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Demystifying wine tasting: Cognitive Psychology's contribution

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## Abstract

Over recent decades, cognitive psychology has made a significant contribution to our understanding of wine-tasting phenomena. At the most fundamental level the discipline's contribution has made us aware that even an apparently 'simple' judgment, such as noting that a wine's odour reflects over-ripe fruit, involves not just our nose but sophisticated cognitive processing. With its information-processing model of how people interact with their surrounding world, and its methodologies and theories regarding how we perceive, conceptualise, remember, image, make judgments, and communicate our experiences, cognitive psychology has markedly advanced our understanding of wine tasting and wine tasters. This review highlights notable wine sensory research outcomes that make evident the importance of a taster's cognitive processes in their wine analysis and appreciation. These include data providing evidence for colour-flavour perceptual bias, prototypical thinking, knowledge-based wine judgments, the close links between olfactory memory, autobiographical memory and emotion, and the notion of wine expertise. Further, it will be argued that such data demonstrate how a consensus model, still dominant in much wine sensory analysis, is limited at best and inappropriate for sensory analysis of complex products such as wine in many contexts. Critical to this argument is appreciating that differences amongst tasters, reflecting each individual's physiology, experience and knowledge, are valid data in themselves rather than 'error in the machine' as they were conceptualised within traditional consensus models of sensory analysis. The article terminates with reference to a promise for even greater understanding of wine tasting phenomena that the future offers by links between cognitive psychology's behavioural data and recent technological advances in neuropsychology and neurophysiology (e.g., cerebral imaging techniques).

Key words: Wine; sensory; tasting; cognition; psychology

## 1. Introduction

How extensively is our brain involved when we taste a wine? What lets us appreciate the flavours and textures of this complex beverage? And how does the bouquet of a fine wine effortlessly evoke distant memories and emotions? The aim of this brief review is to highlight both historically important and selected, recent research reminding us that wine is as cerebral as it is sensual.

The scientific literature provides in-depth knowledge about ‘tasting’; i.e., the visual, gustatory (taste), olfactory (smell by nose; aroma by retro-nasal olfaction), and trigeminal (mouth-feel) sensory systems involved when we experience food stimuli (Doty, 2015). The notion that these multiple sensory inputs combine centrally to produce what we call flavour (Auvray & Spence, 2008; Jinks & Laing, 2001) has also received scholarly attention. In contrast, the specific cognitive processes and emotional experiences associated with such sensory phenomena have been relatively neglected by the food science community.

Well-known psychologist and perception theorist J.J. Gibson asked more than sixty years’ ago what a wine expert has learned that a less-experienced taster has not (Gibson & Gibson, 1955). However it was several decades later before articles concerning the psychological processes underlying wine tasting (Solomon, 1990; Morrot, Brochet, & Dubourdieu, 2001) and the links between cognitive psychology and sensory evaluation (Abdi, 2002) began to appear in the scientific literature. Thanks to these pioneers, the methods and theories of cognitive psychology are now making their presence felt in wine sensory science (Shepherd, 2017; Parr, 2008), having a major impact on our understanding of wine-tasting phenomena, and helping advance wine sensory science from its toolbox and descriptive status to become a theoretically-driven discipline. The key philosophical change involved in a psychological approach to

understanding wine tasting is a shift in focus from the product, namely wine chemical composition and sensory description, to emphasise the taster and his/her interaction with the wine. Inherent in elevating the wine taster and the wine-tasting context to centre stage is focus on validity of data (and not mere replicability), and an embracing of individual differences amongst tasters, a consequence of which has been renewed interest in scientific study of wine expertise. Further, incorporation of cognitive psychology's methodologies and theories into wine sensory science permits not just description of effects but allows inferences about the underlying cognitive processes implicated when a taster undertakes a task. This in turn has resulted in building of models and theory within a discipline that was virtually a-theoretical 50 years' ago.

