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Individual differences in cocktail perception and appreciation

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Dottorando
Dott. Pierguidi Lapo

Tutore
Prof. Erminio Monteleone

Coordinatore:
Prof.ssa Susanna Nocentini

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Abstract

Often when conducting consumer tests, we observe several clusters of individuals showing individual differences and preferences. One important challenge is to identify which variables besides the sensory attributes of a product determine differences in product perception and liking among consumers. An opportunity to meet this challenge is provided by the possibility of improving both products and consumer characterization by means of multidimensional and multidisciplinary approaches. From a product-related point of view, a more comprehensive description of a given product could be achieved using recently emerging "global" methodologies that allow us to broaden our research beyond sensory properties to such different dimensions of product perception as the emotions and contexts of consumption. This could help us to study in greater depth the relationship between product characteristics and differences in appreciation among consumers. Furthermore, a deeper characterization of consumers that adds psychographic and oral responsiveness measures to their demographic characteristics could also allow us to uncover aspects of consumer behavior linked to the appreciation of different products. In addition, scientific advances might result from the study of the moderating effect of liking on product perception in consumers sharing distinct traits and behaviors. Another point of interest is to implement methodologies derived from different research fields in the study of consumer behavior toward foods. In this vein, semiotics and text analysis could be valuable tools allowing us to uncover different aspects of product experience. This could be done while also taking into account the diversity of individual differences in personality and attitudes as well as indices of oral responsiveness in consumers. Another aspect that deserves further investigation is the dimension of product complexity, a variable relevant to the task of determining differences in liking among consumers. Studying this aspect could allow us both to study the representation of this concept in consumers' minds and to observe the effect of individual differences on the perception of complexity and test new models for product testing. This research aimed to integrate different methodologies and approaches to study the effect of product properties and consumer individual differences in the perception and appreciation of alcoholic cocktails.

The specific objectives were:

I. Understand whether and how different consumer clusters showing different liking patterns for alcoholic cocktails differ in their global product experience, including sensory properties, emotions, and context appropriateness. Characterize consumer clusters in terms of individual differences in taste

responsiveness, personality traits, involvement, familiarity with alcohol and cocktail consumption, and unconscious affective brand perception.

II. Test the efficacy of text analysis of the responses to open-ended questions in uncovering preferred aspects of alcoholic cocktails consumption. Test whether specific contexts of cocktail consumption are related to individual differences in personality traits, taste responsiveness, and attitudes, as well as cocktail liking.

III. Investigate the concept of complexity in cocktails as perceived by consumers. Study the effect of individual differences in the relationships between perceived complexity, liking, and familiarity and the applicability of the theory of Berlyne (1970) as an explanatory model of alcoholic cocktail appreciation.

In the present thesis, 201 consumers (52% females, aged 18 to 40 years) were involved, recruited in the Florence area. First, a preliminary study of 41 consumers was carried out to develop product-specific questionnaires for sensory properties, emotions elicited by the products, and context appropriateness, then 159 consumers were characterized for individual differences including familiarity, alcoholic beverage consumption, attitudes, personality traits, unconscious brand perception, implicit reactions to alcoholic beverages, and oral responsiveness. Furthermore, the preferred contexts of cocktail consumption were investigated using open-ended questions and analyzed by means of semiotic text analysis. The same panel of consumers evaluated six alcoholic cocktail samples in blind conditions for liking, emotions, contexts, complexity, and sensory properties.

The main results of the thesis are:

I. The results obtained in the different consumer clusters based on liking ratings support and expand the validity and efficacy of global approaches to the multidimensional study of food and beverages. Supplementing hedonic measures with emotional and context appropriateness variables allowed a better and more detailed differentiation of products. Each response type provided different insights that, when combined, resulted in in-depth sample characterization and discrimination. Furthermore, the application of cluster analysis of liking ratings provided a deeper level of understanding of different groups of cocktail consumers. The value of consumer clustering was confirmed through the establishment of groups of consumers with noticeably different patterns of sample liking and disliking. Our findings showed that the cluster identified for segmentation by liking did not differ greatly in their sensory responses to the product, while they largely differed in emotions and to a lower extent in context appropriateness. Furthermore, the linkages between emotions-contexts-sensory properties were

modulated by liking patterns. Finally, demographic consumer characterization through the addition of psychological traits and attitudes allowed a deeper comprehension of consumer behavior.

II. Text analysis of the open-ended question on consumers' preferred context of cocktail consumption allowed us to identify a variety of situations and factors that characterize the cocktail experience. These results extend the applicability of the use of semiotic methodologies to the study of preferred contexts of product consumption. Our findings showed that consumers indicate different preferred contexts to consume cocktails. We observed three main themes (*relax, sociality*, *aperitif*) that were associated with different psychological variables as well as attitudes. Differences among themes were present also for cocktail liking.

III. When data at the panel level were considered, the perceived complexity was found to be aligned with the hypothesized rank of complexity based on both the number of ingredients and sensory properties. Examining the relationships between complexity, liking, and novelty, we observed a trend similar to Berlyne's model. When individual differences in complexity perception were considered, different trends were observed in different consumer clusters as a function of complexity, liking, and novelty. Perceived complexity was not related to differing sensory responsiveness across the clusters. However, the two clusters associated different sensory properties with the concept of "complex." Also, differences in the association between complexity, emotions, and contexts between clusters were found. Relationships between variables were moderated by the familiarity expressed for the evaluated cocktails.

