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Cognitive influence on the evaluation of wine: The impact and assessment of price

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ABSTRACT

Price is one of the most important product-extrinsic factors influencing the consumers' response to, and presumably experience of, wine. This is ironic inasmuch as the research tends to highlight either no, or else even a slightly negative relationship between price and liking in typical consumers when they taste wines blind. Nevertheless, providing price information, especially when it is high leads to enhanced taste ratings, especially for low to mid-priced wines. Similarly, bottle and label information (that makes a wine look cheaper or more expensive) has also been shown to influence the evaluation of wine by regular consumers (i.e., non-experts). Indeed, product-extrinsic information often appears to outweigh the product-intrinsic sensory attributes of wine in people's hedonic (in not necessarily in their sensory-discriminative) ratings. Such findings therefore highlight the importance of cognitive as compared to direct sensory cues in the evaluation of wine. This narrative historical review critically reviews and evaluates the published experimental literature that has examined the impact of price on wine ratings.

1. Introduction

One of the questions that has long been of interest to many researchers working on the topic of wine (including Wendy Parr, e.g., Parr, 2019; see also Derbyshire, 2013; Spence, 2020) concerns the relative importance of cognitive versus sensory factors to people's wine evaluation/appreciation.[1] Of course, the distinction can sometimes be hard to make, given that the impact of wine colour, say, and/or of artificially changing a wine's colour in an experimental setting (a clearly sensory manipulation), might itself be expected to trigger a range of cognitive inferences about the contents of the liquid in the glass or bottle (e.g., see Morrot, Brochet, & Dubourdieu, 2001; Parr, White, & Heatherbell, 2003; Wang & Spence, 2019a). Nevertheless, a wide range of explicitly product-extrinsic cues have been shown to influence people's judgments about wine. Besides price, there are, of course, many other sources of information that can also potentially influence a consumer's expectations about wine quality, including expert ratings, geographic information concerning the country, or region, of origin (Wansink, Payne, & North, 2007), and/or certification of organic production (see Lockshin & Corsi, 2012). For instance, when wine consumers are exposed to positive reviews from experts, their ratings of a given wine tend to improve, while exposure to negative reviews tends to bring their ratings down (Chocarro & Cortiñas, 2013; see also Siegrist & Cousin, 2009). Even the processing fluency associated with reading the wine label (i.e., making the typeface easy or difficult to read) have been shown to influence people's hedonic response to wine (Gmuer, Siegrist, & Dohle, 2015).

In 2023, the global wine market was valued at US$333 billion and was expected to grow annually at a compound annual growth rate (CAGR) of 5.2 % until 2027 (Benchmark International, 2023). As such, understanding the relative contribution of product-intrinsic sensory cues, such as aroma, taste, and mouthfeel versus the influence of bottle (and/or label), country of origin (COO), price, expert evaluation, wine complexity (see Parr, 2015; Spence & Wang, 2018; Wang & Spence, 2019b), etc. is obviously hugely important as far as optimizing the product offering is concerned. This narrative historical review (see Ferrari, 2015; Furley & Goldschmied, 2021, on the strengths of this style of review, as opposed to, say, a systematic review which is popular in medical research) critically summarizes and evaluates the peer-reviewed academic literature that has investigated the influence of providing product-extrinsic information, focusing in particular on the

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[1] Or as the English wine writer Hugh Johnson (2009, p. 12) once put it: "There is a debate here that we might as well bring out into the open. Of the pleasures that wine gives you, what proportion is simply sensual, finding a delicious drink no matter what its name may be, and what proportion is related to its identity?".

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influence of price information on people's sensory-discriminative and hedonic ratings of wine. Narrative historical reviews are especially useful in those research areas where relevant literature does not appear in online searches (e.g., including grey literature, defined as any information that is not produced by commercial publishers, and/or where there are not specific keywords that clearly delineate the relevant body of research). As such, the selection process involved checking back through the references cited in recent papers as well as using those references that have been picked up over the last 15 years working in the area of wine research. The focus on price (as a cognitive factor) was chosen because it provides a well-studied product-extrinsic attribute that can more easily be compared across studies than, say, the influence of professional wine ratings or wine label/bottle design.

