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Getting More Out of Wine: wine experts, wine apps and sensory science[★]

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How do consumers decide which wines to buy from the bewildering range on offer to them? Who should they turn to for advice? The answers to these questions are of interest not just to consumers but also to producers and wine merchants who hope to influence consumers' choices and develop their interests in wine. At one time, consumers looked to the points awarded by authoritative wine critics but increasingly, they use wine apps to extend their wine choices. Reliance on digital technology is meant to replace reliance on expert wine tasters whose judgments can be questioned or whose verdicts on what count as good quality wines may not line-up with the tastes and preferences of ordinary wine consumers. Wine apps' recommendations based on the wisdom of the crowd favour what most people like but offer little insight into why they like it. It is here that sensory science can play a role in identifying the drivers of liking; however liking should be distinguished from quality. Wine experts aim to identify wine quality; wine apps mostly aim at average liking. To get more out of wine consumers need a way to go beyond liking.

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Which consumers?

Which type of advice will serve consumers best in making purchasing decisions depends in part on what consumers are looking for and how familiar they are with the world of wine. When the consumers in question are casual or social drinkers, they often find a wine that they like and buy it again and again. This is typically a commercial wine produced to ensure every bottle gives the consumer

the same experience each time. In this way, consumers know what they are getting and like what is familiar [1–3]. For these consumers drinking wine is a convivial, social experience, all about the pleasure and ease of sharing a bottle with friends and unlike the demanding experience of wine enthusiasts keen to appreciate and savour a wine's character and quality.

That said, even social drinkers who repeatedly purchase the wines they like can develop hedonic fatigue. Drinking or eating the same thing time after time becomes unappealing [4]. Variety is necessary to maintain interest, and any progression to new and more interesting wine choices can initiate a transition to a new set of consumer interests and preferences.

The social drinker's transition from the familiar to the new matters to wine merchants and producers who hope to offer consumers different wine choices that will lead them eventually to ascend the quality (and price) ladder by experiencing and enjoying wines of greater complexity and interest. For wine enthusiasts, this transition is an important part of their journey to more demanding and satisfying wines. Wine merchants, sommeliers, wine writers, and designers of wine apps can all intervene in the chain between wine producers and consumers. In what follows I will consider the role of the wine expert, the wine app and the sensory scientist. Each offers different expertise: guiding, predicting and illuminating consumers' wine choices. Who best serves the needs and interests of consumers at different stages of their wine journey? Are their contributions mutually exclusive, or can they be combined to offer the consumer better advice?

Wine critics as authorities

At one time, wine drinkers turned to the ratings and recommendations of well-known and respected critics. The best-known system was the 100-point scale of Robert Parker. The effectiveness of Parker Points was that consumers needed no wine vocabulary, nor did they have to read obscure tastings notes to make buying decisions. Parker's points system rated every wine against every other regardless of category: white wine, red wine, sweet wine, Champagne, Bordeaux, Burgundy. But it gave no insight into why one highly-rated wine from a given region or producer could suggest trying others from the

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same region or same producer. Instead, consumers estimated quality-price ratio when buying wines and mostly relied on a sole authority to rank all wines of interest. The trouble came when Parker began to move the market and the wines awarded points in the high 90s became unaffordable to most consumers and even interested amateurs. In addition, consumers were said to be buying wines they did not really like because Parker had given them 90 points or more. If true, this situation was unsustainable in the long term.

By the early 2000s people began to ask themselves if Parker was such a reliable guide to the best wines. Confidence waned for a number of reasons. Not all experts agreed on which wines were best. Famously, Robert Parker and the English wine critic Jancis Robinson clashed over the 2003 Chateau Pavie. In Bordeaux, 2003 was a hot year, and many wines were atypically rich, high in alcohol and glycerol. Parker gave the 2003 Ch. Pavie a score in the high nineties whereas Robinson rated it as flawed, crucially because it was not typical of a Right-Bank Bordeaux [5].

The plurality of opinions grew, fuelled by an online community posting their own evaluations, and soon divergence of opinion led to a steep decline in the credence given to wine critics' ratings. At the same time, there was a growing scepticism in the popular press about whether there was any science behind wine tasting.¹ This included reports on academic articles describing the unreliability of wine panel judges [6] and the fallibility of wine experts [7].