1. Introduction

1.1 The case study: Alcoholic cocktails

The alcoholic beverage market in Europe is currently one of the largest in the world, with an approximate value of 424 billion euros in 2018. The largest market in Europe for alcoholic beverages is Germany, followed by France, the United Kingdom, and Italy. Of these, spirits have a market share of 25%. Globally the alcoholic beverage market was valued at around USD 1263.19 billion in 2017 and is expected to reach approximately USD 1629 billion by 2024, with an expected growth of around 3.7% between 2018 and 2024 (Globe Newswire, Aug. 10, 2018). Following these incremental trends, the growth in cocktail consumption is driven by changes in lifestyles and increases in disposable incomes. Also, deep-rooted cocktail culture in a country such as Italy and the predicted increase in cocktail consumption are expected to provide an opportunity for the expansion of cocktail ingredient market players.

In this picture, an important driver of alcoholic cocktail innovation is the demand for customized products as a function of individual preferences, which influence the choices of every consumer. Alcoholic cocktails are commodities that appease thirst, but more importantly they are a source of enjoyment that will not be regularly consumed if their tastes do not meet the consumer's preferences (Yeretzian, Pollien, Lindinger, & Ali, 2004). In modern markets, the need for product customization has become increasingly evident at the expense of traditional standardization (Eastwood, 1996). The versatility of alcoholic cocktails, which can be prepared with a very wide range of ingredients and presented in different situations and for different uses, is an opportunity to exploit in product development and consumer targeting. A strategy to gain a competitive advantage in product customization is to divide consumers into homogeneous groups or segments characterized by distinct needs and wants leading to different behaviors. Besides geographic segmentation, increasing interest in demographic, psychographic, and behavioral segmentation could be a driving force of new product development and positioning. In fact, individuating specific segments of consumers could allow the development of products and marketing actions that closely meet consumer needs.

Despite the large diffusion of alcoholic beverages in actual and new markets, scientific research about individual consumer differences in perception and appreciation of alcoholic cocktails remains very scarce, even though it could be of interest in collecting data and creating frameworks to study the aspects that drive the acceptance of the sensory qualities of this product. Information about the relationship

between alcoholic cocktail sensory characteristics and liking is important not only at a technical level but also for understanding how consumers will perceive a new product. However, to gain greater advantages in product characterization, going beyond liking to integrate this aspect with other product-related variables is gaining increasing importance (Giacalone, Bredie, & Frøst, 2013; Jaeger, Cardello, Chheang, et al., 2017; Spinelli et al., 2019). From an operational point of view, a deeper description of alcoholic cocktails could be very useful for understanding the marketplace since it provides information on how to adapt the different products in relation to consumers' perceptions. Moreover, new product development continues to be a key activity for companies in both actual and new markets, which are in continuous evolution. It is thus important to consider the many factors that could influence consumers' acceptance of new products (Siegrist, 2007; Thomson & MacFie, 1994). Alcoholic cocktails are characterized by intrinsic attributes (e.g., sensory properties) that affect consumption by generating physiological and psychological effects that consumers remember as either positive or negative experiences. However, these products are characterized as well by other factors (e.g., brand, price, socio-cultural aspects), and consumer personal characteristics, both biological (e.g., the ability to perceive sensory attributes) and psychological (e.g., personality traits and attitudes), that could affect consumer choice and behaviors. There has thus been observed an increasing interest by marketing researchers and sensory and consumer scientists in better understanding the complex interplay between product characteristics and consumers' individual differences.

1.2 The Global Profile methodology to explore consumer responses to alcoholic cocktails

Often when consumer tests are conducted, we are faced with the task of identifying several clusters of individuals with different liking patterns. One important challenge is to identify which variables beyond varying preferences for the sensory attributes of a product drive liking differences among consumers (Kergoat et al., 2010). Variables related to specific aspects regulating preferences (e.g., socio-demographics) are commonly taken into account but do not suffice to explain why consumers prefer one product over another. To overcome this limitation, more multidisciplinary and multidimensional approaches that aim to improve our understanding of the determinants of food appreciation are needed (Köster, 2009). Very many factors affect the liking of food products. On the one hand, there are intrinsic product characteristics, such as sensory properties; on the other hand, there are other factors such as consumption context, emotions elicited by the product, and affective responses linked to the brand. Thus, in order to acquire a deeper and more comprehensive understanding of the consumer experience, the collection of a variety of information that goes beyond liking ratings is required. This could be achieved

by including, in addition to product sensory characterization and liking, measures of the emotions elicited by products (Meiselman, 2016; Spinelli & Monteleone, 2018) and product context appropriateness (Schutz, 1994).

Studying emotions related to food liking is increasingly routinely used in food product development (Köster & Mojet, 2015; Meiselman, 2015), as it is recognized that emotions can exert a large influence on eating and drinking (Jiang, King, & Prinyawiwatkul, 2014; Ledoux, Nguyen, Bakos-Block, & Bordnick, 2013) and could provide a deeper understanding of consumers' product experiences (Meiselman, 2015; Spinelli & Monteleone, 2018). Recently, the linkage between sensory properties and emotions has been investigated more specifically (Spinelli & Jaeger, 2019). It has been shown that sensory-emotions linkages are category-specific, meaning that the sensory properties have a specific emotional connotation within a product category, but are different in another product category (Jaeger, Spinelli, Ares, & Monteleone, 2018). In addition, it has been shown that liking has a moderating role in the relationship between sensory properties and emotions (Kim, Prescott, & Kim, 2017), and while there are some sensory properties whose emotional association is stable within a category, for the vast majority these seem to be related to liking (Spinelli, Monteleone, Ares, & Jaeger, 2019). Moreover, products may differ in emotions even when they do not differ in liking scores (Jaeger, Spinelli et al., 2018; Porcherot et al., 2012; Spinelli et al., 2015, 2019).