1.1. Flavour expectations and flavour experiences

According to Piqueras-Fiszman and Spence (2015), people typically generate flavour/quality expectations prior to tasting, no matter the situation in which they happen to find themselves (i.e., fast food outlet or sensory testing laboratory; see also Deliza & MacFie, 1996; Schifferstein, 2001). These expectations, which may well be based on a host of different factors, include sensory cues such as provided by everything from the weight of the bottle to the closure type, in the case of wine (e.g., Piqueras-Fiszman & Spence, 2012; Spence & Wang, 2017), and, of course, the visual appearance of the product (be it wine, or for that matter any other food or drink product), but also the label, price, brand, and wine description (e.g., Lockshin & Corsi, 2012). Flavour expectations, which are typically generated prior to tasting, appear to anchor subsequent tasting experiences (Masset & Raub, 2023). Consumers may also generate sensory expectations about a wine's likely mouthfeel, and appearance properties (e.g., if presented in a coloured bottle). The suggestion being that when we taste, we evaluate the sensory qualities against the expectations (or predictions) that we have in mind and, provided that there is not too much of a discrepancy, we often tend to live in the world of our flavour expectations, rather than necessarily relying directly on our perceptual experience. As Priilaid (2006, p. 30) once put it: *"the brain is literally tasting price and region before it even begins to consider the merits of the wine itself."* Should the disparity between expectation and taste experience be too great, however, then it can lead to a negatively-valenced disconfirmation of expectation response (see Schifferstein, 2001; Yeomans, Chambers, Blumenthal, & Blake, 2008).

However, despite the evidence showing the relevance of these various sensory and product-extrinsic factors to the consumers' evaluation of wine, generally-speaking, it is the price that consumers appear to pay most attention to (e.g., Oczkowski & Doucouliagos, 2015). The general assumption, as with most goods, is that higher prices reflect higher wine quality, and this, in turn, would be expected to result in higher subjective experience ratings (e.g., Mastrobuoni, Peracchi, & Tetenov, 2014; Schnabel & Storchmann, 2010). However, the link may be less clear for wine than in other food and beverage categories. In the following sections of this review, the experimental evidence concerning the impact of product-extrinsic information on wine evaluation is first critically evaluated (Section 2). Thereafter, in Section 3, the ecological validity of wine pricing studies is questioned. Section 4 briefly assesses the impact of wine expertise on product extrinsic cues' influence over wine evaluation. In Section 5, the factors influencing wine price are considered, before conclusions are drawn (Section 6).

2. Assessing the impact of product-extrinsic information on wine evaluation

Over the last couple of decades, researchers (including both food scientists and wine economists) have investigated the impact of various product-extrinsic sources of information on people's wine evaluations. Researchers typically study people's ratings of a number of wines when served blind (i.e., without any product-extrinsic information being made available) and thereafter their evaluation of the same wines after participants have been given some kind of product-extrinsic information (which might be either appropriate – i.e., correct – or else deceptive; see Table 1 for a summary).

2.1. Experimental evidence

In what is perhaps the first study to have been published in this area, Lange et al. (2002) conducted a study in Dijon, France, in which a group of social drinkers (N = 123) were given five brut non-vintage Champagnes to taste blind. The sparkling wines, which varied in price between 11 and 23 Euros a bottle, received equivalent hedonic rating under blind tasting conditions. However, once the brand information had been disclosed, participants reported that they would have been willing to pay significantly more for the three Champagnes from the top brands as well as for the mid-priced bottle, but would have been willing to pay less for the unknown brand (than they would have done when tasting blind). What is more, the social drinkers who took part in this

Table 1
Summary of studies that have investigated the impact of the provision of product-extrinsic informational cues on people's wine ratings.

Study	N	Experimental manipulation	Results
Lange et al. (2002)	123	5 Champagnes (E11-E23) presented blind or with bottle branding visible	Product-extrinsic cues changed Ps' ratings, WTP & hedonic ratings of wines
Plassman et al. (2008)	20	3 wines ($5, 35, 90), with price cues (sometimes deceptive; $45, $35, or $10)	Price cues influenced hedonic ratings & neural response in brain's reward areas
Siegrist & Cousin (2009)	136	High vs. low Parker rating before or after tasting	Sig. effect on WTP/hedonic ratings when presented before.
Almenberg & Dreber (2011)	131/135	$5/$40 wines tasted blind, & with price revealed before/after tasting	Women assigned much higher price if informed wine expensive before tasting
Plassman et al. (2015)	85	Ps told that wine cost €43/€5; €30/€3; or €16)	Price cue influenced experienced utility ratings of wines
Schmidt et al. (2017)	30	3x E12 wines labelled as E3/E6/E18 wine tasted in brain scanner	Price information affected experienced pleasantness of wine
Goldstein (2019)	35/18	$5/$50 wine presented blind or or in bottle with price	Product-extrinsic cues biased preferences & WTP
Jantzi et al. (2020)	67/68/67	6 Nova Scotia wines presented blind, or in bottle with label, or with price	Wines were rated differently after brand information (label) has been presented
Werner et al. (2021)	140	3 wines ($10/32/65) presented blind or with correct/misleading price	When cheap wine mislabelled as expensive, hedonic ratings increased
Masset & Raub (2023)	24–34 per E	3 wines tasted blind, then with label (E1), with cheap or expensive wine prices (E2), or same wine tasted blind, or from cheap/expensive-looking bottle	E1: Ps unaware same wine presented twice; E2: Price (low vs. high) biased hedonic ratings; E3: Expensive-looking bottle biased hedonic ratings once again

study also gave the Champagnes a higher hedonic rating when the brand information was made available, suggesting that they enjoyed them more. These results are consistent with the view that the value of sparkling wine, at least amongst social drinkers lies, at least in part, in the product-extrinsic cues, such as are provided by branding and any other marketing communications (see also Harrar, Smith, Deroy, & Spence, 2013).