## **2. A cognitive analysis of wine tasting**

Cognitive processes are the cerebral processes we use to acquire and use knowledge (Reisberg, 1997). They include the processes we use to perceive, to carve up the perceived world into a sensible classification system, for remembering, imaging, making judgments and decisions, and for communicating our perceptions and judgments to others. Since the 1960s, these processes have been considered within a behavioural model that views humans as information processors, rather than as passive recipients of one-way input from the environment (Cowan, 1989). The processes are assumed to occur in real time, either in parallel or consecutively, and are affected by the inherent limits to the capacity of the human information-processing system as well as by emotions. When we evaluate a wine, even at the level of a simple recognition judgment, processing the multi-sensorial input likely involves all of the processes mentioned above under most circumstances. One important aspect of cognitive processing in a wine-tasting context is the integration of 'top-down' and 'bottom-up' information processes (Parr, White & Heatherbell, 2003). This involves a taster's already-gained knowledge and emotions influencing perception of

any incoming sensory input by activating memories, expectations, ideas, and so forth so that the taster's experience (subjective representation) of any wine is influenced by their unique physiology and psychological history.

### **3. Key supporting research**

This brief review is of necessity selective, and is aimed at highlighting research based in cognitive psychology that exemplifies the comments above.

#### *3.1. Perceptual phenomena*

Fundamental research concerning flavour perception makes evident the complex nature of multi-modal perception as is involved when evaluating wine (Auvray & Spence, 2008). One of the important, relevant findings is that concurrent multisensory inputs can lead to interactions, the most commonly reported involving influence of colours and/or odours on taste perception such as olfactory-induced, enhanced sweetness judgments (Stevenson, Prescott, & Boakes, 1999). Interestingly, odour-taste associations can occur when the interacting sensory inputs are sub-threshold when presented singularly (Dalton, Doolittle, Nagata & Breslin, 2000) suggesting cross-modal summation at a neural level. That many odour-taste interactions are influenced by prior experience and familiarity with the stimuli suggests that these effects involve cognitive processes such as implicit learning (Stevenson, 2001).

Other perception research demonstrates the difficulty humans have, including experienced perfumers, in detecting more than two or three separate components in odour-taste mixtures, with olfactory components being more difficult to detect than tastes (Marshall, Laing, Jinks, & Hutchinson, 2006). One cognitive process implicated in this difficulty is the capacity limitations of working memory processes, working memory often considered the 'span of

immediate attention' and comprising subcomponents for differing sensory inputs.

Another area of study has argued that different tasting task requirements can lead tasters to adopt different perceptual strategies. As an example, data from a study into one of wine's more abstract qualities, namely perceived complexity (Schlich, Medel Maraboli, Urbano, & Parr, 2015), suggest that judging a higher-order wine attribute like complexity encouraged tasters to see the wine as an integrated whole, rather than to deconstruct the wine into components or parts. That is, tasters associated global wine characteristics such as harmony and balance with perceived complexity, rather than qualities such as the number of distinct components identifiable in the wine, the latter more in keeping with decompartmentalising a wine into its separate elements as is required in analytical evaluation tasks.

Other relevant research demonstrates how our perceptual processes can trip us up, leading us to make erroneous judgments when wine tasting. This includes work on colour-flavour perceptual bias (Morrot et al., 2001; Parr et al., 2003) and other expectation-driven phenomena such as influence of wine price or bottle weight (Piqueras-Fiszman & Spence, 2012).

### *3.2. Higher-order cognition: Categories, prototypical thinking, imagery, semantic memory & language*

Arguably the most influential area of psychological theory in terms of its contribution to understanding wine tasting concerns human categorisation. Categorisation theories attempt to explain how we conceptualise the world, categorise the myriad of incoming inputs to cut down our cognitive load, store them in memory, and use language to communicate what we experience. Prototype theory provides one view of how we do this, arguing that we form prototypes or ideal examples of a category on the basis of our experience with various category

examples (e.g., our ideal Chardonnay). Once a prototype has been formed in our mind (i.e., we have represented mentally an ideal category member), all subsequent judgments a person makes are made with reference to their ideal category member.

