- Peer Reviewed Paper –

The Impact of Glass Shape on the Perception of Wine

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Abstract

The belief that the shape of the glass can have an impact on perception of wine is so strong that for objective assessment of wines, the use of a standard glass such as the French INAO (Institut National des Appellation d'Origine) or the German DLG (Deutsche Landwirtschafts-Gesellschaft) is recommended. Currently, entire lines of specialty wine glasses have been developed which consist of different glass shapes, each meant to enhance a particular wine type. However, only a few scientific studies have directly investigated the influence of glass shape on the perception of wine (e.g., Delwiche and Pelchat, 2002; Fischer and Loewe-Stanienda, 1999; Hummel *et al., in press;* Hüttenbrink *et al.*, 2001).

The results of these studies differed dramatically, making it difficult to conclude what impact glass shape actually has on the perception of wines. However, a systematic comparison of the ways in which the research methods and designs differed, as well as the types of judges used and the amount of information with which the judges were supplied, will lend additional insights into the role glass shape has on the perception of wines.

Introduction

Wine lore dictates that to fully appreciate a wine, it must be drunk from the appropriate glass. There are a plethora of wine glass shapes from which to choose, and some shapes are considered more ideal for the consumption of particular wines than are others. The possibility that the glass shape has an impact on wine assessments resulted in the use of standard glasses including the French INAO (Institut National des Appellation d'Origine) and the German DLG (Deutsche

Landwirtschafts-Gesellschaft). In fact, lines of specialty wine glasses of different shapes have been designed, and each shape is purported to enhance a particular wine type. However, very limited research has directly investigated the influence of glass shape on the perception of wine (e.g., Delwiche and Pelchat, 2002; Fischer and Loewe-Stanienda, 1999; Hummel *et al., in press;* Hüttenbrink *et al.,* 2001), and only one removed both visual and tactile cues, keeping subjects naïve to the actual variable being manipulated (Delwiche and Pelchat, 2002). The following is a systematic comparison of the three primary investigations that have been conducted to date.

Delwiche and Pelchat (2002)

Twenty-eight inexpert wine-drinkers (19 females, ages 19-43; 9 males, ages 21-58), naïve to the focus of this study, assessed the aroma of 60 ml portions of Cabernet Sauvignon (1996 Napa Valley, Robert Mondavi Winery) presented in glasses of four different shapes (see Figure 1). Two of the glasses were from the same glass company and made from the same leaded crystal. One of these was marketed as being an appropriate glass for serving Chardonnay, while the other was marketed as an appropriate glass for Bordeaux (and therefore suitable for Cabernet Sauvignon). Both had a tapered bulb shape. A standard, open bulb-shaped wine glass with a rolled rim (of the type typically used in restaurant settings) and a square-shaped, leaded crystal water goblet were the remaining glass shapes used. Subjects assessed the aroma of both wines for liking (on a 20 point scale), as well as total intensity, fruitiness, oakiness/woodiness, vinegariness, and mustiness (on labeled magnitude scales – [Green *et al.,* 1996; Green *et al.*, 1993]).

Subjects wore a blindfold and were positioned in a headrest. Each glass was positioned a set distance from the nose despite differences in glass height via an

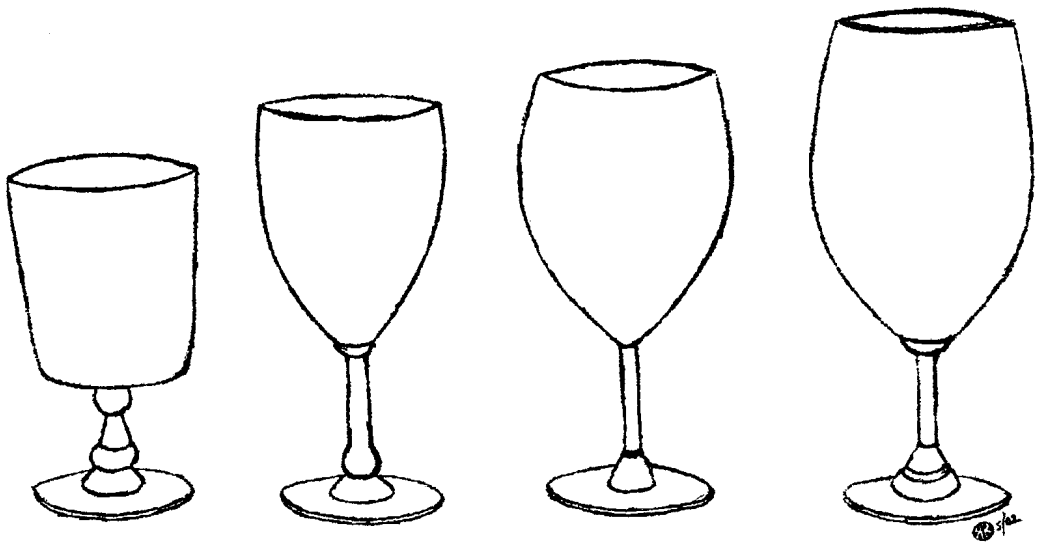

Figure *1: Glass shapes used in Delwiche and Pelchat (2002): Blindfolded subjects assessed the aroma of wine presented in the above glass shapes. Left to right, these shapes were referred to as square, open bulb, tapered bulb (Chardonnay), and tapered bulb (Bordeaux). (Illustration by D.R. Ryan).*