Veale and Quester (2008) investigated the relative influences of price and country of origin (as product-extrinsic cues) on the evaluation of the quality of Chardonnay wine by 263 consumers. Taste testing was conducted in a 3 (price) × 3 (country of origin) × 3 (acidity level) experimental design. There was no blind-tasting condition, nor any deception, in this particular study. The results revealed that price and country of origin information were more important contributors to the perception of wine quality than taste/flavour (i.e., product-intrinsic sensory cues). The research demonstrates that even when people are able to evaluate a wine's sensory properties, the consumer's belief in the price/value relationship tends to dominate their quality assessment.

Plassman et al. (2008) investigated what happens in the brain of twenty students when were given different (and in this case sometimes misleading) information about the price of 'five' Cabernet Sauvignon wines. The $5 wine was either correctly described or else mislabelled as a $45 wine. Another bottle of wine that cost $90 was either presented as a $10 or a $90 wine. The mid-priced wine was correctly referred to as costing $35 a bottle. The price was flashed-up on a computer monitor whenever a sample of wine was delivered through the narrow tube held by participants in their mouths.[2] All of the participants tasted each of the wines a total of 16 times. On some trials, they rated the intensity of the wine's taste on a 6-point scale, while on other trials they rated its pleasantness instead. Sometimes, they were instructed to make no behavioural response at all.

When the wines were tasted blind, there was no association between a wine's retail price and the consumers' ratings of the wine's pleasantness. Higher deceptive prices were associated with higher pleasantness ratings, while deceptive prices that were lower led to reduced pleasantness ratings. These results were corroborated by blood-oxygen-level-dependent (BOLD) activity in the medial orbitofrontal cortex (the brain's reward center), which was higher in the high- than in the low-price condition. Contrary to the subjective pleasantness ratings, participants' ratings of the intensity of the taste were not influenced by the experimentally manipulated prices. There was some evidence to suggest that providing inappropriate pricing information had a larger effect on brain activation for the cheaper wine than for the more expensive one. When the same wines were presented eight weeks later, now without any indication of their price (and this time away from the brain scanner), no significant differences in pleasantness were reported.

Schmidt, Skvortsova, Kullen, Weber, and Plassmann (2017) confirmed the effects of price cues on taste pleasantness ratings in an fMRI study with wines described to participants as costing €3, €6, and €18 a bottle, even though the three wines that were presented all cost €12. The 54 participants were asked to enter their ratings of the pleasantness of the wine sample on a nine-point Likert scale from unpleasant to pleasant (see also Plassmann & Weber, 2015; and Woollaston, 2015, for press coverage).

Siegrist and Cousin (2009) conducted a study in which 136 participants (recruited from a Swiss university and from a Swiss Research Institution, ETH) rated an Argentinian red wine (Clos de Los Siete Mendoza, 2006) retailing at the time of the study at CHF 25/US$23. Robert Parker had rated the wine as 92 out of 100, meaning that he classed it as 'outstanding'. The participants who took part in this study were randomly allocated to one of five experimental groups. One group simply had to rate the wine after tasting it blind. The other four groups either received positive or negative expert rating information (92 out of 100 points from Parker, or 72 out of 100 points from Parker) either before or after tasting the wine.[3] The participants then indicated how much they liked the wine using a Visual Analog Scale (VAS), as well as indicating the maximum amount that they would be willing to pay for a bottle of the wine. Importantly, however, the provision of product-extrinsic information (Parker's rating) only had a significant impact on participants' liking (and a borderline-significant effect on price) when presented beforehand, but not when the information was revealed after the participants had tasted the wine.

Almenberg and Dreber (2011) evaluated consumers' ratings when tasting wine blind or else after having been presented with the actual retail price information (once again presented either before or after tasting). As reported previously, there was no relationship between the retail price and wine pleasantness ratings when the wines were tasted blind in this case. Presenting the expensive retail price prior to tasting tended to increase women's ratings of the wine, but had no effect on the ratings of male participants. The wines in this study were not rated any less favourably if the price was low ($5). What is more, women rated the wine as tasting much better (i.e., they gave the wine a 12 % higher rating) when they had been told (correctly in this case) that the bottle had cost $40.[4]

Harrar et al. (2013) conducted a blind tasting of six Champagnes and one English sparkling wine that varied in price from £18-400. The wines were assessed by four Champagne experts as well as by two groups of more or less experienced regular consumers (six intermediate, and five novice tasters). None of the three groups of participants were able to correctly discern the relative proportion of white/red grapes in the various wines. While certain of the mid-priced Champagnes were preferred over other sparkling wines, there was no correlation between price and hedonic ratings.