An early area of wine research that drew on prototype theory to explain results was particularly innovative. To understand the tasting experiences of four well-known wine critics, Brochet and Dubourdieu (2001) used textual analysis (ALCESTE: Reinert, 1986) to examine the tasting comments. Brochet and Dubourdieu's results demonstrated that the wine critics' comments fell into classes that in general corresponded with descriptions of either red wines or white wines, but which varied greatly across tasters. The authors referred to these classes in terms of wine prototypes, and interpreted their data as demonstrating that tasters were driven largely by top-down cognitive processing. What this means is that the mental representation of a wine that results from immediate experience (i.e., the data-driven input from experiencing the actual wine in the glass) was very much influenced by what was already inside the head of the taster. Hence, it was argued that a taster's past experience of red wines and of white wines led to formation of a prototypical mental representation of the category of 'red wine' or 'white wine' for each critic, this prototype differing amongst the critics and dominating judgment of all subsequent wine experiences for each taster. More recent work, although not prolific, continues to investigate the ways in which wine knowledge is categorised cerebrally. For example, Eguaras, Domezain, & Grjalba (2012) report a study in which the data were interpreted as demonstrating that wine consumers organised their knowledge about red wines and rosé wines within a cognitive construct that included wine type and origin as important information.

A second research area that has progressed theoretically as a result of researchers drawing on theories of human categorisation concerns judgments of wine typicality (Ballester, Dacremont,



Le Fur, & Etievant, 2005; Parr, Green, White, & Sherlock, 2007; Llobodanin, Barroso, & Castro, 2014). Both varietal typicality and regional typicality (vine provenance or terroir) have been investigated. A prototypical or ideal wine varietal from a specific location has been shown as perceived to exhibit certain characteristics (e.g., a combination of fruity and green characters in Sauvignon blanc wines from New Zealand), only some of which are exhibited by Sauvignon wines from other locations. The work has also demonstrated the importance of top-down cognitive input (i.e., knowledge and experience), with less-experienced tasters exhibiting increased variability regarding the characteristics essential to high typicality (Urdapilleta, Parr, Dacremont, & Green, 2011).

### *3.3. Olfaction, cognition and emotion*

Cognition and emotion have a long history within Western philosophy and science as comprising separate systems that seldom interact. Research over recent decades has shifted this perspective, and it is now accepted by the scientific community that cognitive processes are modified by emotion and mood (Ochsner & Phelps, 2007; Prescott, 2017). Much of the fundamental work concerning interactions between cognition and emotion focused on olfaction (e.g., Herz & Engen, 1996), showing the ways in which odours influence our behaviours, moods, and emotions. It is a straightforward extension of such empirical work to argue that qualitative and quantitative aspects of smells can affect how we perceive, judge and appreciate foods and beverages including wine. Autobiographical memories appear particularly closely associated with olfaction and emotion. Emotionally-significant events and their associated smells (e.g., the smell of one's childhood home) have been shown to play a major role in how we name and respond both analytically and hedonically to many smells, especially smells that we learned during childhood (Chu & Downes, 2000). Further, work on representation and memory has

shown that distinctive olfactory experiences, typically highly emotional, are not only remembered well but are remembered so well that they are relatively impervious to forgetting or modifying (Ishii, Kemp, Gilbert & O'Mahony, 1997). This effect argues against the validity of attempting to train tasters to consensually name a particular odour; linguistic uniformity may result, but this will not necessarily imply conceptual uniformity.

A particularly interesting area of fundamental research concerning cognition and olfaction that has application to wine appreciation concerns implicit effects of odorants. For example, Koster, Moller, and Mojet (2014) published data showing that olfactory-induced influences (i.e., observed behaviour change associated with an odour) affect us even when we are not consciously aware of either the presence of the odour or its effect on our behaviour. In other words, we may not be able to articulate or even identify the odour-related influences behind the way in which we appreciate or judge a wine.