In addition to emotions in consumer research, it is also relevant to consider context/situation variables, as it is well known that certain products fit better in specific situations of consumption (Piqueras-Fiszman & Jaeger, 2014; Köster, 2003). Thus, the same product could be more or less liked as a function of the situation in which it is presented, with acceptability higher in the situations where consumers think that the product is better suited (Schutz, 1994). Context appropriateness (i.e., whether a food product is more or less suitable to a particular consumption context) has been proposed as a relevant measure in the investigation of food choice (Cardello & Schutz, 1996; Cardello, Schutz, Snow, & Lesher, 2000; Giacalone et al., 2015). In fact, the context of eating/drinking occasions has a profound effect on our food choice and enjoyment (Köster, 2003), and the study of the appropriateness of consumption contexts for specific products could allow us to understand consumers' liking and emotional patterns in greater depth (Piqueras-Fiszman & Jaeger, 2014a, 2014b).

The use of approaches seeking to integrate these different responses has recently grown considerably (Cardello et al., 2016; Giacalone, Bredie, & Frøst, 2013; Gómez-Corona, Chollet, Escalona-Buendía, &

Valentin, 2017; Jaeger, Cardello, Chheang, et al., 2017; Jaeger, Cardello, Jin, et al., 2017). Hence, the recently developed *Global Profile* methodology (Spinelli et al., 2019) has proven to represent a valid approach to characterize product experience by taking into account sensory properties, emotions, and context appropriateness within the same study. Despite the interest in such integrated approaches, individual differences in liking have not, with some exceptions (Gómez-Corona et al., 2017; Jaeger, Cardello, Chheang, et al., 2017; Jaeger et al., 2019), typically been taken into account. Considering the increasing need in product and consumer differentiation within marketing and research & development (Cardello et al., 2016; Jaeger & Porcherot, 2017), further advances in scientific research that allow the enrichment of consumer liking segments characterization is required. This could be done by individuating variables—personality traits, attitudes, taste responsiveness, and familiarity (Köster, 2009; Monteleone et al., 2017)—that could help illuminate consumer behavior related to food.

Among the available approaches used to study consumer individual differences, the use of questionnaires may be considered as the most common one. However, coupling such explicit methodologies with implicit tests could also be considered a valid option in many cases. Adding implicit measurements of consumers' reactions toward products could allow avoiding some limitations of explicit measurements such as voluntary self-presentation strategies or the inability of respondents to report their own actual cognitive contents (Nosek, Banaji & Greenwald, 2010). In fact, two different cognitive processes exist in each individual: one that is conscious, slow and deliberative and one that is unconscious, rapid and automatic (Kahneman & Frederick, 2002). Spontaneous and impulsive behaviors might often be driven by implicit attitudes whereas more conscious actions are strongly influenced by explicit attitudes. A variety of methodological tools developed in cognitive science could be used to study consumer implicit reactions to foods. Among them, two interesting methodologies are the Affective misattribution procedure (AMP) and the Go/NoGo task. AMP procedure is based on the principle of affective misattribution. On each trial, participants are presented with an image (prime) of either (for example) a positive or negative stimulus for a few milliseconds, which is quickly followed by a Chinese character. Participants are required to evaluate the visual pleasantness of the Chinese character while ignoring the prime image. Even though the instruction is presented, participants' evaluations of the Chinese characters are often influenced by the affective content of the primes that precede them (Gawronski & Ye, 2014; Payne et al., 2005). AMP effects are thought to arise because the spontaneous evaluative reaction that is evoked by the prime stimulus (e.g., a pleasant image) is misattributed to the Chinese character. Because both evaluation and misattribution occur quickly and unintentionally, AMP effects are typically

considered to be implicit measures of stimulus evaluation. Go/NoGo task could be used to assess implicit attitudes on the basis of response time. In the Go/NoGo task participants are required to either respond (i.e., pressing the designated key) or withhold a response (not pressing the designated key) depending on whether a go stimulus or a no-go stimulus is presented (Verbruggen & Logan, 2008). Reaction times for different objects (i.e. different products) could be used as an indicator of the strength of implicit attitudes towards the different stimuli.

1.3 Understanding consumer individual differences in preferences

Consumer personality and food preferences

Individual differences are the more-or-less enduring psychological, biological, physiological and socio-cultural characteristics that distinguish one person from another and thus help to define each person's individuality. Food perception depends on the interplay of product characteristics and these person-related dimensions (Köster, 2009; Rozin, 2006; Rozin & Vollmecke, 1986).

Individual differences in personality traits and attitudes among consumers (not only food-related) have frequently been studied in psychology and marketing research (Haugtvedt, Herr, & Kardes, 2012), while such interest in the sensory and consumer field is relatively more recent. It has been proposed that personality may play an important role in determining food preferences, as shown by studies of food-related personality traits such as food neophobia (Eertmans, Victoir, Vansant, & Van den Bergh, 2005; Jaeger, Rasmussen, & Prescott, 2017; Knaapila et al., 2011) as well as for more general personality traits not explicitly related to food (Byrnes & Hayes, 2013; Keller & Siegrist, 2015; Spinelli et al., 2018). For instance, the investigation of the relationships between sensitivity to reward (SR), sensitivity to punishment (SP) and food preferences and choices is new and still limited but recent studies presented interesting findings. SR was found to be positively associated with the frequency of chili consumption and weakly, though significantly, correlated with the liking of spicy foods (Byrnes & Hayes, 2013; Byrnes and Hayes, 2015). Other relevant associations include those between taste perceptions and preferences and personality dimensions such as sensation seeking, the search for experiences and feelings, that are varied, novel, complex and intense (Raudenbush, Van Der Klaauw, & Frank, 1995; Terasaki & Imada, 1988) and private body consciousness, the awareness of bodily sensations (Stevens, 1990, Stevens et al., 1998) but the results are controversial (Byrnes and Hayes, 2013, Jaeger et al., 1998).

