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## Short Communication

# Effect of glass shape on subjective and behavioral consumer responses in a real-life context of drinking consumption

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## ABSTRACT

Although previous research carried out in laboratory contexts demonstrated the effect of glass shape on consumer judgment and behavior, few specific studies have examined these effects in a naturalistic setting. The main aim of this study was to investigate in a real-life situation the effect of glass shape on subjective responses and on drinking behavior of an alcoholic beverage. A secondary objective was to investigate more specifically a possible effect of glass shape on dynamic consumption patterns.

The study was conducted in a restaurant where an alcoholic beverage was offered to consumers ( $n = 123$ ) prior to the meal. The same quantity of the beverage (15 cL) was served in one of two possible typologies of glass of the same volume: a tall and slender glass and a short and wide glass. Data was collected through subjective questionnaires to evaluate satisfaction with the consumed quantity and the liking after consumption, and through video recording to measure the duration of consumption and the number of sips, in total and as a function of time.

Consumers expressed higher levels of satisfaction regarding the volume in the case of the drinks served in the tall glass. The study of drinking dynamics identified a 'decelerated' and an 'accelerated' pattern of consumption. The results show that glass shape influences the dynamics of drink intake of an alcoholic beverage, with a more decelerated pattern in the case of the short glass. These results confirm, in a real-life context, that the glass shape influences both consumers' behavioral and subjective responses, reiterating the importance of the container in the experience of consumption of an alcoholic beverage.

## 1. Introduction

Containers are able to modulate many characteristics of the contained food or beverage, with an effect on objective aspects such as the quantity of volatile compounds in the headspace (Hirson, Heymann, & Ebeler, 2012) and subjective aspects such as flavor expectations (Wan, Woods, Seoul, Butcher, & Spence, 2015) and liking for the content (Ross, Bohlscheid, & Weller, 2008). A specific aspect of interest in the interaction between container and content is the effect on overall satisfaction experienced toward the consumed content, considered as a mental construct that combines several variables such as sensory satisfaction, fulfillment of volume expectations and fullness after intake (Vad Andersem & Hyldig, 2015). Beside the development of food products that meet expected liking and sensory properties, the knowledge of the factors that affect the perception of the consumed quantity is therefore fundamental to understand the overall satisfaction toward a food or a beverage. Previous research demonstrated that the

perception of the consumed quantity is the result of the comparison between expectations and perceived information about the evaluated property of an object. In fact in the comparison between two containers of equal volume but different shapes it was highlighted that the expected volume of a beverage is inversely related to the perceived volume after consumption (Raghubir & Krishna, 1999). This phenomenon, defined as 'perceived size-consumption illusion', is the result of the combination between expectations and actual perception: when the actual volume disconfirms the expectations a shift of the perceived consumed quantity occurs. For example, when the expected volume is higher than the experienced volume, the consequence is a perception of the consumed quantity that is lower than the actual. In the specific case of table glasses previous research investigated the perception of the content prior to consumption comparing two glasses of different shapes and equal volume. The individual perception of volume is the result of a multimodal interaction that involves visual and haptic senses. Concerning the visual perception, a tall and slender glass and a short and

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wide glass of the same volume were compared in [Wansink and Van Ittersum \(2005\)](#). The result is that consumers tend to visually perceive the tall and slender glass as containing a higher volume of beverage, despite the quantity being identical in both cases. [Holmberg \(1975\)](#) refers to this effect as the ‘elongation effect’, where the main factor influencing volume perception is the height of an object: tall objects tend to be perceived as having a higher volume than shorter objects of the same volume ([Kahrimanovic, Bergmann Tiest, & Kappers, 2010](#)). Further studies confirmed that the elongation effect is mainly related to sight. In fact when consumers are asked to evaluate the volume of the two glasses on the basis of haptic sense alone, the result is the opposite: the glass perceived as more voluminous is the wide and short one ([Krishna, 2006](#)). The authors refer to this phenomenon as the ‘reverse elongation effect’. The situation becomes more complex in a natural condition of evaluation, which is when subjects use both the visual and haptic senses to evaluate the volume prior to consumption. In this condition if the subjects are left alone to focus on the glasses, the elongation effect is obtained, while if their attention diverted away from the visual and then focused toward haptic input, the reverse elongation effect is obtained ([Krishna, 2006](#)). These findings suggest that the type of elongation effect depends on whether it is possible, or not, to use sight in the evaluation of the volume, a condition related to the context of evaluation.

Beside the influence of glass shape on subjective responses, more spontaneous responses, such as the behavior of beverage consumption, may also be affected in important ways. [Attwood, Scott-Samuel, Stothart, and Munafò \(2012\)](#) compared two glasses of the same volume but of different shapes: one straight, the other one curved. The study showed that drinkers consumed the beverage 60% more slowly and with a higher number of sips in the case of the straight-sided glass. More generally, some studies focused on how external factors may modify the individual behavior of consumption. [Westerterp-Plantenga \(2000\)](#) measured the cumulative intake during meals to study dietary and clinical interventions on meal size. This research reported that the main typology of eating was a decelerated curve, also called a ‘biological satiation curve’, a pattern characterized by a higher speed of intake in the first part of consumption ([Kissileff & Guss, 2001](#)). Alternatively another consumption pattern was detected: the accelerated one, characterized by a higher speed of intake in the last part of consumption.

