# Wine Quality and Sensory Assessments: Do Distinct Groups of Wine Experts Differ?

Bianca Grohmann, Annamma Joy, and Camilo Peña

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**Abstract**

*This research examines to what extent and in what ways two distinct groups of wine experts differ in their assessments of the same set of wines. Whereas previous research focused on selected wine panels whose members were in some cases trained for a specific tasting, we implemented a blind wine tasting among two distinct groups of wine experts: local wine experts and influencers in two socio-culturally different locations in the Okanagan Valley in British Columbia and Montreal in Quebec in Canada. Our findings suggest significant differences in how certain wine sensory attributes are evaluated. This article provides insights into how quality and taste are constructed by two distinct groups of wine experts. Our research results further shed light on how different types of wines might be perceived differently based on the locales in which they are marketed.*

Keywords: Wine experts, blind tastings, influencers, sensory profiling and sensory evaluation, taste development.

## Introduction

Wine tasting, by any measure, is on the one hand an objective undertaking: Wine tastes good or does not; it engages the senses—through flavours, color, aroma, and mouthfeel—or does not. Yet, on the other hand, wine tasting is undeniably subjective: The tasting approach of an individual, even a trained wine connoisseur, to assessing wine, to being alert to every sensory impact, affects how an individual perceives a wine, and thus how they experience it.

Wine sensory studies show that panels comprising experienced tasters, such as sensory experts, typically agree on a wine's overall quality—its objective nature—but may differ in their perceptions of other subjective sensory attributes (Cadot, Caillé, Samson, Barbeau, & Cheynier, 2010). Whether different types of training and experience influence how panelists assess wine sensory attributes and overall quality is unclear. Such panelists have generally had extensive training in wine descriptive analysis and significant tasting experience. They may even have had specialized training in preparation for a specific wine tasting (Chapman, Matthews, & Guinard, 2004). Whereas most previous research on wine sensory analysis focuses solely on the analysis of a sensory panel (e.g., King, Dunn, & Heymann, 2013; Mora, Urdaneta, & Chaya, 2018; Parr, Green, White, & Sherlock, 2007), this research seeks to determine to what extent two geographically distinct panels of wine experts, working under the same tasting conditions, differ in their appreciation of a wine's sensory attributes and in how they assess the wine's overall quality. This article thus builds on and contributes to the literature on wine expertise, and its effects on sensory and quality assessment.

## Conceptual Background

This article examines whether diversity in wine expertise is associated with differences in the sensory and overall quality assessment of red wines. This research specifically relates to sensory and quality evaluations provided by wine experts. According to the definition of expertise put forth by the American Society of Testing Materials (ASTM, 2005; cf. Leschaeve, 2007), a wine expert is someone with extensive expertise regarding wine, and who engages—most often on their own—in perceptual evaluations to assess the effects on quality of variations in raw materials, processes, and storage (Leschaeve, 2007). Wine experts are thus more concerned with quality assurance, detection of fault, and new product development than with the identification of wines (Leschaeve, 2007). It is also important to note that wine experts are not sensory assessors—individuals who have great sensory acuity, are trained in the assessment of specific sensory attributes (often across product categories), and work as members of sensory panels. For sensory assessors, the focus is on consistency and repeatability of assessments across testing sessions; on the other hand, sensory assessors are not focused on the assessment of a specific product category (Leschaeve, 2007). Rather, their expertise in judging sensory attributes crosses product categories.

From a consumer and peer standpoint, wine experts comprise wine makers, wine journalists, and wine educators (Leschaeve, 2007). This suggests that wine experts differ in terms of their training as well as the domain of application of their expertise. Winemakers are often trained in oenology. They apply their training to detect faults and craft consistent, good quality wines that represent a specific style or the winery (Joy, Grohmann, & Peña, forthcoming; Peynaud, 1996). Winemakers' concern is thus in the

development of wines as well as quality control (Peynaud, 1996). Winemakers are often associated with wineries that participate in the Vintner Quality Assurance (VQA) program which certifies wines that are fault-free as quality wines. This focused application of knowledge and orientation toward consistency may lead to the development of 'cellar palate' – which alludes to winemakers' habituation to the style of wines produced by their winery as well as their region (Robinson, 2007).