In the infamous study by Morrot *et al.* [7], experts and novices were presented with a white and a red wine to which they gave descriptions. A week later they were offered a white and a red in the same task, although this time the red was the white wine they had experienced a week before, now coloured red with an odourless, tasteless dye. The experts, like the novices, were fooled and used red wine descriptors for the aroma of the dyed white wine.

Behind these concerns lay the suspicion that the words wine critics were using to describe wines did not accurately engage with a genuine subject matter, which led to a populist movement that dismissed critics' opinions and scores as the posturing of an elite. Many found this move liberating, advocating a democracy of taste in which all opinions were equally valid. People were urged to trust their own palates. This is subjectivism about taste: if no opinion is better than any other, there is nothing to get right or wrong when it comes to assessing how good a wine is.

¹ See 'Is wine tasting junk science?' <https://www.theguardian.com/lifeandstyle/2013/jun/23/wine-tasting-junk-science-analysis>.

No one can tell us what we should like, but without guidance, how do inexperienced consumers make good wine choices? In supermarkets and commercial wine stores there is usually little or no opportunity to taste wines before purchasing, in which case consumers must rely on extrinsic features of the product. Behavioural studies have identified a number of factors that can influence a consumer's purchasing decisions: weight of the bottle, price, label design, certificates and medals on the bottle, back-label information [8–10]. These factors will be weighted differently by different consumers. How informative consumers find specifications of grape variety, region, or back-label information, including taste descriptions, food pairings, and method of making, depends on their level of knowledge. The professionals' descriptions of a wine's properties or origins are unlikely to be of much use to social wine drinkers in making their initial choices. Extrinsic factors, like weight of the bottle and label design, may count, however, trial and error will still be the likeliest method for arriving at purchase decisions. More knowledgeable consumers may be able to make more of this information; but on what basis?

Sensory science

The problem is that many of the studies cited only tell us how these extrinsic factors influence consumers' *behavior*, not how *meaningful* this information is to them: what *expectations* about taste are created; whether those expectations are met and how they *perceive* the wines they purchase. To discover this we need to turn to the methods of sensory science to elicit this information from consumers implicitly without asking them. This is important since most wine consumers are unable to tell us which flavours, aromas or textures they perceive or are sensitive to in the wine they are tasting. Consumers will mostly tell us whether they *like* a wine but not *why* they like it; and liking can be a distraction. Novice tasters often treat liking as the sole function of tasting, a matter of producing a verdict about whether to continue or stop drinking, with much of the underlying information about flavour and aroma being lost. Yet if we knew which perceived features a taster likes or dislikes, wine sellers or producers could offer better advice. By bringing consumers into the lab to perform tastings under controlled conditions it may be possible to discover more (see Ref. [11]), but there are less demanding methods in sensory science for telling which features social drinkers perceive and respond to; for example, the free sorting task [12]. In this case samples are presented to untrained consumers (participants) all at once and they are asked to sample these, either by smell or taste or both, and sort them into groups arranged in terms of similarity and difference. The advantage of the free sorting task is that it requires neither wine vocabulary nor the ability to translate sensory perceptions into words [13]. Participants are free to form as many or as few groups as they want. They simply sort samples into groups that make sense to them: every sample in a group is more

similar to members of that group than to members of any other. Participants are usually invited to characterize groups either from a given list of attributes or by providing their own descriptions. Analyses of the data can be carried out and represented by multidimensional scaling or principal components analysis. Once we have such information wine merchants and producers may be able to build up sensory profiles of different types of customers.²

Wine apps

By contrast, the claims on behalf of digital technology companies is that none of these methods of testing or profiling are necessary: there is enough data in consumers' behavior — purchasing patterns and liking — to extract reliable predictions about which other wines consumers will like without the findings of sensory science. Recommendations and ratings are computed using a 'wisdom of the crowd' algorithm. The first task is to crowd-source data from wine consumers and once that data has been gathered ratings are made by statistical averaging over the inputs. Apps such as [Vivino.com](#) offer aggregate scores for wines whose labels consumers have scanned, along with personal recommendations for users; [CellarTracker.com](#) pools the scores of thousands of community reviewers and lists points, prices and availability of wines.

