongly Dislike				Neutral				Strongly Like

b. On a scale of 1 to 9, 1 being extremely low and 9 being extremely high, how tannic do you think Wine 2 is? Please circle one number only.

1	2	3	4	5	6	7	8	9
Low tannin				Medium tannin				High tannin

c. Please circle the descriptors below that you think best describe Wine 2; please circle a MAXIMUM of FOUR descriptors.

Black fruit   Spice   Rounded   Herbal

          Vanilla   Sour   Leather   Red fruit

Coarse   Smoky   Earthy   Smooth

          Grippy   Bitter   Floral   Sweet

Please taste wine number 3 and then answer the questions below for this wine:

Wine 3 is a full-bodied red wine with chewy, taut tannins.

a. On a scale of 1 to 9, 1 being strongly dislike and 9 being strongly like, how much do you like Wine 3? Please circle one number only.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Strongly Dislike				Neutral				Strongly Like

b. On a scale of 1 to 9, 1 being extremely low and 9 being extremely high, how tannic do you think Wine 3 is? Please circle one number only.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Low tannin				Medium tannin				High tannin

c. Please circle the descriptors below that you think best describe Wine 3; please circle a MAXIMUM of FOUR descriptors.

Black fruit   Spice   Rounded   Herbal

Vanilla   Sour   Leather   Red fruit

Coarse   Smoky   Earthy   Smooth

Grippy   Bitter   Floral   Sweet

Please taste wine number 4 and then answer the questions below for this wine:

Wine 4 is a full-bodied red wine with firm, forward tannins.

a. On a scale of 1 to 9, 1 being strongly dislike and 9 being strongly like, how much do you like Wine 4? Please circle one number only.

1	2	3	4	5	6	7	8	9
Strongly Dislike				Neutral				Strongly Like

b. On a scale of 1 to 9, 1 being extremely low and 9 being extremely high, how tannic do you think Wine 4 is? Please circle one number only.

1	2	3	4	5	6	7	8	9
Low tannin				Medium tannin				High tannin

c. Please circle the descriptors below that you think best describe Wine 4; please circle a MAXIMUM of FOUR descriptors.

Black fruit	Spice	Rounded	Herbal
Vanilla	Sour	Leather	Red fruit
Coarse	Smoky	Earthy	Smooth
Grippy	Bitter	Floral	Sweet

Demographic information

Please take the time to fill in these responses as fully as you are comfortable; the responses are an important input to the analytical process.

1. What is your gender?
   - ☐ Male   ☐ Female

2. What is your age range?
   - ☐ 18-29   ☐ 30-39   ☐ 40-49   ☐ 50-59
   - ☐ 60+

3. Is English your native language?
   - ☐ Yes   ☐ No

4. What is the highest wine qualification you have studied for?
   - ☐ None   ☐ WSET Level 1   ☐ WSET Level 2   ☐ WSET Level 3
   - ☐ WSET Level 4   ☐ Master of Wine   ☐ Other:_____

5. How many wine tastings have you attended in the past year (both BB&R and other venues)?
   - ☐ None   ☐ 1   ☐ 2-3   ☐ 4-6
   - ☐ 7-10   ☐ 11+

6. Are you involved in the promotion or selling of wine?
   - ☐ Yes   ☐ No

7. Which style(s) of wine do you prefer to drink? Please tick a MAXIMUM of THREE.
   - ☐ Sparkling   ☐ Dry white   ☐ Off-dry white   ☐ Rosé
   - ☐ Light red   ☐ Full-bodied red   ☐ Dessert   ☐ Fortified

If you wish to be entered into a draw to win a case of wine, please enter your email address below.

Please enter me into the prize draw, my email address is:_____

Tasting #: 101

APPENDIX 4

Word Count

Section	Section Titles	Table and Figure Titles	Tables (EXCLUDING text boxes)	Total	Words Counted
Summary	2			110	**108**
Introduction	2			401	**399**
Literature review	22			1341	**1319**
Methodology	16	56	83	2431	**2276**
Results and Analysis	103	218	491	2358	**1546**
Interpretation and Limitations	59			3277	**3218**
Conclusion	23			679	**656**
Total main text				10597	**9522**
Bibliography				1759	**1759**
Appendices				3549	**3549**