Alcoholic beverages related personality traits

In the case of alcoholic beverages, a higher consumption has been linked to different personality traits such as disinhibition and sensitivity to reward associated with a higher sensitivity of Behavioral

Activation System and to a lower sensitivity of the Behavioral Inhibition System, (Morris, Treloar, Tsai, McCarty, & McCarthy, 2016; Pardo, Aguilar, Molinuevo, & Torrubia, 2007; Tapper, Baker, Jiga-Boy, Haddock, & Maio, 2015). Other studies have also highlighted an association between impulsive behaviors and alcohol consumption pointing out the tendency of drinking a larger amount of alcoholic beverages in more impulsive individuals (Bø, Billieux, & Landrø, 2016; Caswell, Celio, Morgan, & Duka, 2015; Cyders et al., 2014; Henges & Marczinski, 2012; Herman & Duka, 2018; Johnson, Carver, & Joormann, 2013; Kiselica & Borders, 2013; Lannoy, Billieux, Poncin, & Maurage, 2017; Sanchez-Roige et al., 2014) and also between impulsivity and taste preference in wine (Saliba, Wragg, & Richardson, 2009). Other relevant associations include those between alcoholic beverage preferences and consumption and personality dimensions such as Sensation Seeking, that is, the tendency to pursue sensory novelty, complexity, and intensity (Hittner & Swickert, 2006; Terasaki & Imada, 1988).

Consumers' food attitudes

Differences in food attitudes are increasingly studied (e.g. attitudes towards health and taste: Roininen, Lähteenmäki, & Tuorila, 1999) to obtain useful information to characterize the different consumer segments. Among the variables, one of the most relevant is consumer product involvement (Holbrook & Hirschman, 1982). Product involvement reflects a person's perceived relevance of a consumption object on the basis of needs, values, and interests (Zaichkowsky, 1985) and this variable has found widespread use in marketing research as an explanation for product choice and decision processes (Mittal & Lee, 1989). In addition, product involvement could influence the perceived differences between products as well as the emotional responses that they elicit (Solomon, 2010).

Oral responsiveness

Furthermore, measures of taste responsiveness as the perceived intensity of the response to the bitter compound 6-n-propylthiouracil (PROP). have been found to interact with perceived intensity of sensory properties and liking (Bakke & Vickers, 2011; Dinnella et al., 2018; Hayes & Duffy, 2008; Shen, Kennedy, & Methven, 2016; Yeomans, Tepper, Rietzschel, & Prescott, 2007) and personality variables (Scott, Burgess, & Tepper, 2019; Spinelli et al., 2018; Törnwall et al., 2014) such variations have been linked to alcohol intake, with those who are most bitter sensitive (supertasters) showing an enhanced perception of ethanol intensity and less alcohol intake (Duffy et al., 2004; Prescott & Swain-Campbell, 2000). Furthermore, a history of heavy alcohol use was found to be associated with a lower mean Fungiform papillae density (FPD), which may reflect that lower FPD is associated with less irritation from alcohol because of the involvement of the trigeminal nerve Fischer et al., (2013).In another study

subjects with the greatest FP number exhibited the most intense oral burn from alcohol (Duffy, Peterson, & Bartoshuk, 2004). This measure could therefore be of interest for segmenting consumers as well as characterizing consumer clusters based on liking.

Individual differences in liking

Despite the growing interest in the development of integrated approaches that take into account multivariate product profiles and consumer-related dimensions, individual differences in liking have not typically been included in previous studies, with some exceptions (Gómez-Corona et al., 2017; Jaeger, Cardello, Chheang, et al., 2017; Jaeger et al., 2019). Considering the increasing need in product and consumer differentiation within marketing and research & development (Cardello et al., 2016; Jaeger & Porcherot, 2017), further advances in scientific research that allow the enrichment of consumer liking segments characterization is required. This could be done individuating variables - personality traits, attitudes, taste responsiveness and familiarity (Köster, 2009; Monteleone et al., 2017) that could help illuminate consumer behavior related to food.

1.4 Individual differences in the preferred context to drink an alcoholic cocktail

The context in which food is consumed has been shown to be an important factor that affects product appreciation (Meiselman, 2006; Schutz, 1988, 1994), sample evaluation (Hein, Hamid, Jaeger, & Delahunty, 2010) and the emotions elicited by the product (Piqueras-Fiszman & Jaeger, 2015). Most food testing is conducted in laboratories, but such controlled experiments can pose problems in predicting whether consumers will actually choose or consume the product in real-life situations (Hellemann & Tuorila, 1991; Meiselman, 1992). To overcome these limitations, several methodologies have been developed to make product evaluations more similar to real-life contexts and to evaluate the effect of different consumption contexts on product preference and acceptability (Meiselman, 2019). Hence, settings that aim to better approximate natural eating situations while in controlled environments (context-enhanced Central Location Test) have been employed to study contextual effects, thereby avoiding the loss of scientific control due to the use of field locations or home use tests (Jaeger & Porcherot, 2017). One interesting approach is based on immersion in a context during consumer tests in sensory laboratories. Usually, the immersion is based on scenarios, presented in written form, that briefly describe a situation that consumers are asked to imagine. These evoked contexts have become a valuable tool in product testing as they can provide a frame of reference during sample evaluation. This methodology has been used by several authors who found that the results were accurate and discriminating (Äström, Gilbert, Köster, Mojet, & Wendin, 2011; Hein et al., 2010; Hein, Hamid, Jaeger,