The relevant claim is that these recommendations or ratings rely only on hedonic ratings (liking/disliking) of the wine consumers sampled and this serves as the basis from which to calculate predictions of which other wines consumers will enjoy. Algorithms which aggregate opinions about which wines people like extrapolate on the basis of shared experience to guide them about which other wines they would enjoy. This is the advertised claim.

There are two significant part to this claim: (i) that algorithms that aggregate the opinions of others will serve better than relying of the opinions of a few renowned wine critics; and (ii) that subjective liking is a sufficient basis for wisdom of the crowd judgments.

On (i), the opinions of wine critics are said to differ from those of ordinary consumers, either because the tastes of wines are perceived differently by experts [15,16], or because experts diverge from ordinary wine consumers in their preferences: that is, they don't like the same wines. For example, Goldstein *et al.* [17] claim to show that for individuals with wine training there is a positive correlation between price and enjoyment that is not there for ordinary drinkers who like less expensive wine. Therefore, wine recommendations by experts may serve as a poor guide for non-expert wine

consumers. It has since become a regular trope that consumer prefer cheaper wines and not those that experts tell them they should like. [18].

What matters in (ii) is whether the wisdom of the crowd can explain why the collective opinion of a group is superior to the answers given by individuals in the group. When asked to estimate the weight of a bull at the fair, in Francis Galton's example, people will make wildly different estimates, but when the average of the estimates is calculated the result is often nearer the right answer than the individual estimates. The variation between the answers is smoothed out by averaging, which eliminates noise. However, if we accept the subjectivity of taste — that no opinion is better than any other, and that all opinions are equally valid (or invalid) — then if individuals are pronouncing on their own liking, it is hard to understand what it means to say the aggregated liking score corrects for errors or eliminates noise. To what does the collective decision more accurately correspond? And why should I value the opinion of the crowd over my own opinion if all opinions are equally valid? What we have, here, is not the *wisdom*, but the *preference*, of the crowd. These will be frequently purchased wines with high average liking and it is possible to calculate the probability of how much I will like a wine I have never tasted on the basis of much that wine is liked by people who overlap with me in their liking of wines I have previously liked. Those similar to me can serve as guides to what I will like. But will averaging of consumer liking at a given price provide the individual with anything useful on which to build or extend their wine knowledge? A machine learning algorithm that learns from examples is a black-box that offers no underlying explanation of the generalizations about what people like.³

Wine apps versus wine critics

To return to (i), how much do community based reviews and ratings actually diverge from those of wine critics? Despite reports [17] that expert tasters like expensive wines non-expert tasters do not like, a comparison carried out by Mark Schatzker and Richard Bazinet for *Vox* magazine in 2018, found for 9919 Californian wines a Spearman correlation of 0.576 between the ratings on the crowd-sourced app [CellarTracker.com](#) and those in Robert Parker's Wine Advocate; and for 1099 Californian wines a Spearman correlation of 0.424 between the ratings of [CellarTracker.com](#) and those on Jancis Robinson's website. The crowd-sourced reviews and the wisdom/preference of the crowd scores based on them are more consistent with the scores of leading wine critics than we might expect given the methods and motivations behind

² For a thorough review of the techniques of sensory evaluation see Ref. [14].

³ A frequently recited joke describes a machine algorithm walking into a bar and the bar tender asking 'What will you have to drink?' The machine algorithm replies, 'What are the rest of you having?'

the design of wine apps. The authors note ‘a tendency for scores to converge as wines improve in quality’.⁴ What is the explanation? CellarTracker’s founder, Eric Levine notes that the average user has rated 49 wines and 2311 users have rated more than 500 wines. So these are not novices making speculative estimates about a continuous quantity like the weight of a bull. It is unlikely that they are merely offering personal likings to be averaged since there is more convergence of opinion for higher quality wines. Like expert tasters and wine professionals, the individuals in this crowd are not judging their personal liking, but the quality of the wines they tasted; and quality should not be conflated with liking.