Following on from the early, fundamental research demonstrating integration of cognition, olfaction and emotion in human functioning, the last decade has seen an increase in published studies investigating emotion in relation to both intrinsic and extrinsic aspects of beverages including wine, beer, non-alcoholic beer, and Kir (e.g., Porcherot, Petit, Giboreau, Gaudreau, & Cayeux, 2015; Silva, Jager, van Bommel, van Zyl, Voss, Hogg, Pintado & de Graaf, 2016; Van Zyl & Meiselman, 2016; Danner, Ristic, Johnson, Meiselman, Hoek, Jeffery & Bastian, 2016; Silva, Jager, van Zyl, Voss, Pintado, Hogg & de Graaf, 2017). Although emotional-response data in these studies are linked frequently to hedonic data (e.g., liking) or marketing data (e.g., self-reported purchase intent), few studies have interpreted their data concerning emotional responses to wine or wine consumption by inferring the specific underlying cognitive processes associated. An exception is an innovative study reported by

Ferrarini, Carbognin, Casarotti, Nicolis, Nencini & Meneghini (2010). This study, aimed at understanding the complex association between emotion, cognition, and wine, focused not on olfaction and memory as the fundamental research had done but on higher-order cognitive processes related to language. The study aimed to elucidate the emotions evoked in Italian wine tasters when they experienced wines. The authors identified 16 emotional adjectives, the majority expressing pleasant rather than unpleasant emotions, that appropriately conveyed the feelings of the consumers toward wines and wine tasting. The 16 emotions were characterised also in terms of low or high arousal, with less-pleasant wine-tasting experiences associated with less physiological arousal. From a theoretical perspective, these data support the notion that our cognitive processes (perception; memory; classification; judgment) are linked intimately with our emotional processes when we taste wine, allowing an individual's sensory-driven experience to take on a global dimension or totality.

To summarise this section, recent studies employing various sensory and self-report methodologies, contexts, and participant cultures have increased both breadth and depth of our understanding of emotional response to wine and wine consumption. In terms of the integrative relation between emotional and cognitive responses involved in wine appreciation, less progress has been made and may well come in future from outside sensory science, namely from neuroscience. Not only does neuroscience research suggest that the observed behavioural effects involving cognition, emotion and olfaction depend on overlapping neural systems (Shepherd, 2017), but technological developments in the neurosciences such as human functional imaging offer opportunity to map cognitive and emotional responses of tasters to observed cerebral activity.

#### *3.4. Inter-individual differences and wine expertise*

Although a consensus model remains dominant in much wine sensory analysis, recent research suggests that differences amongst tasters, reflecting each individual's physiology, experience and knowledge, may not only be inherent to the situation but can be interesting data in their own right (Parr, 2008). Recent research in neurosciences supports this (Royet, Plailly, Saive, Veyrac, & Delon-Martin, 2013). An area of research making explicit the differences amongst tasters is that concerning wine expertise. Innovative scientists have over recent decades drawn on methods and theories from experimental psychology (e.g., from studies of chess expertise) to investigate both perceptual phenomena (e.g., Parr, Heatherbell, & White, 2002; Ballester, Patris, Symoneaux, & Valentin, 2008) and higher-order cognitive processes such as classification, semantic memory, and language (e.g., Solomon, 1990; Morrot et al., 2001; Hughson & Boakes, 2002; Urdapilleta et al., 2011; Tempere, Hamtat, de Revel & Sicard, 2015). These studies are providing data that not only implicate cognitive processes in what is typically considered sensory assessment, but are as well increasing our understanding of the ways in which our processes of perception, classification, memory, imagery, judgment and language change as we learn more about wine and wine tasting. Just as occurred within clinical psychology a hundred years' ago, by providing data from both those who can and those who cannot undertake a particular task we can begin to elucidate the important phenomena implicated in wine tasting.

