How bottle closures affect sensory discriminations of wine?

François DURRIEU
Professor of Marketing
BEM – KEDGE Business School

Several researches (Combris et al 2009, Mueller et al 2010) have evaluated wines’ quality based on their attributes or perceived characteristics, notably sensory ones, using this metric to explain consumer preferences. Few have analysed how a wine is affected by its closures (Marin and Durham 2007). The means for assessing this effect have usually been the grape mixture and not any sensory dimensions. However, Cuilleré et al. (2009) did analyse the sensory variations and aromatic complexities of a particular wine bottled using different kinds of closures (plastic and cork). The present study is part of a corpus that seeks to evaluate wine’s sensory dimensions (aroma, taste and visual) and how they are affected by extrinsic characteristics (in this case, the closure).

Sensory discrimination by tasting conditions

Most studies have tried to differentiate generally between various types of specific products such as standard consumer products (Buchanan et al 1987). The goal here is to differentiate between products within a particular range using all relevant sensory dimensions (visual, aroma and taste). The interactions between the different dimensions, the effects of the testing conditions and the ways in which tester characteristics affect evaluations made it harder to assess the product and differentiate between the products being tested.

During a tasting session, all of sensory dimensions interact into a broader perception known as the wine’s bouquet (Thomas-Danguin and Ali 2009). Hence the difficulty for tasters is to analyse a range of perceptions (the number of aroma) and differentiate between them. Indeed, wine perceptions can be contradictory. A weak woody taste might reinforce the fruit aroma, whereas a strong woody taste will mask the wine's fruity aspect.

This complexity is reinforced by the physical conditions in which tasting sessions are organised and run (Marchal and Jeandet 2010): the sequencing of wines being tested. In addition, it is important to understand the descriptors that have been chosen, specifically determining what exact vocabulary applies to a particular perception (Brochet and Dubourdieu, 2001) generalised use for a kind of wine (Ballester et al 2008, Maitre et al. 2010).

The closure as an element of sensory discrimination

Consumers continue to view closures as an indicator of quality. This can be explained by the fact that consumers perceive wine in a screw cap bottle as being of lesser quality and cheaper (Marin and Duhram 2007). As for the closure’s quality, the

1 BEM - KEDGE Business School – 680 Cours de la Libération - 33405 Talence Cedex (France) - Phone: +335 56 84 22 54 - Email: francois.durrieu@bem.edu
first consideration is whether it protects the wine's aromas. For instance, an original fruity aspect can only be preserved using screw closures, whereas with plastic closures, this fruity aspect will break down. Cork closures, on the other hand, enable a more mature fruity taste (Vidal et al 2006). In other words, the item used to cork the wine's bottle will have a lasting effect on its sensory qualities.

**Design and methodology**

The sample consists of 39 professionnals originating from different regions (Saint Émilion, Blaye; Pessac and Graves, and Medoc). The wine appellation being tested is "Bordeaux and Bordeaux Supérieur. The bottles were corked using three types of closures (natural cork, DIAM P1 and DIAM P10). The tasters test first a series of six glasses (without seeing the closure and the wine) and secondly a series of six glasses (the tasters could handle the closure). Tasters evaluate by using a grid built by Bordeaux Wines council in exhibit 1. A global evaluation of wine and Cork were given.

**Results and Discussion**

A model (M1) was built to determine sources of wine evaluation variations, based on a univariate analysis of variance $R^2$ of 0.52. The sources of variance can be analysed (Levene=0.66 $F=0.78$). Regarding the sources of sensory variance, the chemical aroma ($F 30.42 P=0.00 \eta^2 0.09$) and the bitter taste ($F 34.19 P=0.00 \eta^2 0.10$) caused the greatest variance in wine evaluations. Also, the type of closure did not have any real effect on wine evaluations but it did have one when it interacted with the wine's sparkle and chemical, vegetal, and floral aromas and sweet taste ($\eta^2 0.13$).

Closure evaluation was also added (M2) with $R^2$ to 0.64. In other words, closures have a significant impact on wine evaluations. We could be analysed sources of variance (Levene 0.58 Prob 0.84). Closure evaluations turned out to cause the greatest source of variance, explaining 0.15 of all wine evaluation variance. In addition, closure types did have one when interacting with chemical, vegetal and floral aromas and with the wine’s sweet flavor ($\eta^2 0.24$). Screw caps had a negative impact and were considered less complex from an aromatic perspective (Cuilleré et al 2009) whereas cork closures had a positive impact.

**Conclusion**

The perceptual discrimination of evaluations is an important topic for products like wine that are characterised by their high level of sensory complexity. It is reinforced when evaluations depend on cork used. The findings have highlighted that certain sensory dimensions (sparkle, chemical, floral, vegetal and sweetness) interacting with closure types explained $\eta^2 0.13$ of all wine evaluation variations. The closure evaluation reinforced the variability of evaluations ($\eta^2 0.15$), on top of which came interactions between sensory dimensions (chemical, floral, vegetal and sweet) and closure types ($\eta^2 0.24$).

---

2 DIAM P1 is a closure that makes it possible to drink wine every day while preserving its taste (keeping the wine fresh, inexpensive and reliable). DIAM P10 is a closure for prestigious wines whose unique aromas are to be preserved over time (emphasis on the terroir). It is a closure used for appellation and Grand Cru wines. Note that DIAM P10 is better quality than DIAM P1 because it is less permeable.

3 The partial eta squared indicator (partial $\eta^2$) shows what proportion of the variance is explained by other variables. The weaker this indicator (between 0 and 1), the more other variables help to explain the effect.
Also the same researchers recommend that taster's panel receives training and decide is crucial to the evaluation (McEwan et al 2002). The suggestion here has been to taste red wine for 36 months of aging. It would make it much easier to perceive differences between aromas.

**Bibliography**


Exhibit 1: Grid used by CIVB (Bordeaux Wines council)

| Visual tests                      | Tint, marked between 1 and 12, with 1 representing young wines versus wines that are 12 years old
|                                  | Intensity, marked between 1 and 7, with 1 representing a dark-coloured wine and 7 a pale wine
|                                  | Limpidity, marked between 1 and 9, with 1 representing a transparent wine and 7 a cloudy wine
|                                  | Sparkle, marked between 1 and 5, with 1 representing a crystalline wine and 7 an opaque wine |
| Aroma tests                       | Animal (i.e., leather), Balsamic (i.e., resin), Woody, Chemical, Spiced (i.e., licorice), Empyreumatic (i.e., chocolate), Ethereal (i.e., fermentation aromas), Floral (i.e., acacia honey), Fruity (i.e., red or black fruit), Mineral (i.e., chalk), Vegetal (i.e., aromatic herbs) – marks ranging from 1 to 5 (1 for no aroma, 5 for a very pronounced aroma) |
| Taste tests                       | Sweet, salted, acid and bitter flavours – marks given range from 1 to 5 (1 for no flavour, 5 for a very pronounced flavour) |