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## **CROSSMODAL INTERACTIONS ON FLAVOR PERCEPTION OF BEVERAGES: IMPACT OF COLORS, MATERIALS AND MUSIC**

### **Abstract**

As shown by many studies the perception of flavor is the result of a multi-sensory combination. This paper, through a series of empirical studies, has the aim to verify how different stimuli impact food flavor. To this end, three experiments have been conducted. In the first one, the study (15 participants) focused on the influence of material in the case of a beverage container. In the second experiment, involving 31 participants, it was analyzed how the congruence or the incongruity between color and aroma might influence the identification of a particular drink. Finally, the third experiment focused on the influence of music on taste of red and white wine (two kind of music were tested, namely Mozart to represent classical music and Justin Timberlake to represent pop music). Participants were asked to mark a value on a scale: data was analyzed through the ANOVA model. Findings and marketing implications are finally discussed.

**Keywords: Cross-modality; flavor; color; packaging; music; food marketing**

### LITERATURE REVIEW

Our beverage purchasing choices and the perceptions we have of them are the result of a multi-sensory experience that we partly consciously and partly unconsciously live. The terms Sensploration or Sensory Marketing indicate that branch of Neuromarketing which analyses and studies the variation of perceptions through the five senses and the consequent purchasing behaviour of consumers. Human perception itself is essentially multisensory (Krishna, 2012), indeed humans live and experience the world through their senses (Krishna and Schwarz, 2014; Spence et al., 2014). Within this experience, packaging is often the discriminating and decisive variable in the choice of purchasing a beverage, just as the container is an influencing factor in the perception of the drinking experience. Shape, colors, materials and graphics, in their broadest sense, influence the idea that the consumer creates with respect to the content. Since packaging is a fundamental strategic lever in marketing as it is capable of driving sales, numerous studies have focused their attention on understanding the interconnections between the five senses, elicited by the packaging (or container), and the resulting subjective and

personal evaluation of a given beverage. Born with the merely essential primary functions of protecting and safeguarding the product, over time packaging has developed itself in a logic of persuasion, which contributes nowadays to determinate the outcomes of competition in the market.

In general, haptic dimensions are capable of arousing positive or negative emotions in individuals (Hertenstein & Keltner, 2006; Knapp & Hall, 1997) as confirmed by many studies from a psychological and physiological perspective analysing the blood flow of brain activity associated to the touch of different materials (Koga & Iwasaki, 2013). The tangibility of a product, manifested in its weight, surface and texture, contributes to the consumer designation of the product value itself (Ortony, Clore and Collins, 1988). In light of the increasing development of online shopping that does not provide tangibility, it would be a subject to be explored how crucial is the latter in making an online purchase.

Products extrinsic characteristics generate sensations capable of influencing the individual perception of the ones intrinsic characteristics (Piqueras-Fiszman and Spence, 2012; Tu et al., 2015; Biggs et al., 2016; van Rompay et al., 2017; Slocombe et al., 2016). This has been referred to as “sensation transference” (e.g. Cheskin, 1972) and “affective ventriloquism” (Spence & Gallace, 2011) to indicate this phenomenon.

It is known that the material and shape of beverage packaging can influence consumers taste and hedonic evaluations (e.g. Piqueras-Fiszman & Spence, 2012; Tu et al., 2015). Thus, for example, the different shape of the container from which one drinks changes the taste experience and, in particular, the more the surface is angular the more the beverage contained is perceived as bitter/intense, the more the surface is rounded the more the beverage contained is perceived as sweet (e.g. Becker et al. 2011). Or again, the perceived taste of wine varies with the shape of the glass in which it is served (Spence & Wan, 2015). The container, its size, its materials and its weight are able to alter the taste sensations experienced by the consumer.

But, can touch specifically play a leading role in altering the perceived taste and in increasing the desirability of a given beverage? A clear correspondence between container materials and the perception of the taste of the beverage within it, has been demonstrated in various studies. For example, if subjects are asked to touch a velvet cloth when tasting a wine, they perceive the wine as sweeter and more pleasant than the same wine tasted at the same time as touching sandpaper (Wang & Spence, 2018). Tactile perceptions therefore influence the sensations experienced in terms of the taste of what you drink. Furthermore, at the same temperature of the liquid contained, glass

tends to convey feelings of coldness and ice compared to plastic and it leads to the perception of a sweeter taste of iced tea (Tu, Yang & Ma, 2015).