Machine learning algorithms whose inputs rely on the experience of proficient tasters can be of use to similar tasters. Although such recommender systems would give no insight into which properties of wine are prized by users of the app. Though the app’s outputs could serve as target data for sensory science. A trained tasting panel could look for common qualities that all the algorithmically selected wines share. The results of combining sensory science with wine apps in this way could be more useful than either is alone, on the assumption that what such recommender systems track are judgments of quality made by competent tasters and not averages of idiosyncratic personal likings.

How do we reconcile the performance of the CellarTracker.com app based on community reviews with the divergence between expert and non-expert tasters [17]? Divergence may occur when non-experts are social drinkers focused on the wines at the lower end of the quality scale. This does not mean, as elitists would claim, that social drinkers could not appreciate wines of higher quality. Many of those drinkers have simply not had sufficient opportunity to taste a range of more interesting wines. People can be astonished the first time they taste a truly great wine, and it is with these transformative experiences that their fascination and love of wine begins. So the distinction is not between those who *can* and those who *can’t* recognize better wines, but between those who are, and those who are not *yet* able to do so.

The gap between expert and novice

One reason for the gap between expert and non-expert tasters is that causal or novice drinkers focus almost exclusively on liking whereas wine experts look for wine quality. The experts in question include wine professionals such as oenologists involved in wine making, sensory evaluators who assess quality standards for appellations or categories, those who train and test sommeliers and wine merchants, who all help to maintain the idea of wine quality. They are looking for better wines, where

‘better’ doesn’t mean liked by more people. It means a better-made wine where the clues to its quality can be revealed by attentive tasting.

Both elitism and populism assume that there are no objective facts about a wine’s quality. But why accept that assumption? Denial of objective quality measures threatens to render irrelevant not only the opinions of wine experts but also the efforts of vinticulturists, wine-makers, enologists, and sommeliers who seek to improve our tasting experiences. Contra populism, it is possible to judge one wine to be better than another, and not all opinions are equally valid. Contra elitism, it is not only experts that can appreciate better wines. By learning how to taste, novices can come to appreciate better and more interesting wines. What holds them back at first is the belief that all there is to a wine is revealed immediately in the first sip and there is whether I like it. It is wholly a matter of the sensations I undergo when tasting, which allows for no gap between what I am tasting and my immediate experience of it: the subjectivity of taste. But tasting takes concentration and practice. A wine does not give up its secrets all at once, or to just anyone. Practiced tasters feel a wine uncurl as it opens up in the glass, and if they know the vineyard from which it comes and the vintage, they may know whether it is performing or underperforming. Given a poor season, a specific cuvée may impress them. In this way, approaching a wine with knowledge and expectations sets the expert taster questions to which the sensations they undergo in tasting can provide answers. Tasting can get things right or wrong; there is something objective to aim at [18,19]. It is the interplay between tasting and knowing that leads to refined discrimination and a better understanding of the wine.

Experience and knowledge guides perceptual learning in experts and distinguishes them from novices. This is not a difference in perceptual capacities. Studies by Ballester *et al.* [15] and Danner *et al.* [20] indicate that novices are just as good at perceptual discrimination as experts; but unlike experts they don’t know they are. Here we have a difference between experts and novices in their meta-cognition [21] Experts are sensitive to what they are tasting, build on knowledge of what they can discriminate, and derive pleasure and interest from doing so. As a result, they are better at categorizing wines and through training and exposure come to have better memories for wines [15,22]. With training and guidance, most tasters can come to make fine discriminations and with that improve the satisfaction and reward they get from tasting good quality wines. First they need to confront the difficulties of tasting.

Why wine tasting is hard: the multisensory perception of wine flavours

Tasting is one of the most complex and multisensory activities the brain performs. Our brains must weigh the

⁴ <https://www.vox.com/2016/12/15/13892364/wine-scores-critics-amateurs>.