adjustable platform. A low setting on a vortex (Fisher Vortex Genie 2) was used to simulate swirling of the wines (the setting level was the lowest setting at which the vortex could move the glass and its contents). This apparatus allowed the subjects to experience the aroma without receiving information through tactile feedback, visual cues, or even awareness of the variable being manipulated, i.e., the glass shape.

No significant difference ($p>0.05$) in liking ratings or in intensity ratings was found between the glasses for fruitiness, oakiness/woodiness, vinegariness, and mustiness. However, the total intensity ratings did differ significantly across glasses ($p=0.0008$), with the Bordeaux glass having significantly lower ratings than the square-shaped and open bulb-shaped glasses (Scheffe's, $p<0.01$), and trended towards significantly lower ratings than the Chardonnay glass ($p=0.087$).

Significant correlations were found between several psychophysical ratings and physical parameters. A significant positive correlation ($p<0.05$) was found between fruitiness and the ratio of the diameter of the opening and the maximum diameter, while significant negative correlations ($p<0.05$) were found between total intensity and cuppa height, between vinegariness and both cuppa height and capacity, and between mustiness and maximum diameter. However, if one corrects for the performance of multiple statistical tests (Darlington, 1990), none of the correlations are significant increasing the likelihood that these findings are spurious.

Fischer and Loewe-Stanienda (1999)

A descriptive analysis panel of nine enology experts participating in the development of a new German industry standard glass (DIN) assessed several red and white wines in eleven different glass shapes of varying cuppa diameter, height, and flare/roundness (Fischer and Loewe-Stanienda, 1999). Thus, while a large variety of wines and glasses were assessed, the judges were quite aware of the underlying variable being manipulated. In fact, they were actively working towards selecting the "best" glass shape. For the majority of assessments, the judges both viewed and held the glasses while assessing the wines. Judges evaluated 30 ml of wine at 20°C. Intensity ratings were made on a 10-cm unstructured line scale. For each wine, three particular odors were assessed: grapefruit, green grass and sulfur dioxide in Riesling; rose blossom, honey, and alcohol in Gewurztraminer; berry fruit, butter, and bell pepper in Dornfelder; and sweet cherry, vanilla, and oak in Pinot Noir. Under these circumstances, glass shape was found to have a significant impact on odors ($p<0.05$) except for butter in Dornfelder.

In addition, significant interactions were found between judges and glass shape for all but 2 attributes, implying that judges disagreed on the impact glass shape had on these aromas. This implies that judge expectation and other cognitive factors were influencing attribute ratings. Further evidence for the influence of cognitive factors was found in the blind test. Here, judges assessed three aroma attributes and three off-flavors in six wines presented in five different glass shapes while blindfolded (see Figure 2). Not surprisingly, deviation from the earlier assessments was found. While many of the ratings did show good agreement, the subjects were still handling the glasses and did receive information about the glass shape through tactile sensations.