The different texture, however, also leads to affirmative results. A rough to the touch container surface makes the wine contained inside perceive as more bitter, on the other hand, a soft to the touch one makes it perceive as sweeter (Van Rompey et al. 2017). Furthermore, coffee was perceived as more bitter if the glass lining was made of cardboard sleeves, as sweeter and creamier in the presence of a glass lined with the fabric of towel sleeves, as sour in case of silicone and stainless steel sleeves, as salty at the touch of linen sleeves (Pramudya et al., 2020). Further researches have shown that the perceived taste of green tea is influenced by specific haptic qualities of the glass used, in particular by the thickness of the rim and the weight of the glass with the same vitreous material. Thus, a thicker rim of a heavy glass led to green tea being perceived as sweeter, compared to green tea tasted in a lighter thinner-rimmed glass, perceived as more bitter (Ichimura et al. 2023).

It is, however, the interactions of the five senses that are decisive in understanding consumer perceptions and not the individual senses atomistically considered and, therefore, the individual sensory activations. This is why researchers are studying sensory combinations in various fields of interest, believing that these improve the understanding of consumer judgements (e.g. sight and touch: Krishna, 2006; taste and touch: Krishna and Morrin, 2008; smell and touch: Krishna et al., 2010).

In particular, as regards taste-sight (taste-colour) association in the food sector, it has been noticed that consumers expectations of beer taste varied significantly depending on the type of the glass chosen and the colour of the beer contained (Casales-Garcia et al., 2023). Sight is indeed the sense that consumers mainly rely on in making personal evaluations about food products and their characteristics (Cardello, 1994; Hutchings, 2003; Spence, 2015; Spence & Velasco, 2018). As far as colour is concerned, the attenders in the above-mentioned research expected, for example, black and brown beers to be the most bitter ever and blue beers to be the least bitter ever. It is concluded that colour has the power to modulate the influence on consumers taste and, more specifically, that, being an intrinsic quality (unlike the shape of the glass which is an extrinsic quality of the product), it acts as a boundary in determining the value assigned to the beverage: when the colour of the beer is common, the shape of the glass less influences the expectation about the intrinsic quality of the beverage. Conversely, unusual colours for a beer, such as blue, green or orange, lead to a greater influence of the shape on final expectations. These results represent evolution and confirmation of previous studies which have demonstrated how, for example, in the presence of

congruence between colour and taste, fruity drinks are perceived as more refreshing and natural than in the opposite case (Garber, Hyatt & Starr, 2000).

What happens, instead, when there is no simultaneity between receiving information on colour and taste? In other words, what do consumers perceive when they first see the beverage and, therefore, observe its colour and only then taste it? A case of cross-modal congruency or incongruency between the two aspects would arise and consumers would process this conflict with their initial expectations in mind. The electroencephalogram (EEG) technique allowed researchers to confirm that an evaluation of the drink would be more positive in case of taste-colour congruency, if these signals are presented simultaneously. The temporal synchronisation in the stimulation of the various senses is, therefore, crucial for better analysing consumers behaviour (Peng, Sun & Wan, 2022).

Some studies, moreover, deals with the relationship between flavor and hearing (defined by Spence, 2015, the “forgotten flavor sense”). In particular, North (2012) carried on an experiment with students, who had to taste red or white wines while listening to background music and then had to evaluate some attributes (powerful, heavy, sharp and refined, exciting and refreshing, soft): he found that these attributes are perceived if music is consistent with those attributes (De Luca et al., 2019). Further research has highlighted how music can contribute to consume longer meals and higher food intake (Stroebele and De Castro, 2006) and that fast-tempo music can fasten the act of drinking (McElrea and Standing, 1992). Research has also underlined the role of music to affect alcohol perception (Gueguen et al., 2008) and sweetness (Guedes et al., 2023a).

Recently Guedes et al. (2023b) have gathered literature on audition and taste through a systematic review.