& Delahunty, 2012; Hersleth, Monteleone, Segtnan, & Næs, 2015; Köster, 2003; Piqueras-Fiszman & Jaeger, 2014). Other techniques aimed at simulating consumption contexts have involved asking the consumer to describe their own context rather than using one evoked by the researcher. Open-ended questions are used in this approach, thus allowing consumers to describe in their own words their context of consumption in a way that the respondent can better identify with it (Köster, 2003; Spinelli et al., 2017). This methodology can be useful to integrate not only some aspects of the physical environment but also other elements, such as social and cultural aspects and emotions that are difficult to determine in advance. This use of open-ended questions follows their successful application in studying consumers' preferences (Lawless & Heymann, 2010) and to explore concepts (Ares et al., 2015; Deneulin & Bavaud, 2016), ideas and feelings for products (Graça, Oliveira, & Calheiros, 2015). The main advantage of open-ended questions is the spontaneity of the consumers' answers, suggesting that they may be a better measure of consumer salient interest as compared to close-ended questions (Geer, 1988; Kelley, 2014). They may also be a richer source of information that provides the researcher with useful data that can be analyzed and then linked to other important variables, e.g. liking or consumer characteristics (Spinelli et al., 2017). Asking consumers to describe their preferred consumption context may provide valuable information about the most meaningful aspects of the consumption experience, which may reflect individual differences in psychological traits, taste responsiveness, familiarity and liking for the products (Köster & Mojet, 2007). Furthermore, because the meanings attributed to different consumption contexts vary from individual to individual, we assume that consumer characteristics may play a role in this variation. If, for example, the preferred context described by an individual highlight very precisely a cocktail's characteristics in terms of temperature, taste, flavor, etc., this might reflect a preference that is driven by the sensory characteristic of the cocktail. Conversely, if the preferred context in which to have a cocktail is described as a social context, in a very crowded situation with loud music, this might reflect a situation where the preference for cocktails reflects its social function, perhaps independently of its taste, and may be more related to the alcohol's effects (Spinelli, 2019). The theoretical background of this hypothesis is rooted on the context principle that focuses on the investigation of the mind in context (Mesquita, Barrett, & Smith, 2010). According to this theory, the situations are in themselves "contextual", in part being determined by the person, who acts as a form of context. This perspective implies that, within a common physical surrounding, there exist different "situations" for different people (or for a single individual at different points in time). The idea behind this is that the mind determines the "active ingredient" or psychological features of a situation. Thus a "situation" does not exist

separately from a person (Barrett, 2006). Within a common scenario, in fact, the aspects valued by different individuals may differ. This means that context is not an "independent variable" because it does not exist separate from the participant. It is the brain that selects what is a stimulus and what is not, in part by predicting what will be important in the future. Said another way, it is the current state of the individual's cognitive state that makes some sensory stimulation into "information" and relegates the rest to the psychologically less important "physical surroundings."(Mesquita et al., 2010). Thus, investigating the preferred contexts may provide information about the features of the situations that are of interest (i.e. meaningful) for an individual (Spinelli, 2019; Spinelli et al., 2017). While the study of the relationships between physiological indexes, personality traits, attitudes and preference is receiving increased attention (Köster, 2009; Monteleone et al., 2017; Rozin, 2006), little attention has been given to the relationship between these variables and the contexts in which individuals prefer to have food. Thus, further research is needed to better evaluate the potential of evoked context in laboratory settings (King, Weber, Meiselman, & Lv, 2004) as well as to uncover the role of individual differences in the choice of preferred contexts of product consumption (Spinelli et al., 2017). In particular, it has been unclear how individual differences might relate to preferred contexts, although it is possible to hypothesize that the most appropriate (preferred) context will vary between individuals especially in the case of products that not have a fixed context of consumption. Recently, Spinelli et al. (2017) showed that physiological variables (caffeine metabolism and fungiform papillae density) are related to the choice of preferred contexts of coffee consumption. These findings are consistent with the idea that individual differences could lead to diversity in the aspects valued by consumers in their preferred context of product consumption. Along these same lines, it is possible to hypothesize that variations in personality traits may also be associated with product consumption contexts, but this has yet to be evaluated.

1.5 The role of perceived complexity on liking

The dimension of complexity has proved to be relevant in the development of food products preferences and acceptability as it is an important arousal-inducing property that can contribute to either positive or negative responses (E. P. Köster & Mojet, 2007b; E.P. Köster & Mojet, 2016; Lévy, MacRae, & Köster, 2006; Mielby, Kildegaard, Gabrielsen, Edelenbos, & Thybo, 2012; Reverdy, Schlich, Köster, Ginon, & Lange, 2010; Sulmont-Rossé, Chabanet, Issanchou, & Köster, 2008). According to Berlyne's theory of optimum arousal level (1960, 1970), the complexity of a stimulus, along with its intensity and novelty, determines the extent to which it is liked. Berlyne (1967) proposes that perceived complexity and liking

are not related to one another linearly but rather by an inverted U-curve. Thus, hedonic value reaches a maximum with moderate arousal and then, as arousal increases further, hedonic value decreases. A stimulus' arousal potential depends mostly on complexity and novelty (Berlyne, 1967) that affect the arousal level via the attention process. Thus, anything that drives arousal up to a high level can lead to a decrease in hedonic responses, while a moderate increase in arousal will be rewarding and pleasant (Berlyne, 1970). Berlyne's model was developed considering visual non-food stimuli but, more recently, there have been attempts to test the model using picture and real foods as a stimulus (Giacalone, Duerlund, Bøegh-Petersen, Bredie, & Frøst, 2014; Lévy et al., 2006; Meillon et al., 2010; Mielby et al., 2012; Porcherot & Issanchou, 1998; Reverdy et al., 2010; Stolzenbach, Bredie, Christensen, & Byrne, 2016; Sulmont-Rossé et al., 2008; Weijzen, Zandstra, Alfieri, & de Graaf, 2008). The inverted U-shaped relationship based on complexity and hedonic response proposed by Berlyne has never been found using real food products as stimuli. This relationship has however been observed in the study of Mielby et al. (2012), which used pictures of foods.

As these findings about Berlyne's theory applicability on food products have shown mixed results, further studies are needed to explore more in depth the concept of complexity applied in the context of food products and its relationships to affective responses and product experience.