Goldstein (2019) conducted a preliminary study in which two groups of participants (N = 35, and 18, respectively) were presented with two bottles of the same white wine (for the first group the wine retailed at $5 a bottle while for the second group, it retailed at $50 a bottle). One bottle was tasted blind, while the other was presented with the price and bottle visible). The participants were asked which wine they preferred and how much they would have been willing to pay for each bottle at a store. The results showed that price/bottle information had an impact on both groups' wine ratings, though the effect was somewhat larger for those drinking the more expensive wine: Around 75 % of the participants chose the mystery bottle as compared to the wine labelled at $5, while almost 60 % chose the exposed $50 bottle rather than the brown bagged bottle. The participants, who were all university professors or students, were willing to pay an average of $4.78 more for the exposed $50 wine than for the same wine when brown-bagged, and were willing to pay an average of $2.19 less for the exposed $5 wines than for the concealed $5 wines.

The 202 regular red wine consumers who took part in a study by Jantzi, Hayward, Barton, Richardson, and McSweeney (2020) evaluated six wines using projective mapping (PM) and ultra-flash profiling (UFP). The participants evaluated the same six red wine blends produced in Nova Scotia, Canada blind, and again with label information describing the sensory attributes of the wines available to read, and thereafter for a third time with the actual price ($15.99–23.99). Participants separated the red wine blends based on sweet, fruity, bitter, and peppery sensory attributes. The novice consumers tested in this study placed importance on the brand name of the wine when depicting its flavour. Crucially,

[2] Perhaps unsurprisingly, given the results, the actual identities of the wines used were not revealed.

[3] And after having the meaning of Parker's idiosyncratic rating system explained to them as well.

[4] However, the seemingly post-hoc nature of this observation, and the fact that few subsequent studies have replicated the observation that women are more influenced by product-extrinsic cues than men means that little weight should probably be placed on this result.

however, the provision of price information did not change how the participants categorized the wines in terms of sensory descriptors. However, this might simply be due to the small range of prices used in this study ($15.99–23.99).[5]

The following year, Swiss researchers conducted a study with 140 participants who happened to attend a public university event in Basel (Werner, Birkhaeuer, Locher, Gerger, Heimgartner, Colagiuri, & Gaab, 2021). These lay consumers were randomly allocated to one of four experimental groups and all tasted and rated three wines (priced at CHF/US$ 10, 32, or 65) blind first. However, unbeknownst to the participants, they were then all invited to rate the same three wines once again (and in the same order, i.e., from the cheapest to the most expensive), but now with price information having been provided. The latter was either correct or else was four times higher than the actual price (for the cheapest wine; CHF 40), or one fourth of the retail price (CHF 16) for the most expensive wine. (Note that the mid-priced wine was always presented at its actual price.) The participants had to rate each of the six wines that they sampled in terms of the intensity of the taste and the experienced pleasantness using a 6-point VAS.

The wines were rated as tasting more intense as the actual price of the wines increased. Intriguingly, however, the provision of pricing information (no matter whether it was correct or misleading) had no effect on participants' ratings of the intensity of the wine's taste. By contrast, the rated pleasantness of the three differently-priced wines was equivalent under blind tasting conditions. Nevertheless, deceptively increasing the price of the cheapest wine fourfold led to a small but significant increase in rated liking for the wine (namely, a .51 change on a 5-point pleasantness scale). By contrast, the rated pleasantness of the other two wines was unaffected by the presentation of either veridical price information, or by the presence of misleadingly low price information in the case of the more expensive wine. It is, however, important to note that, given the lack of counterbalancing of the order in which the three different wines were presented to participants, it is unclear whether deceptive pricing only works for cheap wine (as Werner et al., 2021, were tempted to conclude),[6] or whether instead deceptive pricing only works the first time it is tried in a particular experimental situation.

The impact of wine tasters' expectations on their ratings of wine quality and their willingness-to-pay was also tested in a recently-published study by Masset and Raub (2023). These researchers conducted three experiments with the students taking an elective wine economics course at a Swiss hospitality school (N = 24–34 tasters per study). In each study, five wines were tasted in a laboratory setting. In the first study, three wines were initially tested blind, and then wine descriptions were provided. Thereafter, two of the same wines were tasted once again. The participants failed to notice that they were tasting two of the same wines. In Experiment 2, a new group of participants tasted one wine blind (CHF 35), then the participants were split into two groups, and were given the rating of a CHF 50 wine and then the rating of a CHF 70 wine twice. One group tasted the matching wine each time, while the other group had the mismatching wine ratings. In this case, the results demonstrated that rating information significantly affect wine ratings but was insufficient to completely erase the sensory differences between the wines.

In Masset and Raub's (2023) Experiment 3, the same red wine (a Mas Jullien, Terrases du Larzac Autour de Jonquires, 2016) was presented blind from a decanter, then the same wine was presented in a bottle of E40 Ghemme (an appellation in Northern Piedmont), and finally it was presented from a E150 bottle of Barolo (G. Mascrello Monprivato, 2013). Even though the participants were tasting the same wine three times in a row, their ratings differed predictably based on the product-extrinsic cues.[7] One other observation to emerge from this particular study was that experienced tasters (with wine knowledge garnered in wine societies) expressed stronger adaptation to product-extrinsic cues depending on the bottle/label that was displayed.