In the modern social context, it becomes important to understand the impact of packaging and sustainable containers on the mind of the consumer who is increasingly attentive to wellness issues, just as it is essential to analyse the impact of digital and technology on such a profoundly human subject as that of sensations and emotions by expanding research in the food and beverage sector (see for example Racat et al., 2021; Jeganathan & Szymkowiak, 2023; Baptista & Schifferstein, 2023). It would be appropriate to conduct studies, using the latest technologies, to investigate touch-taste correlations in the consumption and purchase of beverages in order to encourage the consumption of eco-friendly drinks both as content and container. Studies would also be appropriate to analyse how for instance colours, as well as shapes, can play a key role in the online purchasing of beverages, probably remotely influencing the perceived

taste expectations and being sight the only sense to be used in such transactions, at least at an early stage of the process.

## AIMS AND METHODOLOGY

This paper, through a series of empirical studies, has the aim to verify how different stimuli impact food flavor. To this end, two experiments have been conducted. In the first one, the study (15 participants) focused on the influence of material in the case of a beverage container. In the second experiment, involving 31 participants, it was analyzed how the congruence or the incongruity between color and aroma might influence the identification of a particular drink.

## THE INFLUENCE OF MATERIAL

The research question to explore was: does material influence the perception of a beverage's taste? Our hypothesis is:

### **H1: Container material influences the perceived attributes of a drink.**

Fifteen participants (five females and ten males) took part to the experiment. They are aged between 14 and 65 years, for an average of 29.53 years, extraneous to the world of marketing, and ignorant of the purpose of the experiment.

With regards to the product, researchers chose a neutral-colored drink so that the participants were not influenced by its color. The main ingredients of the drink were: water, sugar, carbon dioxide, natural flavors; acidifying: citric acid, ortho-phosphoric acid; preservatives: sodium benzoate. Researchers decided to use a product composed of disposable bottles, so that all participants were served a beverage with consistent physical quality, thus avoiding the natural loss of carbonation that might occur when the bottle is open for a prolonged time. As in the experiment conducted by Tu, Yang and Ma (2014), two cups of different materials have been used, respectively glass and plastic. The weight of the cups was not the same, with the glass beaker be in heavier than the plastic one. Moreover, in order to avoid the color variable to influence the participants, the plastic cup has been chosen of a neutral color (white) insomuch that only the tactile function and the reaction to its material consistency could affect the participants' evaluations.

*Fig.1: The drink we used for the experiment*



The procedure of selection was similar but not identical to what was used in the experiment conducted by Tu, Yang, and Ma (2015).

Each participant was served the drink in the glass beaker and subsequently in the plastic cup.

Fig.2: The glass beaker and the plastic one



The drink was served at a constant temperature (the drink was stored in a refrigerator set at 5 ° C, and all the packs were in the same shelf).

The amount of bitter served was 100 ml (the total content of the disposable bottle, divided equally in two cups): unlike the experiment of Tu, Yang and Ma (2014), the participants had to drink the drink, in order to make them better evaluate the satisfaction of tasting.

Immediately after drinking the beverage from the glass beaker, the participants were given a form to fill, in which it was required (in addition to their age and sex) to give a score on a scale from one to nine to certain characteristics of the product, chosen on the basis of the literature review. Adjectives to be evaluated for the bitter drink were: sweet, bitter, sour, sparkling, "lemon-flavored" (the term has the aim to evoke a lemon aftertaste), cold, pleasant and finally its quality. Subsequently, the same procedure was repeated serving the beverage in a plastic cup. After compiling the form, the participants were thanked and dismissed.

For each feature, it was calculated the average score, both in the case of glass cup and in the plastic one: therefore, the comparison between the two samples was done calculating the difference between the means of the scores. Given the limited number of participants those characteristics which did not exceed at least a 5% of difference between the score relative to glass and that relative to plastic, were not considered significant for the purposes of this experiment. Since the researchers used a nine-point scale, the differences smaller than 5% of nine were deemed insignificant, i.e. 0.45 in absolute value.

From now on, the distances are going to be presented in absolute value, with the symbology:  $d [v-p] = |X|$ , and which of the two degustation has had the highest score is going to be shown from time to time.

