The role of aromatic similarity in food and beverage pairing

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ABSTRACT

Aromatic similarity is often mentioned by culinary experts and Sommeliers as a basic principle for matching food and beverages. The aim of this study was to investigate how this pairing principle modulates consumers' judgment of pairings.

Two kinds of beverage-food pairing were considered: syrup based lemon soft drink paired with aromatized dairy product (experiment 1) and beer flavoured with either lemon or smoky aroma paired with savoury verrines (experiment 2). In each experiment the flavoured drinks were associated with food flavoured with either the same aroma or another one, leading to two contrasting levels of aromatic similarity. We hypothesized that aromatic similarity would increase the liking of the pairing by increasing perceived harmony and homogeneity and decreasing complexity. Pairings were assessed by a group of about 50 participants in a within experimental design.

Experiment 1 confirmed our hypotheses. The pair that shared an aroma was preferred over the pair with different aromas. Aromatic similarity also increased the pairing's perceived harmony and homogeneity and decreased the pairing's complexity. Experiment 2 also supported our hypothesis but to a lesser extent. For lemon beer pairings, aromatic similarity induced an increase in harmony and homogeneity but did not affect complexity. In contrast, for smoky beer pairings, aromatic similarity did not affect harmony or homogeneity but induced a decrease in complexity. Moreover no effect or only a marginal effect was observed on liking. We suggest a model that could account for these results in which aromatic similarity would impact liking of the pair by modulating collative properties, specifically harmony and complexity, of the food-beverage pairing.

1. Introduction

Matching of food and beverages is rooted in cultural practices. All food and beverage pairings are not equivalently appropriate. For instance, Cornwell and McAlister (2013) reported that for US children, soft drinks are more appropriate with French fries than with steamed vegetables whereas the reverse is observed for water. Food and drinks are linked in consumers' representations (Cardello et al. 2016; Martinez, Hammond, Harrington, & Wiersma-Mosley, 2016; Pettigrew & Charters, 2006; Sester, Dacremont, Deroy, & Valentin, 2013). For instance, French people state that wine is key for a nice meal shared with friends and family (Ifop. 2014) and food and wine pairing is an integral part of the "Gastronomic meal of the French" inscribed in 2010 on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity. Food and beverage pairing refers to a complex task that is much more than merely associating two liked products. For instance, Donadini and Fumi (2014), Donadini, Fumi, and Lambri (2012, 2013),

Donadini, Fumi, and Newby-Clark (2015) and Harrington and Seo (2015) showed that when several dishes are tested with several drinks, the best match is not systematically the one that associates the preferred dish and the preferred beverage. Actually, food and drink pairing involves many other aspects that require the expertise of culinary professionals or sommeliers, who can suggest excellent associations, even though experts and consumers might not fully agree on match level (Donadini, Spigno, Fumi, & Pastori, 2008). Some recommendations for pairing are provided by experts in specialized books, websites, or magazines. Often they merely suggest some beverages that could be associated with a specific dish. But in some cases, experts also explain the underlying principles that guide pairing. According to Paulsen, Rognså, and Hersleth (2015) and Harrington (2008), the most often cited principles refer to balanced intensities of tastes, body, flavour, and aftertaste; aromatic similarity between products; and contrasts such as association of fatty food with acidic or tannic wine.

In the literature, works dedicated to pairing did explore some of the

above mentioned principles. For instance, Koone, Harrington, Gozzi, and McCarthy (2014), working with wines and several food categories, and Harrington and Hammond (2005), working with wine and cheese pairings, confirmed the importance of sweetness for a good match. In line with experts' views, they showed that wine sweetness level should be equal to or greater than food sweetness level. Flavour balance is another aspect receiving some attention in the literature. Experts recommend balancing the flavour intensity of food and drink such that neither the food nor the beverage dominates. Most reported results are in line with this recommendation (Bastian, Payne, Perrenoud, Joscelyne, & Johnson, 2009; Donadini & Fumi, 2014; Donadini et al., 2008; King & Cliff, 2005; Paulsen et al., 2015). In some cases however, unbalanced intensity can be favoured, depending on the respective valence of the products' dominating property (Donadini et al., 2012; Donadini et al., 2013).

The balance between wine astringency or acidity and animal based food fattiness levels was also confirmed by several authors. For instance, Koone et al. (2014) found a positive correlation between the perceived intensity of wine's tannin and the level of match with a fatty food (spicy Italian salami). Harrington and Hammond (2006) assessed the effect of combined food fattiness and wine tannin intensity on the match perception and found that when the intensity levels of the wine tannin and food fattiness are equivalent, the level of match is higher than when one dominates the pair.

Although often mentioned by experts, aromatic similarity received less attention in the pairing literature. This principle states that food and beverages that share some aromatic notes would match well. For example, a mineral white wine would be a good match with oysters because of the iodized notes of both products; similarly, a red wine expressing animal or leather notes would be a good match for game meat characterized by the same kind of aromas. To the best of our knowledge, no work dealing with the impact of aromatic similarity on pairing judgment was reported in the literature. The present work is aimed at exploring this experts' principle, i.e., testing whether products with some aromatic similarity are a better match than products with no similarity and identifying underlying mechanisms such as modulation of collative properties of the pairing's perceptual experience.