These findings show that information about the wine's rating, price, or reputation modified regular consumers' expectations and, as a result, they adapted their ratings more strongly can perhaps be taken as providing empirical support for Natalie MacLean's (2008, p. 152) suggestion that: "Some of the cost difference between a $200 wine and a $20 can be attributed to lower yields, better barrels, marketing costs, and so on…However, these cost factors still don't tell us why a $200 wine doesn't always taste ten times better than a $20 one. As wines get more expensive, price depends more on intangible factors such as rarity, prestige, critics' scores, and the winemaker's ego." It remains an interesting question for future research as to whether consumers would necessarily respond differently to price information, especially at the lower end of the price spectrum if they actually know how much of the price goes on the bottle, etc., rather than on the contents of the bottle (see Spence, 2010).

2.2. Interim summary

Taken together, therefore, the research that has been published to date generally appears to converge on the conclusion that taste intensity ratings are relatively unaffected by the provision of actual, or deceptive, pricing information (e.g., Plassman et al., 2008; Schmidt et al., 2017; Werner et al., 2021). Meanwhile, the pleasantness of low- to mid-priced (but not necessarily high quality, i.e., more expensive) wines appears to be affected (enhanced) by deceptively-high pricing information (Plassman et al., 2008; Schmidt et al., 2017; Werner et al., 2021). At this point, it is perhaps important to highlight the fact that according to Spence and Wang (2015), there are at least four different kinds of judgments – sensory-discriminative, hedonic, evaluative, and descriptive – that people can make about a wine (see Table 2).

While Spence and Wang (2015) classified price and quality as analytic judgments, price is sometimes used as a proxy for a hedonic judgment (e.g., 'How highly do you value this wine?'; as is presumably indexed by judgments of Willingness-to-Pay (WTP); e.g., Lange et al., 2002; Siegrist & Cousin, 2009; cf. Lewis & Zalan, 2014). Price estimation judgments might however, also be taken to reflect the judgment of a wine's perceived quality.[8] Now while in many product categories price (as a proxy for product quality) and hedonic evaluation tend to be correlated, wine is one of the (possibly) few product categories where the research shows either no correlation (e.g., Almenberg & Dreber, 2011; Ashton, 2014; Harrar et al., 2013; Sample, 2011; Werner et al., 2021), or else even a slightly negative correlation between price and liking, at least amongst regular (that is, non-expert) consumers when tasting wineblind (see Goldstein, Almenberg, Dreber, Emerson, Herschkowitsch, & Katz, 2008).

Robert Goldstein, a prominent North American food and wine critic, and his colleagues (see Goldstein et al., 2008) conducted a *meta*-analysis

[5] Note also the participants were not asked how much they liked the wines in this study.

[6] In this case, the researchers conclude by noting that: "Our finding that laypeople can be tricked to find budget wines more pleasant by deceptive higher pricing could be considered a two-edged sword as this could both be used to enhance consumers experience as well as wine-sellers [sic] profit. Therefore, it is important to educate the general public about this effect so consumers can be aware of this potentially implicit influence when buying and evaluating their wines." (Werner et al., 2021, p. 6).

[7] Similar results were reported in 2001 by Brochet with French participants (N=57) served same Bordeaux superior wine two weeks apart in bottle of table wine, or Grand Cru.

[8] Complicating matters somewhat here though, there is also the fact that price may be linked to a wine's aging potential. So, given these various considerations, it can be argued that relative differences in price (rather that absolute price) only provide an indication of the quality of a wine under a narrow subset of conditions (Weil, 2005).

Table 2
The four different kinds of judgments that a consumer may make about a wine, as suggested by Spence and Wang (2015).

Hedonic—How much is the wine liked?
Sensory—Assessment of the physical properties of the wine (e.g., sweetness, acidity, fruitiness, alcohol) and their impact on the drinker (grippiness, length, etc.); Analytic—How old, complex, and balanced is the wine? But also assessment of quality and price; Descriptive—Is the wine 'heavy' or 'light', zingy, or lush? Is it masculine or feminine?

of more than 6,000 observations from 17 different blind wine tastings. They documented a slight negative correlation between the price of a wine and its overall rating by non-experts, meaning that social drinkers actually enjoy cheap wine more than expensive wine (at least under blind tasting conditions). By contrast, for those with some degree of wine training (for example, those who had taken a course to become a sommelier), there was a hint (but nothing more)[9] of a positive relationship between the wine's price and the taster's enjoyment (though see also Lecocq & Visser, 2006).[10] The wines in the blind tastings assessed by Goldstein et al. varied in price from $1.65 to $150; Nevertheless, essentially the same pattern of results was obtained when just wines in the $6–15 price range[11] were assessed.