The non-significant attributes resulted:

- harsh:  $d [v-p] = 0.40$
- lemon-flavored:  $d[v-p] = 0.27$
- cold:  $d [v-p] = 0.38$
- quality:  $d [v-p] = 0.07$

It is very interesting what happened with this last attribute; unlike what the researchers expected to be (a higher perception of quality in a glass container), according to the selected sample, there is substantially no difference in quality perception between glass and plastic.

However, significant differences were revealed in the remaining characteristics.

With regards to the sweetness, it can be noted that the beverage is perceived sweeter if served in plastic cup ( $d [vp] = 1.20$ ), as it was expected to be, while an opposite result was obtained with the bitterness ( $d [vp] = 1.27$ ). Since they are two opposite sensations,

the result obtained with the second sense, goes to broadly confirm the result of the first: as a matter of fact if the first taste is less sweet, it is predictable that it should be even more bitter.

As regards to carbonation, the beverage was perceived much more sparkling in the plastic container compared to the glass one ( $d [v-p] = 1$ ).

Finally, one of the most important features to analyze in terms of potential applications in marketing is pleasantness. It is surprisingly superior in the plastic cup ( $d [v-p] = 0.47$ ) although not excessively. Also in this case, the researchers expected a result in favor of glass, traditionally considered better for its preservation properties. However, this can be explained by considering the fact that it may derive from the lighter weight of the plastic container, as it has been demonstrated by Maggioni et al. (2015).

#### I EXPERIMENT: DISCUSSION AND LIMITS

The experiment has given encouraging results. Despite the small sample (the main limit to overcome for future research), it appears to be perfectly in line with the literature and previous experiments.

The starting hypothesis, according to which the container material may have some influence on the perceived attributes of the drink, is confirmed.

Applications on marketing could be almost endless, especially for beverages which can never be served without a container. By analyzing in detail the different characteristics, for example, it seems that serving or selling a beverage in a glass package is not automatically more appreciated than a plastic one because it does not instill a higher quality as suggested by empirical results. This is the case for white bitter the difference of material is not significantly prevalent for this aspect.

As regards the sweetness, results could encourage beverage producers to choose plastic when in order to turn to a consumer more hedonistic and less sophisticated, that definitely like a sweeter drink, while it might select the glass in the case they decide to target a more health-conscious consumer or, in general, who loves less too sweet beverages.

Similarly, the attribute of carbonation is most liked by a hedonistic consumer and far less acceptable to those who consider naturalness and healthiness as part of their own lifestyle.

Finally, as regards the pleasantness, which has been perceived better in plastic cups, it would be important to figure out if this feature can be generalizable from white bitter to other drinks, and, above all, try to comprehend how the weight of the container has affected the results. From this point of view, there is room for further research: exploring the role of weight and expanding the range of beverages to hand out.

In conclusion, these evidences are of great interest, both for manufacturers that need to study the correct packaging for their beverage, but also for those who serve the drink (cafès, a large restaurant chain). Involving a larger number of participants would be useful to confirm what has been inferred from this experiment.

#### THE INFLUENCE OF COLOR

It was assumed that the color of a drink can influence the consumer in terms of aroma identification. This hypothesis may be decomposed into two basic assumptions.

- **H2: A color consistent with the aroma makes the identification easier by the consumer.**
- **H3: A color inconsistent with the aroma should hinder the recognition by the consumer.**

#### METHOD AND RESULTS

In this experiment, inspired by that organized by Zampini and Spence (2005), 31 participants were involved (12 females and 19 males) aged between 15 and 66 years for an average of 29.65 years; they were extraneous to the world of marketing and not aware of the purpose of the experiment. Underage participants had the consent of their parents. The duration of the experiment session was two weeks.

Fundamental piece of this experiment was a beverage created by the researchers, with the following ingredients:

- 500 ml of natural water;
- 4 ml of orange aroma;
- 4 ml of food coloring;
- 30 g of sugar.

Unlike the experiment of Zampini and Spence the drink was smooth and not carbonated.