In the pairing literature, studies dedicated to food-drink pairing proceed from two main approaches. The first is based on the idea that two products match whenever one product of the pair preserves, or even enhances, the properties of the other. This is the typical situation for wine and cheese paring. The astringency of the wine "washes out" the fattiness of the cheese and conversely, cheese fat moderates wine astringency. For instance, Galmarini, Loiseau, Visalli, and Schlich (2016) found that the liking of highly astringent red wine increases in consecutive sips while eating bites of cheese in between. In this approach, participants are usually explicitly required to judge one product of the pair while consuming the other one concomitantly. The match is thus explained by some positive carry-over effects (Bastian, Collins, & Johnson, 2010; Donadini & Fumi, 2014; Donadini, Fumi, & Newby-Clark, 2015; Donadini et al. 2013; Galmarini et al., 2016; Madrigal-Galan & Heymann, 2006; Nygren, Gustafsson, Haglund, Johansson, & Noble, 2001; Nygren, Gustafsson, & Johansson, 2002; Nygren, Nilsen, & Öström, 2017; Peyrot des Gachons et al. 2012).

The second approach is based on the idea that the flavour of the two products should somehow blend into a unique perception. The flavour balance falls under this second approach. In such studies, participants are required to make judgments about the joint perception of the two products. The principle of aromatic similarity seems to fit within this approach too. Aromatic similarity could favour such blending through a high level of perceived harmony. This is suggested by observations made in the visual modality: pairs of colours with similar hues were on average perceived as more harmonious than pairs with different hues (Schloss & Palmer, 2011). Our first hypothesis is that aromatic similarity increases the perceived harmony of the pairing.

Going even further, aromatic similarity could link the two

components of the pairing, pushing toward a higher level of integration of the two flavours. The pairing experience would be perceived as a homogeneous multidimensional percept. Our second hypothesis is that aromatic similarity increase the flavour homogeneity of the pairing.

Finally, the blending of the different components of the pair could also affect its perceived complexity. According to Berlyne (1960), the perceived complexity reflected a perceived lack of blending or a distinction of the mixture's components. Berlyne and Boudewijns (1971) demonstrated that the perceived complexity of visual stimuli made of two geometrical figures increased along with the number of differences between the two elements. Thus, our third hypothesis is that aromatic similarity decreases the complexity of the pairing.

Perceived complexity is one of the collative properties, described by Berlyne (Lévy, MacRae, & Köster, 2006) as influencing the arousal potential of objects, itself related to liking according to an inverted U-shaped relationship. There is an optimum level of perceived complexity that leads to the highest appreciation level. If the perceived complexity is lower or higher than this optimum, the object is less liked. In the case of food and beverage pairings, associating two products could lead to a highly complex percept, potentially more complex than the optimal level. Thus, aromatic similarity by decreasing complexity could increase liking. According to the concept of "unity in variety" introduced by Paulsen et al. (2015) in the field of pairing, highly complex stimuli need to also be highly harmonious for the match to be appreciated. Thus, aromatic similarity would also increase matching level by increasing harmony within the highly complex percept of a food-drink pair. Thus, our fourth hypothesis, which conforms to experts' know-how, is that aromatic similarity increases liking of the pairing.

Paulsen et al. (2015), referring to the general principle of "unity in variety" for aesthetic pleasure, underlined the importance of the combined effect of collative properties (harmony and complexity) on liking. This leads us to consider explaining the impact of aromatic similarity as a combined effect of harmony and complexity levels, rather than with each property separately as is usually done.

To summarize, aromatic similarity's effect would be mediated by both harmony and complexity, which jointly modulate liking of the pairing. We propose a tentative model that accounts for this joint effect. In a first attempt, the combined effect of harmony and complexity will be considered additive.

The present study therefore aims to test whether aromatic similarity (1) leads to more harmonious, more homogeneous, and less complex matches and (2) increases liking of the paring. It also intends to provide a theoretical model that accounts for aromatic similarity's effect on liking through the modulation of collative properties harmony and complexity. To test these hypotheses, aromatic similarity was manipulated by aromatizing both the drink and the food in the pair. Two levels of aromatic similarity were contrasted; high aromatic similarity when the same aroma was added to the drink and the food vs. low aromatic similarity when different aromas were added. The experiment was run with two kinds of pairing. The first associated a lemon soft drink with an aromatized dairy product. The added aroma was dominant in each product, leading to a strong contrast in terms of aromatic similarity. The second one associated beer with an *amuse-bouche*. The added aroma was an aromatic note clearly perceived but that did not dominate, leading to a moderate contrast in terms of aromatic similarity.

2. Materials and methods

2.1. Pairings with high similarity contrast: Lemon syrup based soft drink and flavoured dairy product

2.1.1. Participants

Fifty-three participants (36 women and 17 men aged from 18 to 65 years old) were recruited on the Dijon campus and vicinities. They volunteered to participate in the experiment and were rewarded by a