Other wine experts consist of sommeliers, wine judges, wine critics and wine journalists. Consumers consider these experts as sources of knowledge regarding wine and take their assessments into consideration when making wine choices (Lesschaeve, 2007). The application of these experts' knowledge is mostly concerned with an independent judgment of a variety of wines originating in different regions, and oriented toward providing information and recommendations to consumers.

In sum, there seem to be substantial differences in terms of the nature and purpose of wine expertise. Wine experts associated with wineries and drawing on a background in oenology are more oriented toward the detection of faults and design of wines, whereas sommeliers, wine educators, and wine journalists focus to a greater extent on providing assessments directed toward influencing consumers and their choice of wines. This indicates that—even among wine experts—evaluations of wine can diverge to some extent. For example, wine experts associated with wineries may develop idiosyncratic evaluations due to repeated exposure to similar wines (i.e., 'cellar taste'), whereas wine experts who assess a wider variety of wines in the context of food services or recommendations targeted toward consumers. We therefore seek to examine to what extent such differences emerge in the assessment Canada. of a variety of red wines

between two panels of wine experts representing these backgrounds and are distributed across two geographical regions in Canada.

This research was conducted between 2017 and 2018 in two tasting locations in Canada: the Okanagan Valley in British Columbia and Montreal in Quebec. British Columbia is renowned for its lush vineyards and award-winning white wines; the population of Quebec is robust in its wine consumption—in 2013, Quebec had the highest red wine consumption per capita of any Canadian province (Montreal Gazette, 2015). These two provinces were selected specifically because of their differing European socio-cultural traditions: British Columbia is steeped in its British history, while Quebec is shaped by its French background (Sharpton, 2012). Moreover, wine-tasting panelists in these two locations are trained differently; in the Okanagan Valley wine experts lean towards Wine & Spirit Education Trust (WSET) training, founded in the United Kingdom in 1969 (Wine & Spirit Education Trust, 2018), while in Montreal experts prefer the sommelier approach (the oldest sommelier association, l'Union des Sommeliers de Paris, was founded in France in 1907 (Association des Sommeliers de Paris, n.d.); each training thus mirrors the historical influences of these distinct provinces. The Okanagan panel comprised primarily local winemakers and winery employees, while its Montreal counterpart was staffed with sommeliers, wine educators, and wine journalists.

## Method

The research method was adapted from Peña, Joy, and Lawrence (in press), who also

focused on the sensory characteristics and quality attributes of wines.

### *Panel Members*

The two panels used in this research consisted of wine experts (i.e., individuals with wine-related experience and education) who were influencers in their geographic area. One panel was drawn from the Okanagan Valley of British Columbia, the other from Montreal in Quebec. Due to the time restrictions faced by wine experts, recruitment was based on snowball sampling. Within the two geographical panels, the training and expertise of the members was similar, but distinct from that present in the other panel. Table 1 summarizes participants' experience/education by location. To protect confidentiality, participant names were omitted.

[Insert Table 1 about here]

### *Tasting Procedures*

Panel members participated in two tasting sessions, in which each panel sampled the same seven wines in each tasting session. Table 2 provides details on the wines tasted, which were chosen to represent a broad spectrum of red wine styles and vintages. Wine selection was also by necessity based on availability. Four bottles of each wine were purchased—one for each of the tasting session at the two locations.

[Insert Table 2 about here]

Both panels assessed the full set of wines in two tasting sessions. The two tasting sessions took place in the Okanagan Valley in June and July of 2017, and in Montreal in January and February of 2018. Wines were coded with unique three-digit codes and presented in ISO glasses (these glasses meet international standards for wine-tasting glasses set by the International Standards Organization) to the panelists, who knew only that the tasting involved red wines. The sequence in which participants tasted the wines was randomized. Following Lawless and Heymann (1998), all wines were served concurrently. Wine samples were identical in amount and similar in appearance, and could be evaluated in one tasting session. The wines were poured approximately thirty minutes before tastings commenced; glasses were covered with petri dishes to preserve the aroma. The wines were served at room temperature. Panelists first evaluated the wines by orthonasal olfaction, then tasted, and finally expectorated the wine samples. The panelists water and salt crackers available to clear their palates between samples. Each tasting session took about one hour to complete, and panellists received CAD100 per session as a compensation for their time.