It was decided to produce two versions of the drink, one orange, consistent with the aroma, and the other one inconsistent, since it was purple, consequently the sample was divided into two groups. The drink was served in a simple glass of colorless plastic: each participant independently from his/her group followed the same procedure. Successively they took a sit and were served a cup of water in order to eliminate any residues of drinks or foods eaten before the experiment. Subsequently, the drink has been presented, in a 40 ml plastic cup, and the participant tasted it. The drink was served at 5 ° C temperature. After the tasting they were given a questionnaire in which they were asked personal details such as gender and age. The key question, however, has been similar to what happened in the experiment of Zampini, "Please indicate which taste this drink tasted of". The question was a closed one and fruit flavors to choose were: lemon, strawberry, cherry, black cherry, grapefruit, mango, peach, orange, lime, apple, pineapple and berries. Specifically the researchers chose colors ranging from yellow-orange to purple passing through red. Once the participants indicated to what the drink tasted like, they were thanked. As for the first group, for which the color of the drink was consistent with its content, there was a very high percentage of respondents who indicated the right taste of the drink (69%), followed by who thought it was grapefruit (19% ), pineapple (6%) and mango (6%). The second position may be explained by the fact that the taste is citrusy, however, and probably the answers "pineapple" and "mango" are justified by the color of the drink. As regards the second group, for which the drink has been presented with an inconsistent color (purple), the number of participants who indicated the right taste of the drink was less marked (47%), followed by those who perceived a grapefruit taste (33%) and a black cherry (13%) or a lemon (7%) one. Although a majority of respondents, as in the first group, perceived the correct taste, it is necessary to emphasize the differential rates between the two groups (consistently - inconsistent = 22%). In this case the response can derive from the idea of pink grapefruit to which it is easier to link purple, and moreover the similar citrus flavor recalled this kind of fruit. The perception of lemon taste can be explained by the citrus flavor of the product, while the black cherry sensation is typically caused by a strong influence of color, very similar to its real tone.

**Fig.3: Color difference between the drinks**



## II EXPERIMENT: DISCUSSION

It can be said that both the hypotheses have been confirmed, as a matter of fact, consistent color facilitates the perception of the right flavor of the drink as opposed to an inconsistent color that hinders it, as also shown in Zampini and Spence (2005), whose study inspired this experiment. It should be emphasized that in both groups the number of people who gave the correct answer is the majority, so there is a good part of the participants that are not influenced by color. Moreover, most of the responses were related to the macro-category of citrus fruits (in the first group as many as 88% gave an answer regarding this kind of fruit similar to the percentage of the second group 87%). So the color definitely influences the perception of the product, but with due limitations. The color cannot completely divert the perceived flavor, but can only partially be confused, at least that is what can be deduced from the results.

### THE INFLUENCE OF MUSIC

This experiment was inspired by North (2012). In order to study the impact of hearing on wine taste, the researchers' hypotheses are:

- H4: The choice of a peppy and lively music increases the perception of the characteristics "sizzling" and "refreshing" in sampling wine than other musical styles or when there is no musical stimulation;

- H5: The choice of a refined music increases the feature of the perception of refinement of a wine than when another typology of music is broadcast or when there is no musical stimulation;
- H6: A background music does not particularly affect the following attributes of wine: "mild", "sweet", "sour", "alcoholic."
- H7: The listening of music, regardless of which type, positively influences the pleasantness of a wine, compared to its absence.

### Method and results

30 participants were involved (11 females and 19 males)- mean age of 29.8 years, they were not aware about the purpose of the experiment, whose session lasted two weeks. The participants were divided into three groups. Every group listened to a different music and tasted a different wine. Two wine were selected: a Salento Chardonnay (white) and a local Merlot (red), while, for music, the researchers selected:

- “Can’t stop the feeling” by Justin Timberlake (peppy and lively music)
- Turkish March” by Wolfgang Amadeus Mozart (polished music)

Each group was assigned a wine and a kind of music, as represented in this table.