#### **4. Summary and future directions**

A cognitive approach to understanding wine tasting, with the differences amongst tasters as data of interest, is advancing food sensory science both theoretically and methodologically. By drawing on an information-processing model of how people interact with their surrounding world, research concerning how we perceive, conceptualise, remember, image, make judgments, and communicate our experiences about wine is beginning to provide an understanding of many

wine-tasting phenomena. Even greater understanding in future is offered by increased interdisciplinary links between sensory science, oenology, cognitive psychology and the neurosciences. As mentioned in 3.3 above, technological advances in neurosciences offer exciting opportunities to map specific cognitive/behavioural phenomena and emotional responses associated with wine tasting to objective data in the form of observed cerebral activity, reducing cognitive psychology's reliance on hypothesised mental constructs when interpreting data (Royet et al., 2013).

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## References

- Abdi, H. (2002). What can cognitive psychology and sensory evaluation learn from each other? *Food Quality and Preference, 13*, 445-451.
- Auvray, M., & Spence, C. (2008). The multisensory perception of flavour. *Consciousness and Cognition, 17*, 1016-1031.
- Ballester, J., Dacremont, C., Le Fur, Y., & Etievant, P. (2005). The role of olfaction in the elaboration and use of the Chardonnay wine concept. *Food Quality and Preference, 16*, 351-359.
- Ballester, J., Patris, B., Symoneaux, R. & Valentin, D. (2008). Conceptual vs perceptual wine spaces: Does expertise matter? *Food Quality and Preference, 19*, 267-276.
- Brochet, F. & Dubourdieu, D. (2001). Wine descriptive language supports cognitive specificity of chemical senses. *Brain and Language, 77*, 187-196.
- Chu, S., & Downes, J. (2000). Odour-evoked autobiographical memories: Psychological investigations of Proustian phenomena. *Chemical Senses, 25*, 111-116.
- Cowan, N. (1989). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information-processing system. *Psychological Bulletin, 104*, 163-191.
- Dalton, P., Doolittle, N., Nagata, & Breslin, P.A.S. (2000). The merging of the senses: integration of subthreshold taste and smell. *Nature Neuroscience, 3*, 431-432.

- Danner, L., Ristic, R., Johnson, T.E., Meiselman, H.L., Hoek, A.C., Jeffery, D.W., & Bastian, S.E.P. (2016). Context and wine quality effects on consumers' mood, emotions, liking and willingness to pay for Australian Shiraz wines. *Food Research International*, 89, 254-265.
- Doty, R. L. (2015) (Ed.). *Handbook of Olfaction and Gustation*, 3<sup>rd</sup> edition. NJ: Wiley Blackwell.
- Eguaras, R.C., Domezain, M.E., & Grjalba, J.M.M. (2012). Consumers' internal categorization structures: an additive tree analysis. *European Journal of Marketing*, 46, 760-789.
- Ferrarini, R., Carbognin, C., Casarotti, E.M., Nicolis, E., Nencini, A., & Meneghini, A.M. (2010). The emotional response to wine consumption. *Food Quality and Preference*, 21, 720-725.
- Gibson, J.J. & Gibson, E.J. (1955). Perceptual learning: Differentiation or enrichment? *Psychological review*, 62, 32-41.
- Herz, R. & Engen, T. (1996). Odor memory: review and analysis. *Psychonomic Bulletin & Review*, 3, 300-313.
- Hughson, A.L. & Boakes, R.A. (2002). The knowing nose: The role of knowledge in wine expertise. *Food Quality and Preference*, 13, 463-472.
- Ishii, R., Kemp, S., Gilbert, A. & O'Mahony, M. (1997). Variation in sensory conceptual structure: An investigation involving the sorting of odour stimuli. *Journal of Sensory Studies*, 12, 195-214.
- Jinks, A. & Laing, D.G. (2001). The analysis of odor mixtures by humans: evidence for a