***Measures***

The panelists evaluated each wine on seven aroma and nine taste and flavor attributes, following a descriptive analysis methodology adapted from Guinard (2006), which provides a pre-defined list of red wine sensory attributes: "vegetative" (aroma), "vegetal" (aroma), "berry" (aroma), "green bell pepper" (aroma), "cassis" (aroma), "spicy aroma," "oak aroma," "berry flavor," "oak flavor," "bitterness," "astringency," acidity," "mouth-feel," "taint/off-flavor" (added according to Peña, Joy, & Lawrence, in press), "length of finish," and "balance." Panelists evaluated the wines using 10 cm. linear scales. The

panelists received no training on their sensory attributes prior to their evaluations.

The descriptive analysis was followed by a quality assessment. Because the sensory attribute and quality evaluations were conducted blind, the assessments were free of brand bias or previous experience with specific varietals.

For each of the wines, the panelists assessed eight quality dimensions using an assessment grid adapted from the University of California at Davis (1959; Noble, 1995). These quality dimensions consisted of appearance/color, aroma, defects/faults, residual sugar/bitterness/acidity, body/mouthfeel, flavor length of finish and balance, astringency, and overall quality, and were categorized on scales ranging from 0 to 2 or 0 to 4. These quality dimension scores were then added to achieve a total quality score. The maximum possible quality score was 20.

## Research Results

The statistical analysis was based on data from twenty-two participants (fourteen in the Okanagan panel, and eight in the Montreal panel) who each participated in two tastings of the seven wines. Data was analysed using the IBM SPSS statistics software (version 22), with dummy coded variables denoting panel and tasting session (panel: 0 = Montreal, 1 = Okanagan; tasting session: 0 = first tasting, 1 = second tasting).

### *Multivariate Analysis of Variance – The Effects of the Panel, Wine, and Tasting Session*

In a multivariate repeated measures analysis of variance (MANOVA), the tasting session did not have a significant effect on any of the descriptive attributes and overall quality

score ($p > .76$). The data were therefore collapsed across tastings, denoting tasting sessions with a dummy variable. In a full-factorial MANOVA with a panel location, a tasting session, and the wine serving as independent variables, and the descriptive adjectives and total quality score serving as the dependent variables, significant multivariate main effects emerged for panel location ($F$ (17, 262) = 8.40; $p < .001$) and wine ($F$ (17, 262) = 10.54; $p < .001$), indicating that assessments differed among the two panels and across wines. The main effect for the tasting session ($F < 1$; $p > .73$), and two- and three-way interaction terms ($p$s > .07) did not reach significance.

***Univariate Analysis of Variance – The Effects of Panel Location and Wine***

Based on the significant multivariate effects of the panel location and the specific wine, follow-up univariate analyses of variance (ANOVAs) examined the differences in the perception of the descriptive attributes and the overall quality scores across panel locations and wines, respectively. Table 3 summarizes the means of descriptive attributes, and overall quality scores by panel location. Significant differences across panel locations emerged in the perceptions of vegetative ($F(1, 278) = 54.39$, $p < .001$), vegetal ($F(1, 278) = 16.48$, $p < .001$), green bell pepper ($F(1, 278) = 13.73$, $p < .001$), spicy aroma ($F(1, 278) = 4.30$, $p < .05$), oak aroma ($F(1, 278) = 13.48$, $p < .001$), bitterness ($F(1, 278) = 61.94$, $p < .001$), acidity ($F(1, 278) = 19.00$, $p < .001$), taint/off-flavor ($F(1, 278) = 4.70$, $p < .05$), and balance of flavors? ($F(1, 278) = 4.68$, $p < .05$) attributes. Compared to the Okanagan panel, the Montreal panel reported significantly higher levels of the attributes vegetative, vegetal, green bell pepper, spicy aroma, oak aroma, bitterness, acidity, taint/off-flavour, and balance across the wines tasted in this study. Despite these significant differences in the assessment of descriptive attributes across panels, the

overall quality scores did not differ significantly across panel locations ($p > .68$).

The wines tasted in this study differed significantly in terms of cassis flavour ($F(6, 278) = 6.57$, $p < .001$), oak aroma ($F(6, 278) = 4.22$, $p < .001$), berry flavour ($F(6, 278) = 3.78$, $p < .001$), oak flavour ($F(6, 278) = 6.18$, $p < .001$), astringency ($F(6, 278) = 5.89$, $p < .001$), acidity ($F(6, 278) = 5.33$, $p < .001$), mouthfeel ($F(6, 278) = 4.91$, $p < .001$), and length of finish ($F(6, 278) = 2.41$, $p < .05$). These results reflect the diversity of wine brands and varietals tasted in this research.