Table 1: Wine/music pairing

Wine	Music	Participants
White	Peppy and lively	10
White	Polished	10
White	No music	10
Red	Peppy and lively	10
Red	Polished	10
Red	No music	10

The participants listened to music through headphones, using an app of the computer (speaker volume of the computer = 28). Every participant was provided a cup of water to eliminate residues deriving from the other experiments and then were served 40 ml of wine to the 5 ° C temperature. The background music was heard from some headphones for one minute before tasting, during tasting and also for the next minute. After this experience the participants had to evaluate some attributes of the wine, in particular they had to rate from 1 (not at all) to 10 (very much) these attributes: sparkling, refreshing, delicate, refined, sweet, sour, alcoholic and, finally, pleasant.

Before presenting the result, it is necessary to introduce the legend of the symbols we used:

MBN: average value of a white wine characteristic when served without musical accompaniment;

MBB: average value of a white wine characteristic when served when served with a peppy background music;

MBR: average value of a white wine characteristic when served when served with a refined background music;

MRN: average value of a red wine characteristic when served without musical accompaniment;

MRR: average value of a red wine characteristic when served when served with a peppy background music;

MRR: average value of a red wine characteristic when served when served with a refined background music.

## **Findings**

### ***1) White wine: peppy music versus no music***

*Attributes excluded a priori:* “alcoholic”= excluded because the difference **MBB-MBN= 0**.

*Attributes excluded on the basis of ANOVA:* ( non-significant with an alpha= 0.1): “sparkling” (MBB-MBN= -1,11), “delicate” (MBB-MBN= 1,4), refined (MBB-MBN= -0,7), “sweet” ((MBB-MBN= 0,7), “sour” (MBB-MBN= -0,6), “pleasant” (MBB-MBN= 0,5).

*Attributes which passed the ANOVA test:* the attributes does not seem to be influenced by a peppy music in comparison with the absence of music. Differences in perception within groups are in most cases greater than the difference in perception among groups.

### **2) White wine: refined music versus no music**

*Attributes excluded a priori* were “sparkling” (MBR-MBN= 0) and “pleasant” (MBR-MBN = 0,3).

*Attributes excluded on the basis of ANOVA:* “refreshing” (MBR-MBN= 1,3), “refined” ((MBR-MBN= 1,3), “sour” (MBR-MBN= -1,5), “alcoholic” (MBR-MBN= 0,6) (non-significant with an alpha= 0.1).

*Attributes which passed the ANOVA test:* “delicate” (MBR-MBN= 1,7) (greater than the critical F with alpha= 0.1). Also “sweet” (MBR-MBN= 1,6) was significant, since the F\* was higher than the critical F with alpha= 0.1.

### **3) White wine: refined music versus peppy music**

*Attributes excluded a priori:* “delicate” (MBR-MBB= 0,3) and “pleasant” (MBR-MB= -0,2) (because of the marginal difference between the averages).

*Attributes excluded on the basis of ANOVA:* “sparkling” (MBR-MBB= 1,1), “refreshing” (MBR-MBB= 0,6), “refined” (MBR-MBB= 1,6), “sweet” (MBR-MBB= 0,9), “sour” (MBR-MBB= -0,9) and “alcoholic” (MBR-MBB= 0,6) (they were non-significant with alpha=0.1).

*Attributes which passed the ANOVA test:* the null hypothesis H0 was verified for all the attributes so all groups, are assimilated into a single population.

### **4) Red wine: peppy music versus no music**

*Attributes excluded a priori:* “sparkling” (MRB-MRN= 0,1), “refreshing” (MRB-MRN= -0,1) and “delicate” (MRB-MRN= -0,2), were excluded (because of the difference between averages was lower than 0.5 in absolute value).

*Attributes excluded on the basis of ANOVA.* “refined” (MRB-MRN= 0,8), “sweet” (MRB-MRN= -0,6), “sour” (MRB-MRN= 0,6) , “pleasant” (MRB-MRN= 0,8). They were non-significant on the basis of ANOVA test with alpha=0.1.

*Attributes which passed the ANOVA test:* “alcoholic” (MRB-MRN= -1,7) (significant, with an effective F (F\*) higher than the F-critical value, with an alpha more stringent than 0.05).

### **5) Red wine: refined music versus no music**

*Attributes excluded a priori:* “sour” excluded because **MRR-MRN= -0,2**, (lower than 0.5 in absolute value).