relative contributions from taste, smell, touch, and the trigeminal nerve to arrive at a unified perception of flavor. We are not just receiving sensations of sweet, sour, bitter, salty, savoury (umami), from the tongue. These alone are unable to explain the wide range of things we are capable of tasting. Our experience of *flavour* notes such as honey, pear, gooseberry, elderflower, strawberry, raspberry, black cherry, black current, do not come from the tongue: we don't have black current receptors on our tongues. The experience of these flavours is due to smell where odours rise from the mouth and are pulsed to the nose when we swallow. As we swirl wines in our mouths, taste and smell combine with touch to produce an integrated and unified experience of flavour that is hard for a taster to dissect. Touch matters too. The mouthfeel of a wine, or the sting of CO₂ bubbles in sparkling wines that irritate trigeminal nerve endings,⁵ as well as temperature are part of touch. All have an impact on flavor: cold it accentuates bitterness, while warmth enhances sweetness.⁶

The sensory inputs from taste, smell and touch don't just combine they interact and affect each other's workings. Smell has an effect on touch and certain odours can make what is in the mouth taste creamier [23]. Touch has an effect on taste with smoothness being interpreted as sweetness by the brain [24] while the feel of astringent tannins in some young red wines are often confused with bitterness, an effect that can be reinforced by high acidity. Smell and taste interact with the taste of sweetness intensifying fruit odours, while fruit odours enhance sweetness [26]. In all these ways, cross-modal interactions between the senses modify the final summation of inputs integrated into a unified experience of flavor that gives us very little clue that it is the result of the multisensory integration. Tasting is not a single experience; it has a dynamic time course, drawing on different sensory inputs. We misclassify multisensory flavour perceptions as simple taste experiences and most of the time are unable to decompose them into their component parts: it is hard to undo the subtle workings of the brain that integrates these different inputs.

There are also better and worse tasters and there are individual differences. On average, women have a better sense of smell than men. Some tasters will have specific anosmias for TCA (cork taint) or rotundone (peppery note), and all of us are subject to a wide variety of factors, internal and external, that impinge moment by moment on our ability to taste well. Wine drinkers will trust their own palate for verdicts about liking but if they want to go beyond liking: to know whether a wine is faulty, is showing a near-threshold level of TCA, is somewhat

dumb and would be better after a year, or after an hour of being poured, or one degree warmer or colder, whether it is typical of the producer, the vineyard, or the vintage, they may do better to confer with knowledgeable and practiced tasters.

The experience of flavor depends on inputs that vary from taster to taster depending on whether one has the tongue of a supertaster, a taster, or a non-taster [27]. Each of us is likely to have a specific anosmia, meaning that we are 'blind' to particular odors (e.g. TCA cork taint.) It is little wonder, then, that tasting judgments diverge. But this doesn't mean they are idiosyncratic or inexplicable, nor that they are subjective and wholly independent of the flavors in the wine. Were one to take the line that tastes just were the sensations of an individual one would readily understand why judgments of taste would seem like mere opinions, answerable to nothing but an individual's immediate reactions, which is a faulty view of tasting.

Consider again, the fallibility of experts. The frequently cited study by Morrot *et al.* [7], in which expert tasters used red-wine descriptors for white wines that were dyed red with tasteless, odorless food coloring only had participants sniffing and not tasting the wines in question. What the findings show is that in conditions of uncertainty, visual information dominates olfactory information as a sensory clue to the properties of a stimulus — something we knew already from the study of multisensory perception. Also, experts were more susceptible to the effects of colour on odour identification because they use colour cues when tasting wine more than novices do. A subsequent study by Ballester *et al.* [28] has shown that both experts and novices were able to distinguish the odours of red and white wines (but not rosés).

It would be a mistake to equate the existence of facts about a wine's quality straightforwardly with an expert taster's scores and assessments of it. Human tasters are imperfect instruments, and, as we have seen, wine tasting is hard. It takes practice and knowledge of what one is looking for to arrive at a reasonable assessment of what is going on in a wine. Giving a score on top of that is merely impressionistic. Lack of agreement between such scores is not a sign that there is no objectivity to perceptions of a wine's character, and even when there is radical divergence, as in the case of Parker and Robinson over the 2003 Ch Pavie, there was less disagreement about the properties they perceived the wine to have: ripe, jammy fruit, high alcohol, high glycerol content. It is simply that Parker likes these characteristics and Robinson does not.⁷

⁵ The trigeminal is the fifth cranial nerve that serves the eyes, the nose and the mouth and produces stinging, burning and cooling sensations in response to stimulants in spices.