Although there was no significant multivariate interaction of location and wine, a significant location × wine interaction on the descriptive attribute berry aroma ($F(6, 278) = 2.31$, $p < .05$) and overall quality score ($F(6, 278) = 2.58$, $p < .05$) emerged at the univariate level. The Okanagan panel reported greater berry aroma for wines #2, #3, and #5, whereas the Montreal panel detected greater berry aroma in wines #1, #4, #6, and #7. With regard to quality scores, the difference across locations was driven by the panels' evaluation of wine #5; Okanagan tasters rated the wine as significantly higher quality than their Montreal counterparts. This particular wine, the 2015 Apothic Red from California, had been critiqued by many wine writers as undrinkable and overly sweet, with others concluding that the wine did not reflect a vineyard but rather was a wine assembled toc onvey good balance and a sense of deliciousness (Goode, 2013). In contrast, wine # 4 (having the best average quality score) had the most similar assessments (the least variance) across panels. Produced by a winery known for its exceptional value-for-money wines (The Sunday Times Wine Club, n.d.), this wine was the 2014 30 Mile Shiraz from South Eastern Australia, which had been well received by the wine community, winning, among other awards, one double-gold and one gold medal

in international competitions. There were no significant interaction effects of location and wine on the other descriptive attributes ($p$s > .08). Tables 4 and 5 summarize attributes and overall quality scores by wine and location.

[Insert Table 4 about here]

[Insert Table 5 about here]

### *Regression Analysis – The Influence of Sensory Attributes on Overall Quality Scores*

Overall quality is the most important attribute in terms of a wine's definition and marketing. In this research, the overall quality score was calculated as the sum of scores of eight quality dimensions (rated on nominal scales ranging from 0 to 2, or 0 to 4) rated for each wine by each panel member. A regression analysis examined the relative influence of the descriptive sensory attributes (measured using continuous 10 cm linear scales administered separately) on overall quality scores. The linear regression model included the tasting session (session 1 = 0, session 2 = 1), and panel (0 = Montreal, 1 = Okanagan), the sensory attribute ratings, and the sensory attributes – panel interaction terms as the predictors. The latter were added to examine whether the sensory attributes affected quality scores differentially across panels. The quality score served as the criterion. The overall regression model was significant ($F(34, 271) = 9.81$, $p < .001$, $R^2 = .47$). The regression coefficients are summarized in Table 6.

[Insert Table 6 about here]

The tasting session was not significantly associated with overall quality scores ($p > .66$). The regression coefficient for the panel also did not reach significance ($p > .11$), suggesting that over all, the quality scores were similar across panels. Bitterness was negatively associated with quality scores ($b = -.42$, $t = 2.03$, $p < .05$), whereas balance was significantly and positively related to quality scores ($b = 1.02$, $t = 5.84$, $p < .001$).

Several sensory attributes had a differential effect on overall quality scores among the two panel locations: spicy aroma was associated with higher quality scores in the Okanagan panel ($b = .43$, $t = 2.35$, $p < .05$), whereas taint/off-flavour perceptions ($b = -.78$, $t = -4.86$, $p < .001$) and balance ($b = -.65$, $t = 3.14$, $p < .01$) related significantly more positively to quality scores in the Montreal panel. In sum, the Montreal panel seemed more forgiving of off-flavour perceptions when deriving overall quality scores, but gave more weight to balance in its assessment of overall quality.

## Conclusions

This research examines the assessment of sensory attributes and the overall quality of seven wines across two tasting sessions by two expert panels located in different geographic regions in Canada. Consistent with previous research relying on panels of sensory experts (Cadot et al., 2010), the wine educators and influencers who served as wine experts in the current research, generally agreed on the overall quality of the wines they evaluated, whereas their perceptions of subjective sensory attributes differed. These findings have several theoretical and practical implications.