- configurational process. *Physiology & Behavior*, 72, 51-63.
- Koster, E.P., Moller, P., & Mojet, J. (2014). A « Misfit » theory of spontaneous conscious odor perception (MITSCOP): reflections on the role and function of odor memory in everyday life. *Frontiers in Psychology*, 5, article 64. DOI: 10.3389/fpsyg.2014.00064
- Llobodanin, L.G., Barroso, L.P., & Castro, I.A. (2014). Sensory characterization of young South American red wines classified by varietal origin. *Journal of Sensory Science*, 79, S1595-S1603.
- Marshall, K., Laing, D.G., Jinks, A.L., & Hutchinson, I. (2006). The capacity of humans to identify components in complex odor-taste mixtures. *Chemical Senses*, 31, 539-545.
- Morrot, G., Brochet, F., & Dubourdieu, D. (2001). The color of odors. *Brain & Language*, 79, 309-320.
- Ochsner, K.N. & Phelps, E. (2007). Emerging perspectives on emotion-cognition interactions. *TRENDS in Cognitive Sciences*, 11, 317-318.
- Parr, W.V. (2008). Application of cognitive psychology to advance understanding of wine sensory evaluation and wine expertise. In *Applied Psychology Research Trends*, Karl H. Kiefer (Ed.), Nova Science Publishers, pp. 55-76.
- Parr, W.V., Heatherbell, D., & White, K.G. (2002). Demystifying wine expertise: Olfactory threshold, perceptual skill, and semantic memory in expert and novice wine judges. *Chemical Senses*, 27, 747-755.
- Parr, W.V., White, K.G., & Heatherbell, D. (2003). The nose knows: Influence of colour on perception of wine aroma. *Journal of Wine Research*, 14, 79-101.