3. Questioning the ecological validity of wine pricing studies

While the various research that was reviewed in the previous section clearly supports the notion that product-extrinsic information can sometimes have a dramatic effect on people's wine evaluation under a range of different experimental tasting conditions, the ecological validity of at least certain of these studies can be questioned. In particular, one of the problems with the interpretation of the cognitive neuroscience studies (such as that of Plassman et al., 2008) that have attempted to investigate the neural underpinnings of price information on people's evaluation and enjoyment of wine is that the experimental set-up tends to severely limit the multisensory information that tasters have available to them. As such, there is a danger that the results of such studies may overemphasize the relative influence of price information relative to normal tasting conditions, given that sensory cues associated with the wine itself are so impoverished while the participant lies flat on their back in the brain scanner (cf. Spence, 2014; Werner et al., 2021).

The participants in Plassmans et al.'s (2008) study, who were all students at MIT in California, actually had 1 ml samples of three different wines periodically squirted via a tube into their mouths (each squirt washed down with a drop of artificial saliva). Each taste of wine, which could not be swallowed immediately, to prevent scanning artefacts attributable to head movements (linked to swallowing), obviously minimizes the retronasal (not to mention eliminating the orthonasal) olfactory cues that normally play such a key role in wine evaluation. Given that something like 75–95 % of what the consumer thinks that they taste, they actually smell (see Spence, 2015, for a review), much of the sensory pleasure, and the majority of the sensory information/cues that the consumer normally has available to them, were denied to the participants under such artificial wine tasting conditions.[12]

Plassmans et al.'s (2008) study, along with a number of other studies on the influence of price (and other product-extrinsic cues) on wine can also be criticized for testing WEIRD (standing for Westernized, Educated, Industrialized, Rich, and Democratic) participants (see Henrich, Heine, & Norenzayan, 2010a, b). The criticism is both that the demographic characteristics of such participants tends to be highly skewed (i.e., and hence is not necessarily representative of the average wine consumer) but also that university students may well simply have less wine-tasting experience/knowledge about wine, and hence their judgments concerning the qualities of a given wine might be more easily biased with the provision of (for example) pricing information (though see also Masset & Raub, 2023).

While the order in which sensory and product-extrinsic cues are presented (i.e., before or after tasting) has been studied experimentally, the lead time of advance (product-extrinsic) information has not been varied systematically. That is, most studies present price, or whatever other product-extrinsic information, immediately before tasting, hence presumably prioritizing its salience in the mind of the taster. Note also that few studies provide more than a single source of information for their participants to evaluate. As such, all of the studies that have been reviewed in the previous section can be criticized for only providing a single product-extrinsic cue and/or potentially for making that cue more salient than it normally is (either because the consumer typically has to evaluate multiple competing product-extrinsic cues (such as price, brand, country of origin, etc.) and/or the information is divulged to the participant just before tasting (and hence may be more likely to be top of mind for the taster than might otherwise, or often, be the case). Here, just consider buying a wine at the supermarket for dinner later in the week, or even ordering wine in a restaurant before enjoying the meal. In both cases, there is a much longer temporal separation between attention being devoted to price information and the subsequent evaluation of the wine's taste, hence perhaps emphasizing the immediate sensory qualities of the wine over the other product-extrinsic cues.

One other potential consideration here concerns the impact of anchoring effects (Goldstein, 2019; Poundstone, 2010). The research shows that even arbitrary numbers can anchor people's judgments of how much they are willing to pay. So, for example, it turns out that how much people are willing to pay for a bottle of 1998 Côtes du Rhône Jaboulet Parallel (with a score of 86 from the *Wine Spectator* magazine) and a bottle of the 1996 Hermitage Jaboulet La Chapelle (with a rating of 92 from the *Wine Advocate* magazine) was dramatically affected by just such 'end anchoring' effects (Ariely, Loewenstein, & Prelec, 2003). The 55 marketing students who took part in the end anchoring study conducted at MIT's Sloan School of Management were initially given a sheet of paper on which six items were listed, including the two bottles of wine, a cordless trackball, and some Neuhaus chocolates. At the start of the experiment, the students had to write the last two digits of their social security number next to each item on the list. Next, they indicated whether they would pay that amount (in dollars) for each of the items on the list. Finally, they had to write down the maximum price that they were willing to pay for each of the items on the list. Those students whose social security number ended with a low number (in the 0–19 range) bid significantly less for the wine ($8.64 and $11.73, respectively) than students whose social security number ended with a high number (in the 80–99 range). Those in the latter group bid an average of $27.91 and $37.55, respectively, for the wines. In other words, people who just so happened to have a social security number ending in the top quintile were willing to pay more than three times as much for the same wine as those whose number fell in the bottom quintile.

So, if we start with some nominal value for an item, we typically fail to update our estimates of its actual worth sufficiently to overcome the

[9] Note that the trend for a positive correlation in the experts was only borderline-significant. Moreover, it was no longer significant when rigorous statistical criteria were used.

