



Wine complexity: An empirical investigation

Qian Janice Wang*, Charles Spence

Crossmodal Research Laboratory, Oxford University, UK



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ABSTRACT

Complexity is a term that is often invoked by people when writing appreciatively about the taste, aroma/bouquet, and/or flavour of wine. However, it is not clear what exactly wine complexity refers to. The present study was designed to uncover which attributes are most strongly linked to the social drinker's perception of complexity in wine. Notably, unlike previous studies of wine complexity, we assessed the temporal component of complexity by acquiring information from participants at the various stages of smelling, tasting, and aftertaste. Furthermore, natural language processing techniques were used to analyse participants' flavour descriptors in order to assess their semantic associations with complexity. Eight wines, chosen for their ability to showcase various aspects of complexity, were tasted in three flights, grouped by dry white, red, and sweet wines. Participants rated the perceived liking, quality, and complexity of each wine, as well as listing flavours of the wines perceived at different stages (aroma, in-mouth, post-swallowing). The results demonstrated that complexity was positively correlated with liking and with quality, but not with the price of the wines or the number of flavours detected. Furthermore, semantic analysis revealed that participants used more consistent vocabulary to describe wines that they perceived to be more complex. We also observed similar consistency trends for wines that were liked more, as well as wines rated to be lower quality. In general, secondary and tertiary flavours (derived from fermentation or from ageing) were more often used to describe more complex wines. These results reveal intriguing patterns in how social drinkers assess perceive/infer wine complexity, as well as elucidating the relationship between complexity, quality, and liking.

1. Introduction

The term complexity is often used to describe some desirable attribute of a wine. For instance, just take the following quote from long-time wine critic Matt Kramer:

“The single greatest standard used in assessing the quality of a wine is complexity. The more times you can return to a glass of wine and find something different in it—in the bouquet, in the taste—the more complex the wine. The very greatest wines are not so much overpowering as they are seemingly limitless.”

(Kramer, 2012)

The belief that complexity is a positive quality has driven some wine producers to explicitly try to develop a more complex product offering so as to appeal more to consumers. For instance, Parr (2015) describes one such commercial winemaking project that deliberately aimed at increasing complexity in New Zealand Sauvignon Blanc wines via innovative grape-growing and winemaking practices. However, what exactly does ‘complexity’ mean when it comes to wine (or, for that

matter, any other drink)?

Intuitively, complexity in perception must come from multiple elements. However, we could be talking about physical/chemical complexity, where complexity arises from the structural arrangement of the individual molecules (in other words, the nature, connectivity, and orientation of its component elements¹) or from the number of different molecules. Complexity could also refer to perceived/inferred complexity, where the focus lies in what the taster takes away from the wine based on sensory elements that are perceived within it.

In terms of physical complexity, there is some evidence at least that perceived complexity seems to correlate weakly with the physical complexity of monomolecular odorants (Kermen et al., 2011). However, given that wine is made up of many hundreds of different volatile compounds, this certainly is not the appropriate level at which to address wine complexity. Alternatively, one can consider the number of different volatile aromatic compounds to be found in wine – intuitively, the greater number of aromatic compounds, the greater the perceived complexity. However, there is evidence to suggest that we can only

* Corresponding author at: Department of Experimental Psychology, New Radcliffe House, University of Oxford, Oxford OX2 6BW, UK.

E-mail address: qian.wang@psy.ox.ac.uk (Q.J. Wang).

¹ In fact, chemists have developed a molecular complexity index taking into account both the elements that make up the molecule, and structural features of the molecule such as its symmetry and the number and types of bonds of its component elements (Hendrickson, Huang, & Toczko, 1987).

detect a limited number of aromas (around three) in mixtures (Jinks & Laing, 1999; Laing, Link, Jinks, & Hutchinson, 2002; Marshall, Laing, Jinks, & Hutchinson, 2006). In addition, there is no simple linear mapping from physical/chemical complexity to perceived complexity, since what smells “like a rose” consists of a complex array of compounds, and what smells complex may consist of a single molecule (Sell, 2006; Yeshurun & Sobel, 2010). Therefore, in practical terms and according to the literature, what people are concerned with when speaking of complexity in the world of wine (or other flavour experiences) would seem instead to be a notion that is *inferred*, by the taster, from elements that are perceived in the wine.

That said, inferred complexity can be thought of in multiple ways – for instance, in terms of the number of components perceived, in terms of the temporal evolution of flavours in the mouth (or in the bottle), or in terms of a holistic integrated percept whose elements may not be indivisible. For instance, a heady Gewürztraminer or Viognier gives rise to many flavours that are perceivable at once, whereas a Chablis might give rise to a sensation of seamless minerality rather than any specific range of flavours (Robinson & Harding, 2015). Different still, an aged claret might unveil its flavours slowly in the mouth, with bright acidity and blackcurrants slowly giving way to leather and cigar box flavours later on. And, over a longer timescale, the same claret, if left in the cellar, will likely develop and take on different characteristics as it ages in the bottle. Might all of these different ways of perceiving a wine give the same resulting inference concerning complexity in the mind of the taster?