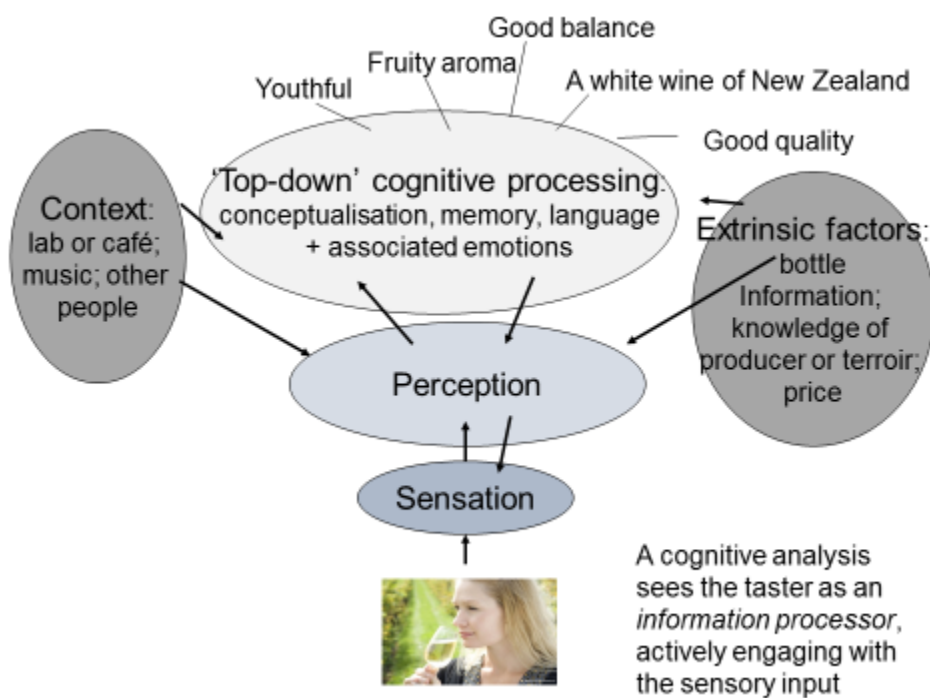


- Parr, W.V., Green, J.A., White, K.G., & Sherlock, R.R. (2007). The distinctive flavour of New Zealand Sauvignon blanc: Sensory characterisation by wine professionals. *Food Quality and Preference*, *18*, 849-861.
- Piqueras-Fiszman, B., & Spence, C. (2012). The weight of the bottle as a possible extrinsic cue with which to estimate the price (and quality) of the wine? Observed correlations. *Food Quality and Preference*, *25*, 41-45.
- Porcherot, C., Petit, E., Giboreau, A., Gaudreau, N., & Cayeux, I. (2015). Measurement of self-reported affective feelings when an aperitif is consumed in an ecological setting. *Food Quality and Preference*, *39*, 277-284.
- Prescott, J. (2017). Some considerations in the measurement of emotion in sensory and consumer research. *Food Quality and Preference*, *62*, 360-368.
- Reinert, M. (1986). Un logiciel d'analyse lexical: [ALCESTE]. *Les cahiers d'analyses des données*, *9*, 471-484.
- Reisberg, D. (1997). *Cognition: Exploring the science of the mind*. New York: W.W. Norton & Co.
- Royet, J.-P., Plailly, J., Saive, A.-L., Veyrac, A., & Delon-Martin, C. (2013). The impact of expertise in olfaction. *Frontiers in Psychology*, *4*, 928.  
<http://doi.org/10.3389/fpsyg.2013.00928>
- Schlich, P., Medel Maraboli, M., Urbano, C., & Parr, W.V. (2015). Perceived complexity in Sauvignon blanc wines: Influence of domain-specific expertise. *Australian Journal of Grape and Wine Research*, *21*, 168-178. DOI: 10.1111/ajgwr.12129

- Shepherd, G.M. (2017). *Neuroenology: How the brain creates the taste of wine*. New York: Columbia University Press.
- Silva, A.P., Jager, G., van Bommel, R., van Zyl, H., Voss, H-P., Hogg, T., Pintado, M., & de Graaf, C. (2016). Functional or emotional? How Dutch and Portuguese conceptualise beer, wine and non-alcoholic beer consumption. *Food Quality and Preference*, *49*, 54-65.
- Silva, A.P., Jager, G., Van Zyl, H., Voss, H-P., Pintado, M., Hogg, T., & De Graaf, C. (2017). Cheers, proost, saude: Cultural, contextual and psychological factors of wine and beer consumption in Portugal and in the Netherlands. *Critical Reviews in Food Science and Nutrition*, *57*, 1340-1349.
- Solomon, G. (1990). The psychology of novice and expert wine talk. *American Journal of Psychology*, *103*, 495-517.
- Stevenson, R.J. (2001). Is sweetness taste enhancement cognitively impenetrable? Effect of exposure, training, and knowledge. *Appetite*, *36*, 241-242.
- Stevenson, R.J., Prescott, J. & Boakes, R.A. (1999). Confusing tastes and smell: How odours can influence the perception of sweet and sour tastes. *Chemical Senses*, *24*, 627-635.
- Tempere, S., Hamtat, M-L., de Revel, G., & Sicard, G. (2015). Comparison of the ability of wine experts and novices to identify odorant signals: a new insight in wine expertise. *Australian Journal of Grape and Wine Research*, *22*, 190-196.
- Urdapilleta, I., Parr, W.V., Dacremont, C., & Green, J.A. (2011). Semantic and perceptive organisation of Sauvignon blanc wine characteristics: Influence of expertise. *Food Quality and Preference*, *22*, 119-128.

van Zyl, H. & Meiselman, H.L. (2016). An update on the roles of culture and language in designing emotion lists: English, Spanish and Portuguese. *Food Quality and Preference*, 51, 72-76.

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Graphical abstract

### Highlights

- Wine tasting is as cerebral as it is sensual.
- Cognitive psychology has contributed substantially to an understanding of wine-tasting phenomena.
- Both theory and methodology from psychology are implicated.
- Links among food sciences, psychology, and neurosciences offer even greater understanding in future.

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