### *Differences in Perceptions of Sensory Attributes of Wines Across Panels*

Notably, panel members, regardless of location, were equally consistent in their assessment of the sensory attributes of the wines they tasted across tasting sessions. The tasting sessions thus never emerged as significant factors influencing sensory attribute perceptions or overall quality judgments. Interestingly, a multivariate ANOVA and follow-up univariate ANOVAs indicated that the panels evaluated the wines differently with regard to several sensory attributes: Overall, the Montreal panel tended to rate wines higher in vegetative, vegetal, green bell pepper, spicy aroma, oak aroma, bitterness, acidity, taint/off-flavour, and balance, compared to the Okanagan panel.

That the assessment of sensory attributes differed across wines is not surprising, given that the wines spanned a wide variety of regions and varietals. In response to this variety, panel members reported that the wines differed significantly in terms of cassis flavour, oak aroma, berry flavour, oak flavour, astringency, acidity, mouthfeel, and the length of the finish.

Somewhat weaker evidence emerged for a difference regarding the assessments of berry flavour and the overall quality of specific wines. The former finding suggests that the two expert panels (each of whose members had different training and experience from their counterparts) may have had a different perception of the degree to which red wines overall displayed certain sensory attributes. The latter point was informative in that the Okanagan panel—perhaps more aligned with New World winemaking traditions—was much more positively predisposed toward the more controversial "engineered" 2015 Apothic Red wine compared to the Montreal panel, which was more closely aligned with-Old World traditions in terms of training.

### *The Influence of Sensory Attributes on Overall Quality*

A second analysis focused on the weight given to the sensory attributes in deriving overall quality across the two panels. Results of a regression analysis indicate a difference in the way sensory attributes contributed to panel members' overall quality scores. The Okanagan panel seemed to relate spicy flavor to overall quality to a greater extent than their Montreal counterparts, whereas the latter was significantly more forgiving of faults and defects, and related balance to overall quality to a greater extent. Thus, a red wine with spicy aroma might be better received in the Okanagan, while a wine with more taint/off-flavour might do better in Montreal. This finding adds to the discussion regarding how New World winemakers tend to detect faults better than Old World winemakers, who might consider low levels of wine faults as simply elements of certain styles (Goode & Harrop, 2011). The results of this research indeed support that within a New World tasting context, different sets of wine experts have different takes on both quality and faults.

Across the seven wines and two tasting sessions, overall quality assessments did not differ significantly across the panels. This finding was documented in the ANOVA as well as the regression analyses (i.e., there was no primary effect of a specific panel on assessments of overall quality, nor was there a significant regression coefficient for the panel).

### *Practical Implications and Future Research Recommendations*

This research shows that there are differences in how wines are assessed by wine experts in different geographic locations. Wine experts differ in the extent to which they detect

sensory attributes in wines, and in the extent to which they relate these sensory attributes to overall perceived quality. This finding has implications for what types of wines might have a better chance of being well received in different regions. For example, the Apothic Red wine did significantly better (in terms of the quality score) in the Okanagan than in Montreal. This finding of course might have been a different story had we not implemented a blind tasting (considering the generalized disapproval for Apothic Red within the wine world (Goode, 2013).

This paper focused on the role of wine panels' geographic location—and related socio-cultural context—in the sensory assessment of red wines. The findings highlight that there is a difference in how sensory attributes are perceived by different groups of experts, each in a distinct location with unique socio-cultural contexts and training or expertise. This difference is important to acknowledge, considering that these groups of experts are important stakeholders in how a taste culture is developed and legitimized in these regions. Wine journalists, educators, and sommeliers in Montreal and winemakers, winery employees, and Vintners Quality Assurance [VQA] wine panelists in the Okanagan are all wine experts. Additionally, they are all in contact with consumers (both directly and indirectly by educating, evaluating, and writing about wines) and have key roles in defining what constitutes a good or bad wine in each region; their expert opinions guide consumers' taste perceptions and wine appreciation, albeit often to different conclusions. For the marketing of wines, an awareness of differences in training, sensory assessment, and subsequent consumer preferences is critical in either targeting distribution or directing marketing communications. Although certainly other factors

influence differential taste perceptions, this paper provides an initial step toward an investigation of such geographic and socio-cultural differences in sensory perception.