A weak point of the studies that investigate the effect of glass shape on both beverage perception and consumption behavior, are the laboratory conditions in which they are conducted. In this context, subjects put high awareness on the object in study and may also express a more restrained behavior due to the controlled condition of evaluation ([Robinson, Kersbergen, Brunstrom, & Field, 2014](#)). Carrying out a study in a naturalistic setting would allow a lower influence of the environment on the spontaneous behavior of subjects, in particular for food and beverages that are frequently consumed in a social context like alcoholic beverages. Considering this background, the aim of the study was to investigate the effect of glass shape on subjective responses and drinking behavior in a real-life context of consumption and considering an alcoholic beverage, this in order to understand if the evidence highlighted in laboratory conditions persists in a social condition of consumption and in which range. On one hand, the influence of glass shape on liking and satisfaction related to the served quantity was considered. On the other hand behavioral aspects were studied over the total time of consumption and the number of sips needed to consume the alcoholic beverage. Moreover, the study explored the diversity of dynamic patterns of consumption based on the analysis of videos. It aims to verify if contextual elements such as the glass shape may affect the consumption patterns of an alcoholic beverage.

## 2. Methods

The participants were 123 French consumers (41% male) who booked a table for dinner at the Living Lab of the Institut Paul Bocuse,

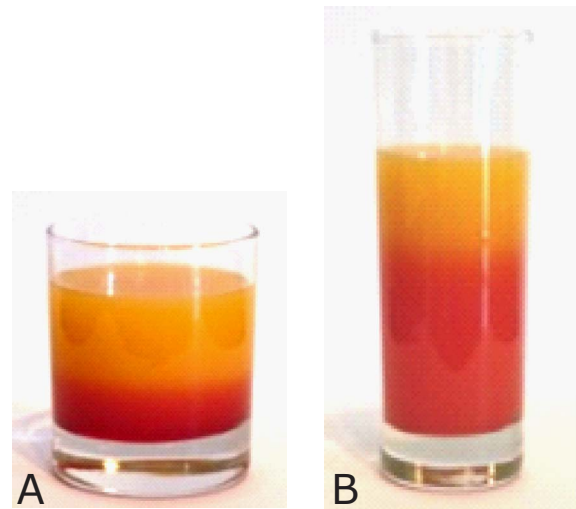


Fig. 1. Short and wide glass (A) and tall and slender glass (B) used in the experimentation.

Lyon, France ([Porcherot, Petit, Giboreau, Gaudreau, & Cayeux, 2015](#)). No exclusion criterion was adopted and no detailed information was given about the aim of the study. A tall and slender (TS) glass (height: 15.2 cm; internal diameter: 4.2 cm; volume: 22 cL; weight: 213 g) and a short and wide (SW) glass (height: 8.3 cm; internal diameter: 6.6 cm; volume: 20 cL; weight: 253 g) were selected for the study ([Fig. 1](#)). Both glasses were made of transparent glass and were of comparable glass quality (Iceland, Arcoroc). 12 experimental sessions were carried out, six where the cocktail was served in the SW glass and six where the cocktail was served in the TS glass. The aperitif was offered at the beginning of the meal when neither food nor drink had been previously consumed. Even if the study was focused on an alcoholic beverage, consumers were allowed to choose between an alcoholic or a non-alcoholic version of an orange-based cocktail, this in order to not force them in the choice and recreate a real-life situation. Both types of cocktail were served with a black drinking-straw and in a quantity of 15 cL. Before tasting it, consumers were asked to fill the first questionnaire concerning how well and how thirsty they feel. Subjects rated their agreement for each statement (“I feel well”; “I am thirsty”) on a 5-point category scale (1 – Not at all, 2 – A little, 3 – Moderately, 4 – A lot, 5 – Extremely). After the questionnaire had been completed, consumers were served their chosen cocktail and were allowed to consume it freely within a maximum of 45 min. During the cocktail tasting consumers were provided with 6 plain crackers and 0.5 L of water for each two persons, this in order to create a real-life situation. The control of consumed quantity of crackers and water during cocktail consumption was not considered in the study. The glass was withdrawn when the cocktail had been entirely consumed or when the participant declared they had stopped drinking the beverage. At the end of the aperitif, participants were asked to fill the second questionnaire to evaluate their overall liking for the cocktail on a 10-cm linear scale (I do not like it at all - I like it a lot) and their satisfaction about the served quantity on a 10 cm linear scale (I am not satisfied - I am really satisfied). The dinner started after the second questionnaire had been entirely filled out. At the end of the dinner, participants were asked to fill out the third questionnaire about socio-demographics and their frequency of cocktail consumption on a 5-point category scale (1 – Never, 2 – Once a month at least, 3 – Several times a month, 4 – At least once a week, 5 – Several times a week, 6 – At least once a day).

The cocktail consumption was recorded using video devices (Sony EVI-D70). Only participants fully visible in video recording during the entire cocktail consumption and that used the drinking-straw were included in the study. Considering that only 5 customers on 123 ordered the non-alcoholic version of the cocktail, only participants that

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