⁶ There are thermal tasters who have sensations of sweetness when they feel warmth on the tongue, and sourness or saltiness when they feel something cold there [25].

⁷ Or, rather, Robinson does not rate them when found, uncharacteristically in a Right-Bank Bordeaux wine. Robinson always judges wines within a category, unlike Parker's 100-point. It is harder than many suppose to locate the basis for such disagreements (See Ref. [29]).

Even if there were consistency among the assessors' scores this would still leave plenty of room for differences with respect to which wines people preferred. An experienced critic can rate a type of wine, cite the best vintages for it, the best producers, and still not personally like the wine. It is also wrong to suppose that if wine quality were objective everyone would recognize it and agree on which wines had it, or that this would be reflected both in the scores of critics or in which wines people like best. The fact that there is something to get right or wrong is why we can be fallible and why some people are better tasters than others. Populism is right to stress the democracy of taste if that means everyone is entitled an opinion, but not all opinions are equally good. It is also worth remembering that individual tasters' perceptions at any particular time amount to nothing more than snapshots of an unfolding flavor profile that will evolve in the glass and in the bottle.

Wine tasting and predictive processing

Wine professionals need knowledge, experience and attention to judge a wine's character and quality. Expert tasters' judgments are revisable, unlike immediate impressions of liking. The precise character and qualities of a complex wine are often elusive and not revealed all at once, or in a single sip. Understanding a wine means knowing where it is in terms of its development and maturity: appreciating its dynamic *flavour profile*. With practice, one can predict how a wine will taste several years from now, whether it will come into balance, whether it will fade, how it will behave once decanted, how it will taste one degree warmer or colder. These are predictions, and they can be confirmed by how things subsequently turn out. There are facts here to get right or wrong, and experience teaches us that.

A recent theory of how the brain works provide a useful framework for this view of wine expertise. This is the predictive coding model. On this view we do not start with sensory inputs as the basis of perception and judgement. Rather, perception arises from comparing prior expectations of sensory inputs with actual sensory inputs. Perceptual learning takes place through the revision of priors in the light of generated prediction errors in response to our sampling of the world. The aim of the Bayesian brain is to minimize error, continually update our prior expectations, thus reducing noise in the input signal and giving greater precision to our perceptions. [30]. In wine tasting, we build up priors of flavour profiles that give us sensory expectations but we must attend to and make salient use of the sensory information by which we can know more about the wine, in order to generate prediction errors, and reach precision weighting. Knowledge (of grape variety, domain, vineyard, vintage) produces a range of hypotheses to be tested — that is, that can be confirmed or disconfirmed by our sensory inputs.

Is wine tasting social? Are two brain brains better than one?

What of the accuracy of wine critics and wine professionals? It is here that we might borrow the idea of the wisdom of the crowd, or at any rate the wisdom of pairs. Recent evidence from cognitive neuroscience has shown that when individuals carry out routine perceptual judgments they perform better as pairs than they do individually. Each is asked to make a decision about what they are looking at (e.g. is this image brighter than the last one?). They also express how confident they are in their verdict. Then they share their individual responses and their confidence ratings and come to a collective decision and confidence rating. The latter is usually more accurate than the verdicts they produce individually. Two brains are better than one in arriving at perceptual judgements, when no one of the pair dominates the other. This well-attested paradigm of Optically Interacting Minds [31] may apply to wine tasters conducting evaluations or giving scores. Two palates may be better than one.

Rejecting both elitism and populism

Tasters should be encouraged to form opinions for themselves, not simply deferring to what the critics say. But to do so, they need help to hone their skills as tasters, and need good guides to help them know what to look for when tasting wines from a certain place or made with a certain grape. Guided in this way, novice tasters can develop finer powers of discrimination and seek out wines of greater complexity and interest. The autonomy of judgment will be respected when tasters are able to recognize and appreciate the features of outstanding wines themselves. Appreciation requires apprenticeship, and the possibility of educating one's sensibilities. The role of a mentor is critical. Wine enthusiasts are looking not just for encouragement but for a reason to believe that they, too, can themselves recognize the qualities of a great wine.

Conflict of interest statement

Nothing declared.

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