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Table 1. Expert Panel Description

| Panelist # | Location | Expertise/Training |
|---|---|---|
| 1 | Okanagan | WSET level 3 - VQA panelist |
| 2 | Okanagan | Master of enology - instructor and winemaker |
| 3 | Okanagan | Winemaker |
| 4 | Okanagan | Master of enology - winemaker |
| 5 | Okanagan | Enology degree - sensory scientist and winemaker |
| 6 | Okanagan | Winemaker |
| 7 | Okanagan | VQA panel assessor - liquor store wine consultant |
| 8 | Okanagan | WSET level 3 - winery employee |
| 9 | Okanagan | WEST level 3 - instructor |
| 10 | Okanagan | Winemaker |
| 11 | Okanagan | Sensory scientist - VQA panel assessor |
| 12 | Okanagan | Enology degree/sensory scientist (wine) - wine consultant |
| 13 | Okanagan | WSET level 3 - winery employee |
| 14 | Okanagan | Master of Wine candidate - winery employee |
| 1 | Montreal | Sommelier - retired wine educator |
| 2 | Montreal | Wine consultant/educator |
| 3 | Montreal | Wine writer |
| 4 | Montreal | Wine journalist and sommelier |
| 5 | Montreal | Master sommelier |
| 6 | Montreal | Wine journalist |
| 7 | Montreal | Wine journalist/wine educator |
| 8 | Montreal | Sommelier-conseil, wine journalist |

Table 2. Description of Wines

| Wine # | Wine Name | Vintage | Varietal | Region | Sweetness | Alcohol % | Price |
|---|---|---|---|---|---|---|---|
| 1 | Carinena Reserva-Monasterio De Las Vinas | 2006 | Red blend-garnacha, tempranillo, carinena | Spain North | 0 | 13% | $14.49 |
| 2 | Jackson Triggs - Reserve Merlot | 2014 | merlot | Okanagan, BC, Canada | 0 | 14% | $13.99 |
| 3 | Gray Monk Pinot Noir | 2015 | pinot noir | Okanagan, BC, Canada | 0 | 12.7 % | $17.99 |
| 4 | 30 Mile Shiraz | 2014 | syrah/shiraz | South Eastern Australia | 0 | 14.5 % | $13.99 |
| 5 | Apothic Red | 2015 | Red blend - zinfandel, syrah, cabernet sauvignon, merlot | California, USA | 2 | 13.5 % | $15.49 |
| 6 | Road 13 Honest John Red | 2014 | Red blend - merlot, pinot noir, gamay noir | Okanagan, BC, Canada | 0 | 14.9 % | $19.99 |
| 7 | Cahors-Chateau Eugenie Tradition | 2015 | Red bend - malbec (80%), merlot (20%) | Southwest France | 0 | 12.5 % | $22.99 |

Table 3. Descriptive statistics

| Okanagan | Mean | Std. Deviation | N |
|---|---|---|---|
| Vegetative | 2.476 | 1.8888 | 196 |
| Vegetal | 2.946 | 2.0494 | 196 |
| Berry | 5.742 | 1.9527 | 196 |
| Green bell pepper | 2.134 | 1.7616 | 196 |
| Cassis | 4.938 | 2.1480 | 196 |
| Spicy aroma | 5.058 | 2.0569 | 196 |
| Oak aroma | 4.834 | 2.0121 | 196 |
| Berry flavour | 5.764 | 1.8946 | 196 |
| Oak flavour | 5.245 | 2.0108 | 196 |
| Bitterness | 3.119 | 2.1139 | 196 |
| Astringency | 4.955 | 2.2399 | 196 |
| Acidity | 4.724 | 1.9048 | 196 |
| Mouthfeel | 5.347 | 1.7168 | 196 |
| Taint/off-flavour | 1.462 | 1.9329 | 196 |
| Length of finish | 5.605 | 1.7774 | 196 |
| Balance | 4.995 | 2.0266 | 196 |
| Quality scores | 14.510 | 2.8644 | 196 |
| Montreal | Mean | Std. Deviation | N |
| Vegetative | 4.235 | 2.3122 | 112 |
| Vegetal | 3.929 | 2.1270 | 112 |
| Berry | 5.689 | 1.6851 | 112 |
| Green bell pepper | 2.929 | 2.0515 | 112 |
| Cassis | 4.968 | 1.9203 | 112 |
| Spicy aroma | 5.496 | 1.6836 | 112 |
| Oak aroma | 5.648 | 1.9124 | 112 |
| Berry flavour | 5.867 | 1.1805 | 111 |
| Oak flavour | 5.526 | 1.8333 | 112 |
| Bitterness | 5.072 | 1.9567 | 112 |
| Astringency | 5.071 | 1.7975 | 112 |
| Acidity | 5.636 | 1.5885 | 112 |
| Mouthfeel | 5.381 | 1.4322 | 112 |
| Taint/off-flavour | 1.946 | 1.8022 | 112 |
| Length of finish | 5.413 | 1.4050 | 112 |
| Balance | 5.447 | 1.4826 | 112 |
| Quality scores | 14.335 | 2.7373 | 112 |