[10] This result seemingly consistent with the famous French oenologist's Emile Peynaud's observation that the *"Blind tasting of great wines is often disappointing."* (quoted in Goode, 2007, p. 91).

[11] At the time (2007–2008), the majority of US wine sales would have fallen squarely within this price bracket.

[12] In passing, one might also want to consider the more fundamental impact that changes in posture, such as lying flat on one's back in the brain scanner, might have on tasting.

influence of the initial value (or anchor). End anchoring constitutes an ubiquitous form of decision bias, one that affects us all the time, no matter whether we realize it or not, and wine is likely to be no exception (cf. Stewart, 2009). Thus, over-and-above its actual meaning in terms of the price of a wine, one might wonder whether part of the impact of presenting a lower or higher figure can simply be explained in terms of an abstract end anchoring effect that is divorced from the number's meaning. As such, and given the above considerations, future research should attempt to move beyond testing WEIRD participants, and try and take the testing out of the laboratory and into more naturalistic testing conditions. There is some evidence of this starting to happen already in the literature. It would also be interesting to have more cross-cultural data, given the explosion of the wine market in places like China in recent years. Does pricing (and other kinds of product-extrinsic information) have as much impact on Asian consumers as it does in Californian students? As yet, we simply do not have any data to answer such questions.

4. The impact of wine expertise on the influence of product extrinsic cues

But what of the nature of any individual differences in the impact of product-extrinsic cues that have been revealed by the research published to date? The few studies that have engaged wine experts (however, they have been defined) in blind wine tasting, generally demonstrate that they are unable to identify the more expensive wine (e.g., Harrar et al., 2013).[13] Furthermore, in those studies that have explicitly compared more versus less experienced wine tasters, the evidence would generally appear to demonstrate that the experts are more likely to be misled by the introduction of erroneous cues, be it miscolouring white wine red or rosé-coloured (Parr et al., 2003; Wang & Spence, 2019a), or else the provision of misleading price information (see Masset & Raub, 2023). Note that those who are more self-confident (rightly or wrongly) in their own wine knowledge, may also be more influenced by external cues (in part, because they believe that this is one way in which their knowledge/skill reveals itself; Masset & Raub, 2023).

Wine economists often worry about the ethics of deceiving their participants (Goldstein, 2019; Masset & Raub, 2023; Werner et al., 2021). At the same time, one might also consider the possible impact of demand characteristics (Rosenthal, 1964, 1966, 1967) on people's wine judgments. It is certainly rare to find the participants questioned as to their understanding about what was actually going on, or what they thought that the purpose of the study was, and hence what they might have intuited that the desired response might have been. As such, it is unclear what role experimenter expectancy effects may have played in the various results that have been obtained (and which were reviewed in Section 2).

5. Factors influencing the price of a bottle of wine

One important point to note before concluding this review is that the cost of producing wine is only partly reflected in the price paid by the consumer for a glass/bottle. The actual price charged for a wine also depends to a great extent on the location where it is offered for sale. For instance, consider only the 300 % mark-up (or more; see Brennan, 2017) that many restaurants typically charge for the wines that they offer (e.g., when compared to supermarket prices for the same, or similar, wine). And even within the context of restaurant wine offering, an analysis by Chung (2008) demonstrated that the price charged for the same bottle of wine, varied dramatically depending on the venue/location. According to Chung, the same bottle of Cabernet cost $1,500 at San Francisco's *Jardinière* and $5,435 at Las Vegas's *Prime Steakhouse*? In another example, a bottle of 1999 Dom Pérignon Champagne retailed at anywhere between $155 (at *Legal Sea Foods* in Washington), at *McCormick & Schmick's*, less than half a mile away, the same bottle was being sold for $250; At *Carnevino* in Las Vegas, it was $450, and $595 (at *Per Se* in New York). In the latter case, the argument is presumably that the price reflects the highly professional wine service bestowed on the diners by the sommelier that one would expect to receive at such a famous restaurant. Based on the research that has been reviewed in this article, one would have to presume that the wine likely tastes significantly better at the latter restaurant as well, at least if those tasting it have any idea of how much is being charged for the wine they are drinking. However, at this stage, this must remain as nothing more than an unfounded assertion, given the lack of the relevant empirical evidence on the topic.

At the same time, however, it is worth considering how only 37p of the £5 paid by the consumer for a bottle of wine in a UK supermarket actually goes on the liquid in the bottle (Brennan, 2017; see also Harding, 2005, p. 120). The duty (tax and value added tax; see Asen, 2021) on alcohol also varies markedly from one country to the next, though presumably few consumers would necessarily rate the wine sampled in a high tax area, such as, for example, Norway, as tasting better, than the same wine when purchased in France (where the duty on wine is much lower). In other words, much of the actual difference in price has anything whatsoever to do with the quality of the wine that is being tasted (Konnikova, 2014). All these factors should presumably be considered before one gets to the impact of wine discounting (e.g., in the supermarkets; see Anon, 2014).