The limited attention given to the relationship between complexity and hedonic response may reflect the difficulty of providing a clear and shared definition of perceived complexity and, consequently, of how it can be measured as highlighted by several authors (Lévy et al., 2006; Palczak, Blumenthal, Rogeaux, & Delarue, 2019; Sulmont, 2002; Sulmont-Rossé et al., 2008). Three aspects of perceived complexity have been identified: sensory, cognitive an emotional (Palczak et al., 2019). On the one hand, complexity has been defined as a sensory property, associated with the perception in a product of multiple flavors, ingredients or aromas (Bitnes, Ueland, Møller, & Martens, 2009; Lévy et al., 2006; Meillon et al., 2010; Porcherot & Issanchou, 1998; Ruijschop, Boelrijk, Burgering, de Graaf, & Westerterp-Plantenga, 2010; Weijzen et al., 2008). However, complexity is not only derived by the amount of ingredients. Bitnes et al., (2009) have shown for example that the number of different components is not always consistent with the number of perceived stimuli, suggesting that certain components may enhance, suppress, or mask stimuli arising from other components. Also, Jellinek and Köster (1979) discovered that the odor of one component can be perceived as more complex than a perfume containing 40 different components. An explanation of this effect could be the empirical observation of Livermore & Laing (1998) that found a limited capacity of human beings in the perception of more than four components. Then, more research

on the perceptual basis of complexity is needed to disentangle the effect of different factors (e.g. congruity, intensity, quality) affecting complexity perception. Cognitive dimensions of complexity have been also defined, by considering those products in which aromas were not easy to identify as more complex (Lévy et al., 2006; Meillon et al., 2010; Porcherot & Issanchou, 1998; Ruijschop et al., 2010). Finally, the emotional aspects of perceived complexity have been addressed by research that focusses on the level of surprise elicited by products. Giacalone et al. (2014) found a positive linear relationship between surprisingness and complexity as well as with novelty and Lévy and colleagues (2006) found a positive linear relationship between surprise and descriptors of complexity, such as *elaborated* described as "composed as a mixture of many flavors" and *shattered* described as "certain flavors that clearly detach themselves with the others". Even if not yet investigated, it might be expected a relationship between perceived complexity and emotions other than surprise differing in valence and/or arousal.

Recent studies suggested that perceived complexity is linked to situational appropriateness; Jaeger et al. (2017) found that well-liked beers with high drinkability (medium level of complexity) were also more versatile, with high perceived situational appropriateness for social occasions and when together with friends and family, while more complex beers were found to be more appropriate when people want "something different" and to taste with friends interested in beer. Pocheptsova, Labroo, & Dhar (2010) found that products that are consumed in special occasions are considered as exclusive, unusual, unique or out of the ordinary by consumers. This effect could mask the normal aversion for not familiar products that may result in a higher liking for such products even if they are perceived as more complex than the optimal level.

Since complexity, like surprisingness and novelty, is a collative property that implies a comparison of the stimulus with the context of the situation and the previous experience of the individual (Goodwin, 1980), it is clear that the complexity ratings of a given food are likely to be subject to individual differences, and hence it is important to analyze data at an individual level (Berlyne, 1970; Lévy et al., 2006; Palczak et al., 2019). This is particularly the case since novelty, which relies on the individual's previous experience with a certain stimulus group (which for consumer products can be thought of as product familiarity), has been identified as a crucial determinant of the hedonic value of complex stimuli (Berlyne 1960; 1970). The importance of product familiarity on consumer hedonic responses was well established by previous findings (Hirsch & Kramer, 1993; Meiselman, 2001, 2003, 2008; Meiselman, Johnson, Reeve, & Crouch, 2000; Rozin & Tuorila, 1993). Moreover, according to the Berlyne model, the hedonic value of novel complex stimuli would be lower compared to complex familiar ones, while

an opposite pattern is expected for simple stimuli. According to Berlyne (1970) novelty (defined as opposed to familiarity) may either refer to the frequency with which a particular stimulus has been encountered before or to the extent to which the stimulus resembles other known stimuli. In addition, Berlyne recommended to investigate novelty in association with other collative variables, such as "surprisingness", defined as 'contrary to expectation' rather than 'unfamiliar'. In fact, very familiar stimuli may be quite surprising when presented out of context and quite unfamiliar stimuli are often not unexpected or surprising (Lévy et al., 2006). Stimuli that are simple but high in novelty or high in complexity but familiar are expected to have medium arousal potential (see Figure1).

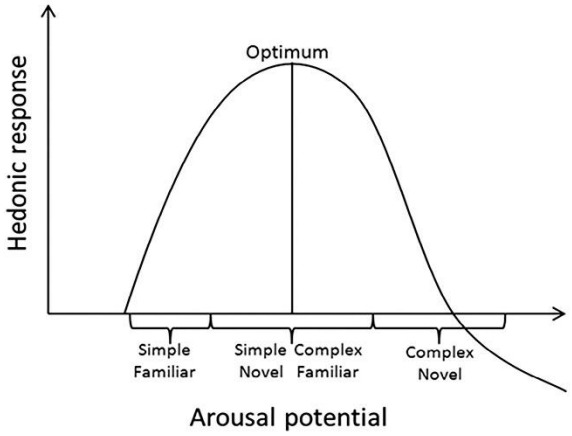

Fig.1. Relationship between arousal potential (x) and hedonic response (y) (adapted from Berlyne, 1970).