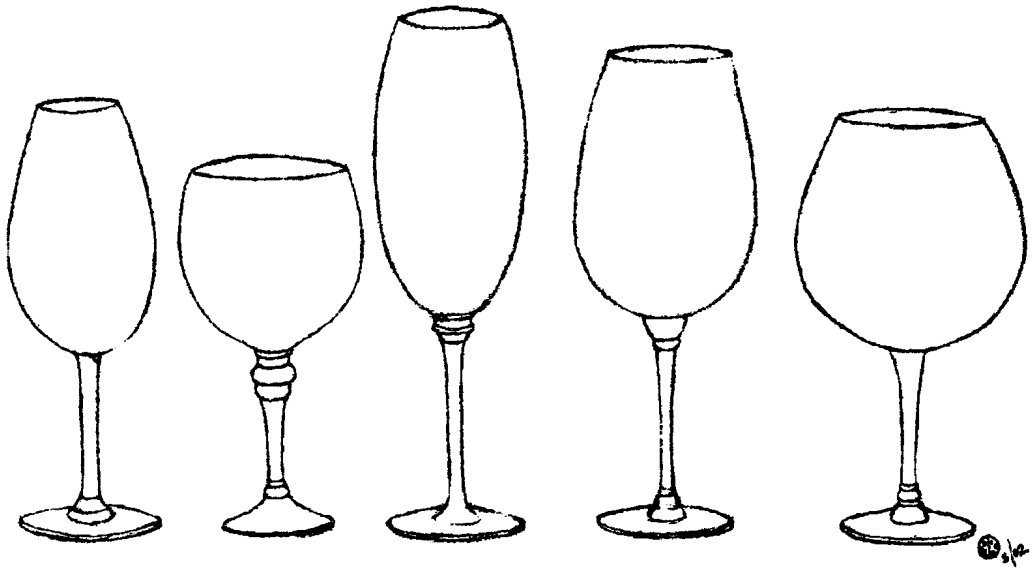

Figure *2: Glass shapes used in Fischer and Loewe-Stanienda (1999): Blindfolded judges assessed wine presented in the above glass shapes. Left to right, these shapes were referred to as standardized ISO and DIN glasses followed by their experimental glasses 3, 6, and 9. (Illustration by D.R. Ryan).*

In direct contradiction of Delwiche and Pelchat (2002), Fischer and Loewe-Stanienda (1999) found odor intensity increased as cuppa height increased. The designs of the two studies differed in several key ways, making it difficult to

pinpoint the cause of this discrepancy. For example, Delwiche and Pelchat (2002) used twenty-eight inexpert subjects naïve to the variable being manipulated, while Fischer and Loewe-Stanienda (1999) used nine trained panelists who were not only aware that they were tasting the same wine in different glasses, but were actively attempting to assess the impact of the different glasses in order to select a new "DIN" glass. Furthermore, since Fischer and Loewe-Stanienda (1999) did not give the measurements of the physical parameters of the glasses, it is not possible to know which glasses are most comparable to those used by Delwiche and Pelchat (2002).

Hummel *et al.* (*in press*)

One hundred eighty-one inexpert wine drinkers (85 males, 96 females; 19 to 73 years old) were asked to assess the intensity of either 100 ml red (Robert Mondavi, Napa Valley, Cabernet Sauvignon, 1995) or white (Robert Mondavi, Carneros, unfiltered Chardonnay, 1996) wine presented in 3 glasses of identical height and similar opening diameter, but of different shapes (see Figure 3). Two glasses were used for both red and white wines: a simple, water-glass shape (beaker), and a "tulip" shape (tulip). The third glass shape used was bulbous, but the exact glass used differed for the red and white wines. For the 92 volunteers assessing white wine, the third glass-shape used was that of a Chardonnay glass (Riedel, Austria), while the third glass shape for the remaining 89 volunteers assessing red wine was a Chianti glass (Riedel, Austria). Red wine was served at 17-22°C; white wine was served at 12-15°C. Subjects were not told the number of wines being tested, and 84 and 24 subjects indicated they thought two and three wines were presented, respectively. They assessed wine intensity on computerized visual analogue scales. While subjects were naïve to the aims of the study, they did both view and handle the glasses.

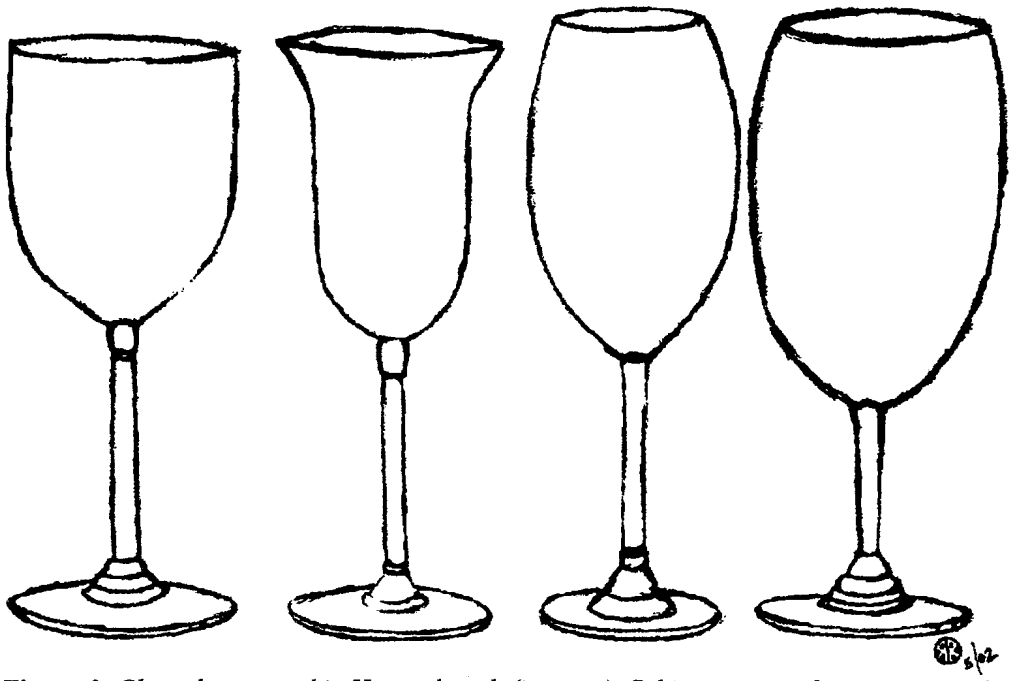

Figure *3: Glass shapes used in Hummel et al. (in press): Subjects assessed wine presented in the above glass shapes. Left to right, these shapes were referred to as small bulbous, large bulbous, beaker, and tulip. (Illustration by D.R. Ryan).*