Table 4. Okanagan – Attribute and quality scores

| Wine | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Vegetative | 2.0 | 2.4 | 2.7 | 2.8 | 1.3 | 3.2 | 2.9 |
| Vegetal | 2.6 | 2.8 | 3.1 | 3.7 | 2.0 | 3.2 | 3.2 |
| Berry | 5.4 | 6.1 | 6.0 | 5.2 | 6.9 | 5.1 | 5.5 |
| Green bell pepper | 2.1 | 2.2 | 2.0 | 2.4 | 1.4 | 2.1 | 2.8 |
| Cassis | 4.4 | 5.2 | 3.6 | 5.2 | 6.2 | 5.2 | 4.7 |
| Spicy aroma | 4.3 | 5.6 | 4.9 | 5.5 | 4.5 | 5.3 | 5.3 |
| Oak aroma | 4.5 | 5.0 | 3.7 | 4.7 | 6.2 | 4.9 | 4.7 |
| Berry flavour | 4.8 | 5.9 | 5.5 | 6.0 | 7.1 | 6.1 | 5.0 |
| Bitterness | 3.4 | 3.1 | 3.0 | 3.2 | 2.2 | 3.6 | 3.4 |
| Oak flavour | 4.8 | 5.2 | 4.1 | 5.3 | 6.7 | 5.7 | 4.9 |
| Astringency | 5.5 | 5.0 | 5.0 | 4.8 | 3.1 | 5.7 | 5.6 |
| Acidity | 5.1 | 4.6 | 5.5 | 4.9 | 3.4 | 4.5 | 5.1 |
| Mouthfeel | 4.9 | 5.8 | 4.4 | 5.4 | 6.0 | 6.0 | 5.0 |
| Taint/off-flavour | 1.8 | 0.9 | 1.2 | 1.9 | 0.8 | 2.1 | 1.5 |
| Length of finish | 5.4 | 6.2 | 4.9 | 5.9 | 5.4 | 5.9 | 5.7 |
| Balance | 4.7 | 6.0 | 4.8 | 5.1 | 4.4 | 5.0 | 4.9 |
| Quality scores | 13.2 | 15.5 | 14.4 | 15.3 | 14.9 | 13.8 | 14.5 |

Table 5. Montreal – Attribute and quality scores

| Wine | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Vegetative | 4.0 | 3.9 | 4.1 | 4.1 | 5.0 | 4.8 | 3.9 |
| Vegetal | 3.6 | 4.8 | 3.8 | 3.6 | 3.5 | 4.3 | 3.8 |
| Berry | 5.9 | 5.3 | 4.9 | 5.7 | 5.7 | 6.1 | 6.1 |
| Green bell pepper | 2.6 | 3.9 | 2.4 | 3.3 | 2.9 | 2.7 | 2.8 |
| Cassis | 4.8 | 5.3 | 3.1 | 5.5 | 5.0 | 6.3 | 4.7 |
| Spicy aroma | 5.5 | 5.1 | 4.7 | 5.9 | 5.9 | 5.8 | 5.5 |
| Oak aroma | 5.6 | 5.6 | 4.3 | 6.3 | 6.3 | 5.7 | 5.6 |
| Berry flavour | 5.6 | 5.8 | 5.2 | 6.2 | 6.1 | 6.3 | 5.8 |
| Oak flavour | 5.1 | 5.4 | 4.2 | 6.3 | 6.7 | 5.9 | 5.2 |
| Bitterness | 4.5 | 5.1 | 6.1 | 5.0 | 4.4 | 5.4 | 5.1 |
| Astringency | 4.7 | 5.7 | 5.5 | 4.7 | 3.9 | 6.0 | 5.0 |
| Acidity | 5.8 | 5.7 | 6.6 | 5.5 | 4.6 | 5.3 | 6.0 |
| Mouthfeel | 4.7 | 5.6 | 4.5 | 5.8 | 5.6 | 6.1 | 5.4 |
| Taint/off-flavour | 2.0 | 2.0 | 1.9 | 1.9 | 2.3 | 1.7 | 1.9 |
| Length of finish | 5.1 | 5.8 | 4.9 | 5.8 | 4.9 | 6.1 | 5.3 |
| Balance | 5.8 | 5.3 | 5.3 | 5.5 | 4.5 | 5.7 | 6.1 |
| Quality scores | 15.0 | 14.3 | 13.8 | 15.3 | 12.5 | 14.3 | 15.2 |