It remains unclear in exactly which way wine writers refer to complexity when talking about wine, although from Matt Kramer's quote (see above), he at least would seem to be referring to a combination of complexity in terms of temporal evolution in addition to having many different flavours. Or take Master of Wine Alex Hunt, who defines complexity as having multiple flavours as well as flavour diversity, but also refers to a kind of “intricate subtlety, requiring sustained mental effort to grasp, as with a complex puzzle²” (Oxford Companion to Wine). Adopting a more scientific (rather than anecdotal) approach, Parr, Mouret, Blackmore, Pelquest-Hunt, and Urdapilleta (2011) developed a model for how people with different levels of expertise think about complexity in wine (see Fig. 1). Compiling interviews with both wine consumers and professionals from New Zealand and Australia, these researchers concluded that, in general, the casual consumer is driven more by the image/brand (D'Alessandro & Pecotish, 2013; see also Plassmann, O'Doherty, Shiv, and Rangel (2008), for evidence of perceptual influences of marketing actions) and hedonic qualities of the wine, whereas the wine professional tends to give more weight to inferred methods of viticulture and wine production.

So what, exactly, are wine professionals taught about complexity? For a professional trade perspective, one need look only at the Wine and Spirits Education Trust, a globally accredited provider of education and qualifications in both wine and spirits. According to the WSET, complexity can either result from fruit character alone – when the flavours span multiple categories such as floral, herbaceous, citrus fruit, stone fruit, etc. – or from a combination of primary (fruit-based), secondary (from wine-making), or tertiary (from bottle ageing) aromas (WSET Level 4 Diploma candidate assessment guide). This follows Parr et al.'s (2011) model of complexity (see Fig. 1), where the wine professional is trained to think about how the flavours are linked to wine production (i.e., yeast, lees, MLF, barrel, volatile acidity) as well as intrinsic qualities in the wine.

In terms of the actual tasting experience, Schlich, Maraboli, Urbano,

and Parr (2015) addressed the role of domain-specific expertise in ratings of the perceived complexity of Sauvignon Blanc wines. 13 New Zealand Sauvignon Blancs (including 10 from the aforementioned complexity innovation winemaking program) were evaluated by experts (oenologists in this case), connoisseurs (non-professionals with a great deal of experience in wine tasting), and consumers via a free sorting task and a complexity questionnaire. The authors found that, while experts associated complexity with the number of flavours, with harmony, with balance, with the length of finish (duration of aftertaste remaining in the mouth), and with familiarity; connoisseurs and consumers correlated complexity with intensity. Additionally, there was evidence that experts had closer agreement amongst themselves in terms of their evaluation of complexity as compared to either connoisseurs or consumers. Interestingly, there was no evidence that the ease of identifying individual flavours in a wine enhanced the perceived complexity, seemingly adding support to the holistic notion of complexity, one that goes beyond the perception of multiple individual elements. One drawback of this study, however, is that the wines were not perceived as particularly complex to begin with by the French participants who took part.

In the present study, we set out to assess how complexity in wine is perceived by social drinkers, especially which attributes are most linked to their assessment of complexity in wine. We used three flights of wines with white wines, red wines, and dessert wines, at various ages and prices, to showcase the spectrum of wine complexity. By means of this selection, we also hoped to ensure that, unlike with the Schlich et al.'s (2015) study, the participants would find at least some of the wines reasonably complex. Notably, different from previous studies on wine complexity, we aimed to get a sense of the temporal component of complexity by acquiring information at the various stages of smelling, tasting, and aftertaste. Furthermore, natural language processing techniques were also used to analyse participants' flavour descriptors, in order to provide a preliminary assessment of any semantic associations they had with complexity.

2. Methods and materials

2.1. Participants

18 participants (7 female, 11 male) of age 28–62 years ($M = 46.2$, $SD = 11.3$) took part at the Complexity and Wine tasting event as part of the Leverhulme International Network 'Evaluating Methods of Aesthetic Enquiry across Disciplines' workshop held at Somerville College, Oxford, UK. The participants were researchers in art history, music, psychology, philosophy, and neuroscience. All of the participants gave their informed consent to take part in the study.

2.2. Wines

A flight of 8 different wines, grouped into 3 flights, were selected to showcase different aspects of wine complexity (see Table 1, see Table 5 for price information). The first flight consisted of three white wines designed to showcase different interpretations of complexity, from many aromas present at once, to the idea of complexity as a single percept (Parr, 2015), to the disjoint nose and palate. The second flight of three red wines demonstrate a single variety, the same variety in a blend, and the same blend with ageing (see Singleton & Ough, 1962). The final flight (pair) of sweet wines were chosen to showcase the effect of modern versus traditional winemaking on the same type of grapes (from the same winery, in fact). All wines, as 30 mL samples, were served in standard 270 mL wine glasses, at room temperature (20 °C).

2.3. Procedure

Each participant was presented with the wines, one flight at a time. All of the wines from each flight were served at once, although

² Along the lines of mental difficulty, Snitz et al. (2016) have proposed a novel, robust, and quantitative method for measuring intricacy (a related but not exchangeable term with complexity) that depends on more intricate stimuli evoking a larger variance in the response of observers.

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