It would be interesting to know whether providing a price breakdown to the participants in studies of wine pricing would modulate the influence of price information (cf. Edwards & Spawton, 1998). Similarly, it would also be interesting to know what price promotions (3-for-2 offers) and other marketing interventions might have on the impact of price information (cf. Shiv, Carmon, & Ariely, 2008, for a similar question asked in relation to discounted drinks). At the same time, however, it would also be interesting to know what effect, if any, press reports of cheap supermarket wines winning international awards might have on the consumer's belief in the price-taste/quality link (see Daily Mail Reporter, 2012). It would also be interesting to know what impact the wealth of the consumer has. Surely, the bankers who spend vast amounts on wines (Harding, 2005, p. 83), wouldn't be influenced in the same way by a $12 dollar difference in the labelled price of a wine (e.g., when compared to the poor students who are so often tested in psychological research).[14]

One other factor to consider here is the investment angle. The price that people are willing to pay for wine sometimes reflects its potential as a vehicle for generating a financial return. After all, estimated annual returns on investment grade wines reached 10 % a few years ago (e.g., see Masset & Weisskopf, 2010; Sanning, Shaffer, & Sharratt, 2007). (Note also that wine is not subject to Capital Gains tax either.) In such cases, there may be no real expectation that the person who purchased the wine will ever get to taste it. In such cases, the price may more closely track the expected return on investment (ROI) rather than necessarily how much a wine is liked, or necessarily even its quality.

6. Conclusions

A wide range of product-extrinsic cues have been shown to impact people's wine evaluation, including everything from the type of bottle closure (e.g., Spence & Wang, 2017), through to the colour of the ambient lighting (Oberfeld, Hecht, Allendorf, & Wickelmaier, 2009;

[13] Research analysing the consistency of expert wine judges' ratings of wines shows that replicates of the same wine often do not receive the same ranking, or quality assessment, on different occasions (e.g., Hodgson, 2008, 2009a, b).

[14] Consider only the 6-litre bottle of the Californian cult classic cabernet, Screaming Eagle, that sold at the annual Napa Valley charity auction in 2000 for $500,000. That works out at $12,500 for a 150 ml glass (MacLean, 2008, p. 267; see also BBC News, 2011a, b).

Spence, Velasco, & Knoeferle, 2014; see Spence, 2019, for a review).[15] Specifically related to the wine itself, its price, the country, or region, of origin (e.g., Balestrini & Gamble, 2006; Wansink et al., 2007), any expert ratings/rankings (Siegrist & Cousins, 2009), and bottle/label information (Brochet, 2001; Peynaud, 1987, p. 33; Masset & Raub, 2023) all impact the ratings that consumers give (see also Ashton, 2017). Taken together, taste intensity ratings appear to be relatively unaffected by the provision of actual, or deceptive, pricing information (e.g., Plassman et al., 2008; Schmidt et al., 2017; Werner et al., 2021). At the same time, the pleasantness of low- to mid-priced (but not necessarily high quality, i.e., more expensive) wines appears to be affected (enhanced) by deceptively-high pricing information (Plassman et al., 2008; Schmidt et al., 2017; Werner et al., 2021). That said, the ecological validity of the experimental designs can sometimes be questioned.

Many of the findings reported in this narrative historical review make sense in terms of the various product-extrinsic cues, such as price, helping to set people's sensory expectations of product quality (see Piqueras-Fiszman & Spence, 2015, for a review). The latest research (Masset & Raub, 2023; Werner et al., 2021) has confirmed earlier observations (see Spence, 2010, 2014, for reviews) that telling people that a cheap wine is more expensive than it really is, is likely to lead to enhanced ratings. Given the marked discrepancy between the results of blind and sighted tastings, Priilaid (2006, p. 19) was led to conclude that: *"All too often it seems that sighted & blind tasting scores seem so disparate as to suggest that either the wine pairing has been mixed up or that 1 of the 2 tasting panels was bribed. From this apparent lack of correspondence, it is tempting to conclude that for visual judgements – extrinsic cues appear to be over-riding or masking the true intrinsic merit of the wine."*.

CRediT authorship contribution statement

Charles Spence: Writing – review & editing, Writing – original draft, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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[15] In Oberfeld et al.'s study, simply changing the color of the lighting in a German winery from white or green to red or blue was shown to increase the amount that the 200 unsuspecting consumers said that they would be willing to pay for the bottle of Riesling that they were tasting (from E4 to E6). Finally, it is important to consider an alternative explanation for the influence of certain product-extrinsic manipulations on people's wine evaluations that is linked to emotion. While am emotional modulation account of such colour effects has been suggested by some researchers (Jiang, Niimi, Ristic, & Bastian, 2017; Niimi, Danner, & Bastian, 2019; Niimi, Danner, Luxing, Bossan, & Bastian, 2017), Spence et al. (2014) have argued against the emotional account of ambient lighting's effect on wine consumers' evaluations.

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