Somewhat in contradiction to Delwiche and Pelchat (2002) and somewhat in agreement with Fischer and Loewe-Stanienda (1999), odor intensities were found to be significantly stronger for the bulbous glass shapes than the tulip and beaker shapes ($p<0.001$). No significant difference was found between glasses for sweet, salty, and bitter ratings ($p>0.05$), although the beaker glass was rated as being significantly higher in sourness than the other glass shapes ($p<0.05$).

In Delwiche and Pelchat (2002), subjects only smelled the wines while the subjects in both Fischer and Loewe-Stanienda (1999) and Hummel *et al.* (*in press*) both smelled and tasted the wines. It is possible that differences between glass shapes is more pronounced when drinking the wine rather than just smelling it. Another possible explanation is that in Delwiche and Pelchat (2002) the subjects were completely unaware that the shape of the wine glass was being

varied, receiving neither visual nor tactile cues. In the Hummel *et al.* (*in press*) study, subjects not only saw the different glasses, they also handled the glasses. As mentioned above in connection to the Fischer and Loewe-Stanienda (1999) study, the cognitive influence of this additional information could explain the discrepancy in findings across studies.

Conclusion

Taken as a whole, the findings of the previous studies seem to suggest that the glass shape does have a limited impact upon the perception of wines, but that these effects are subtle and may be due largely to cognitive effects. In fact, it appears that the more knowledgeable an individual is and the more information a person is given about glass shape, the stronger the impact of the shape seems to be on the perception of the wine. This calls into question the mechanism underlying the impact of glass shape on the perception of wine, but further investigation is necessary before this question can be answered.

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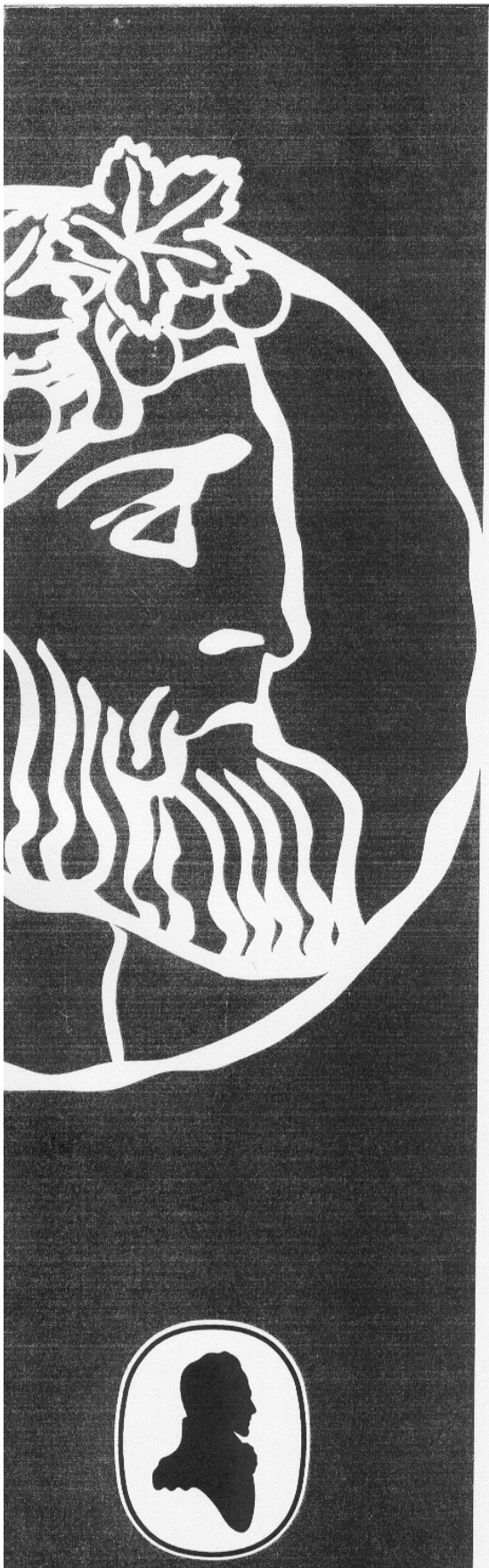

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