Previous studies have investigated perceived complexity in alcoholic beverages, including beers (Giacalone et al., 2014) or wines (Meillon et al., 2010; Schlich, Medel Maraboli, Urbano, & Parr, 2015; Wang & Spence, 2018). In these studies, the complexity of alcoholic beverages was positively correlated both with the number of components in terms of aromas, ingredients, flavors, or other sensations that are perceived and also with hedonic appreciation. Furthermore, Giacalone (2014) found curvilinear relationship between liking and perceived novelty in commercial beers, whereas mixed results were obtained in the relationship between liking and familiarity and complexity. In a study on partially dealcoholized wines, Meillon et al., (2010) found that complexity was positively related to the quality of wines and also to alcohol content, pointing out that alcohol itself is a complex and intense sensory stimulus that brings several sensations in alcoholic beverages (e.g. hotness and bitterness). Also, Wang & Spence (2018) observed a positive relation between complexity and quality of wines as well as liking and number of flavors detected, in a small panel of highly educated subjects. Further studies are needed to confirm this positive relationship between complexity and liking in alcoholic beverages. One of the

reasons of these controversial findings might be that selected samples were not perceived as sufficiently incongruent to activate the hedonic rejection threshold. Furthermore, despite some previous studies have explored the relationship between complexity and surprise, the link between perceived complexity and the variety of different emotions elicited by products has remained only little explored. The present work aims to build on these prior studies of complexity in alcoholic beverages by extending the investigation of perceived complexity in bitter-based cocktails and its relationship with sensory properties, situational appropriateness, emotional responses and liking.

2. Aim of the thesis

This research aimed to study the effect of individual differences in alcoholic cocktails perception and appreciation. For this purpose, a number of factors that can influence consumers' cocktail experience, such as attitudes, personality traits, familiarity, emotions elicited by the products, context appropriateness, sensory properties and product complexity were considered. Bitter-based alcoholic cocktails were selected to span the highest variety both in familiarity and in the hypothesized perceived complexity based on the scientific literature, according to the criteria of alcohol content (Meillon et al., 2010), number of ingredients (Lévy, MacRae, & Köster, 2006) and sensory properties differing in arousal potential, such as sweet and bitter (Verastegui-Tena, van Trijp, & Piqueras-Fiszman, 2018). All cocktail samples selected for the experiment shared a same "bitter" ingredient but differed for the number and sensory quality of the additional ingredients. In particular, the objectives of this research were the following:

I. Extend the applicability of the Global Profile approach to alcoholic cocktails, integrating an investigation on how it changes in different consumer clusters showing different liking patterns for alcoholic cocktails. In particular, the effect of liking patterns in modulating the linkages between sensory properties, emotions and context appropriateness was investigated. In addition, consumer clusters were characterized in terms of individual differences in taste responsiveness, personality traits, involvement, familiarity with alcohol and cocktail consumption and unconscious affective brand perception.

II. Investigate the different concepts of complexity among consumers and the individual differences in the pattern of responses to products in terms of perceived complexity. Evaluate the effect of emotions that differ in valence on the arousing effect of complexity and its relationships with hedonic responses. Study the effect of cocktail complexity on context appropriateness and the association with specific

sensory properties in the bitter-based product category that may have an arousing potential. Test the impact of PROP responsiveness on the perceived complexity of bitter-based cocktails.

III. Test the efficacy of a method that couples semiotics and statistics in uncovering aspects of preferred context of cocktail consumption; Test if specific preferred contexts of cocktail consumption are related to individual differences, here represented by variations in taste sensitivity (PROP status and fungiform papillae density), personality traits (impulsivity and sensation seeking) and attitudes (involvement) as well as with the rate of consumption of alcoholic beverages; Investigating the relationships between preferred context to have cocktails and patterns of liking for cocktails.

3. Materials and Methods

3.1 Overview of the experimental plan

A two-step approach was applied to study the individual differences in cocktail perception and appreciation among consumers in the selected category of bitter-based alcoholic cocktails, with the first step (qualitative) conceived as preliminary to the second step (consumer testing).

First Step—Preliminary study: This phase concerned the development of product-specific questionnaires based on the emotions, context appropriateness, and sensory properties that consumers associate with cocktails and the development of a complexity criteria questionnaire to investigate consumers' concepts of cocktail complexity.

Second Step—Consumer test: This phase was dedicated to the study of differences in cocktail perception and appreciation between segments of consumers within the considered product category as a function of individual differences following the general conceptual plan shown in Figure 2