Table 6. Regression coefficients – Attributes associated with overall quality scores

| Model | | Unstandardized | Standard Error | Standardized | t | p |
|---|---|---|---|---|---|---|
| 1 | Intercept | 8.928 | 1.741 | | 5.128 | < .001 |
| | Panel | 3.122 | 1.954 | 0.535 | 1.598 | 0.111 |
| | Tasting session | 0.107 | 0.246 | 0.019 | 0.433 | 0.665 |
| | Vegetative | -0.177 | 0.109 | -0.140 | -1.616 | 0.107 |
| | Vegetal | -0.254 | 0.143 | -0.192 | -1.779 | 0.076 |
| | Berry | -0.180 | 0.171 | -0.118 | -1.047 | 0.296 |
| | Green bell pepper | 0.210 | 0.155 | 0.143 | 1.358 | 0.176 |
| | Cassis | 0.120 | 0.155 | 0.088 | 0.772 | 0.441 |
| | Spicy aroma | -0.159 | 0.163 | -0.110 | -0.974 | 0.331 |
| | Oak aroma | 0.115 | 0.178 | 0.082 | 0.649 | 0.517 |
| | Berry flavour | 0.277 | 0.254 | 0.165 | 1.093 | 0.275 |
| | Oak flavour | 0.076 | 0.179 | 0.053 | 0.424 | 0.672 |
| | Bitterness | -0.424 | 0.209 | -0.342 | -2.026 | 0.044 |
| | Astringency | 0.137 | 0.187 | 0.102 | 0.729 | 0.467 |
| | Acidity | 0.107 | 0.190 | 0.070 | 0.564 | 0.573 |
| | Mouthfeel | 0.084 | 0.180 | 0.048 | 0.468 | 0.640 |
| | Taint/off-flavour | 0.098 | 0.127 | 0.066 | 0.769 | 0.443 |
| | Length of finish | -0.048 | 0.197 | -0.028 | -0.243 | 0.808 |
| | Balance | 1.023 | 0.175 | 0.676 | 5.843 | < .001 |
| | Vegetative × panel | 0.105 | 0.156 | 0.072 | 0.676 | 0.500 |
| | Vegetal × panel | 0.240 | 0.178 | 0.185 | 1.344 | 0.180 |
| | Berry × panel | 0.232 | 0.201 | 0.262 | 1.151 | 0.251 |

| Model | Unstandardized | Standard Error | Standardized | t | p |
|---|---|---|---|---|---|
| Green bell pepper × panel | -0.184 | 0.187 | -0.114 | -0.984 | 0.326 |
| Cassis × panel | -0.014 | 0.178 | -0.015 | -0.079 | 0.937 |
| Spicy aroma × panel | 0.430 | 0.183 | 0.450 | 2.346 | 0.020 |
| Oak aroma × panel | -0.144 | 0.203 | -0.145 | -0.713 | 0.477 |
| Berry flavour × panel | -0.508 | 0.272 | -0.572 | -1.867 | 0.063 |
| Oak flavour × panel | -0.109 | 0.207 | -0.116 | -0.526 | 0.600 |
| Bitterness × panel | 0.400 | 0.229 | 0.322 | 1.748 | 0.082 |
| Astringency × panel | -0.305 | 0.207 | -0.323 | -1.469 | 0.143 |
| Acidity × panel | -0.109 | 0.214 | -0.106 | -0.507 | 0.613 |
| Mouthfeel × panel | 0.081 | 0.214 | 0.084 | 0.376 | 0.707 |
| Taint/off-flavour × panel | -0.782 | 0.161 | -0.473 | -4.855 | < .001 |
| Length of finish × panel | 0.258 | 0.228 | 0.280 | 1.135 | 0.258 |
| Balance × panel | -0.648 | 0.206 | -0.668 | -3.141 | 0.002 |