*Attributes excluded on the basis of ANOVA.* “sparkling” (**MRR-MRN= -1,4**), “refreshing” (**MRR-MRN= -0,6**), “delicate” (**MRR-MRN= -1,1**), “refined” (**MRR-MRN= -0,6**), “sweet” (**MRR-MRN= -1,7**), “alcoholic” (**MRR-MRN= -1,1**), “pleasant” (**MRR-MRN= -1,3**) (non-significant with  $\alpha=0.1$ ):

*Attributes which passed the ANOVA test:* the red wine attributes seem not to be affected by refined music compared with a situation of absence of music.

#### **6) Red wine: refined music versus peppy music**

*Attributes excluded a priori:* no attribute excluded a priori, as a matter of fact all the differences of the average values were  $\geq 0.5$ .

*Attributes excluded on the basis of ANOVA:* “sparkling” (**MRR-MRB= -1,5**), “refreshing” (**MRR-MRB= -0,5**), “delicate” (**MRR-MRB= -0,9**), “sweet” (**MRR-MRB= -1,1**), “sour” (**MRR-MRB= -0,8**) and “alcoholic” (**MRR-MRB= 0,6**).

*Attributes which passed the ANOVA test:* “refined” (**MRR-MRB= -1,4**) were significant after ANOVA analysis with  $\alpha=0.1$ . Furthermore, the attribute “pleasant” (**MRR-MRB= -2,1**) resulted significant.

These data show that peppy music affected the participants to perceive red wine as more refined, more if compared to classical music (the opposite of our hypothesis n.2). The pleasantness of red wine is, moreover, deeper when listening to peppy music.

### III EXPERIMENT: DISCUSSION AND LIMITS

The H4 is rejected, because “sparkling” and “refreshing” were not significant (both for white and red wine). Anyway, it is necessary to say that the wines were quite straight. However, peppy music influences the perception of red wine as less alcoholic.

H5 is rejected, as a matter of fact refined music seems not to affect the perception of refinement (pop music, on the contrary, seems to be more incisive from this point of view). Classical music, anyway, affects more the attributes «delicate » and «sweet».

H6 and H7 are also rejected. H6 because sourness is not influenced by background music but, on the other hand, the perception of attributes such as “alcoholic”, “delicate” and “sweet” are influenced by music. H7, moreover, is rejected because music seems not to be incisive in modifying the pleasantness of wine.

Interestingly, our study seems to confirm Stafford et al. (2012), whose study highlighted that high-volume music reduce the perception of alcohol.

Limits of this experiment are essentially the differences with North (2012). As a matter of fact:

- our sample was little (North's experiment involved 25 participants per group, ours 10)
- our participants listened to music only when they were involved in the experiment, while in North's study participants listened to music in loop, for the complete session.

#### FINAL REMARKS

Implications for marketers resulting from the experiments can be numerous. With regards to the first experiment, concerning the differences in perception of a white bitter depending on the material of the container, marketing decisions may not only relate to the manufacturer, but also to a cafeteria. The producer could intervene, depending on its contractual strength, suggesting the food chain to use the container of a certain material (e.g. glasses branded with the manufacturer brand). If those who serve the drink want to make consumers perceive it as sweeter, fizzier and more pleasant, they will have to use a plastic container and not a glass one. No significance had instead the attribute "quality" so marketers should not take into account this attribute in the selection of the recipient (although commonly glass is deemed to be more appropriate to communicate quality, it is sufficient to think about tuna in cans and tuna in glass).

In regards to an original choice of color, it has to be taken into account the problems deriving from a possible inconsistency with the main ingredient of the drink. In this case, it would be highly advisable for a company to use a formulation of ingredients that makes the flavor of the drink really unmistakable, so that a non-coherent color could give originality without creating doubts in the mind of the consumer.

The wine experiment, finally, recommends to pay attention to background music in a local, especially by considering the inner atmosphere. Classical music seems to give Chardonnay a note of more sweetness and delicateness, while high-volume pop music seems to influence the perception of alcoholicity in the case of Merlot (it could be relevant for American bars, for example).

We recognize the limits of this study in terms of samples. These results will be the basis for further studies, with more music genres and food/beverages.

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