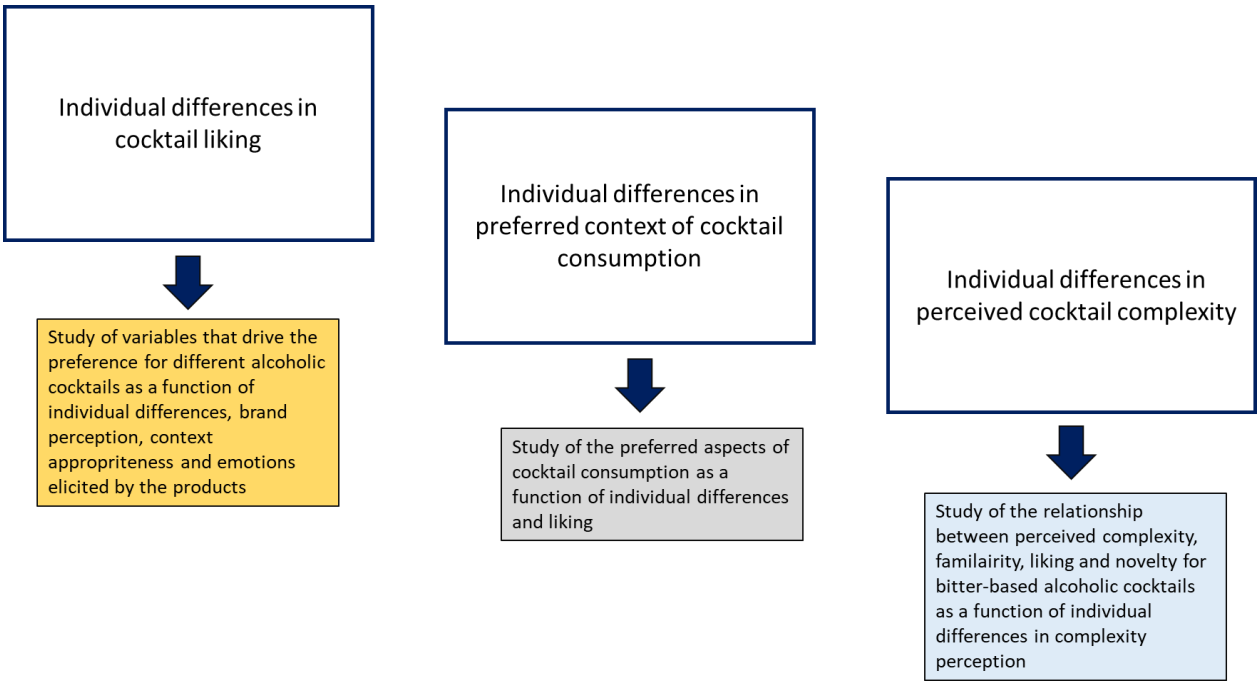

Fig.2. Conceptual plan of consumer test

3.2 Consumer panel

A total of 201 cocktail consumers were involved in the PhD project, age range 18–40, Italian native speakers, recruited in the Florence area (Tuscany, Italy) using online advertising.

a) Preliminary study: Forty-two consumers (20 males and 22 females) were assigned to the preliminary study for product-specific questionnaire development. Two different panels of 21 consumers each, balanced for gender (11 females and 10 males) and age (from 21 to 36 years), participated respectively in one-on-one interviews on emotional responses and context appropriateness and on the sensory characterization of the products.

b) Consumer test: A total of 159 consumers (85 females, mean age = 25.4) participated in the study of individual differences in cocktail perception and appreciation. Data were collected in the Sensory Laboratory of the University of Florence (Italy).

Written informed consent was obtained from all consumers. All consumers were informed about the study's aim and they authorized the personal data treatment according to Decree 30.6.03 n. 196 (Italian legislation). For their participation, a monetary reward was provided.

3.3 Cocktail samples

Six different cocktail samples (coded: A, B, C, D, E, F) were used as stimuli in both the preliminary study and consumer test. The cocktails were selected to ideally span a range of perceived complexities based on the criteria of alcohol content, number of ingredients, and differences in sensory properties (Figure 3). Cocktails samples were prepared following the composition of real cocktails by the use of market-available ingredients (https://www.campari.com/it) as reported in Table 1.

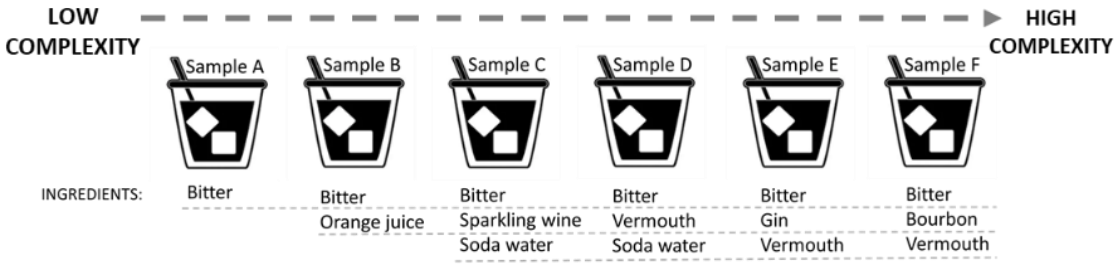

Fig.3. Sample complexity as a function of number of ingredients and sensory properties.

The preparation procedure for each cocktail was standardized along with evaluation procedures to avoid critical changes in sensory properties during the experimental procedures (e.g., carbonation loss). Just before the assessment, soda water was added to samples C and D, then two ice cubes of 14 grams each were added to each sample. Samples were evaluated within 10 minutes of sample preparation. Widmark's formula (Widmark, 1981) was used to calculate blood alcohol content depending on gender, weight, and age as a function of the total alcohol content of the sample set to ensure that panelists' blood alcohol content after a session would never exceed 0.5 g/l (the drink-drive limit in Italy).

Fig.4.Sample appearance after preparation

Table 1. Characteristics of cocktail samples

Cocktail name	Ingredients	Quantity (ml)	Mixing temperature	Weight (g)	Alcohol content
Sample A	Bitter	15	18–22 °C	18.69	25 %
Sample B	Bitter	10	18–22 °C	43.06	6.2 %
	Orange juice	30	4 °C		
Sample C	Bitter	10	18–22 °		
	Sparkling wine	15	4 °C	38.9	13.8 %
	Soda water	5	4 °C		
Sample D	Bitter	10	18–22 °C		
	Vermouth	10	18–22 °C	32.6	13.6 %
	Soda water	10	4 °C		
Sample E	Bitter	10	18–22 °C		
	Gin	10	18–22 °C	31.83	27 %
	Vermouth	10	18–22 °C		
Sample F	Bitter	10	18–22 °C		
	Bourbon	15	18–22 °C	31.46	33.3 %
	Vermouth	10	18–22 °C		

3.4 General procedures

3.4.1 Questionnaire development

The first step of the PhD project was dedicated to the development of product-specific questionnaires for emotions and the context appropriateness, sensory properties, and complexity of bitter-based alcoholic cocktails. Product-specific questionnaires were developed based on one-on-one interviews conducted in the Sensory Laboratory of Florence University based on a modified version of the Repertory Grid technique and analyzed applying a semiotic approach as described in Spinelli et al. (2014). The EmoSemio approach was here extended to cover not only emotional responses but also to context appropriateness and complexity (see also Spinelli et al., 2019, for the extension of the EmoSemio approach for product characterization). Consumers were asked to taste the six samples presented in randomized order and to rank them from the most to the least preferred. The objective of this first ranking

was to familiarize interviewees with the samples. The samples were then split into two triads according to the ranking (triad I: 1, 2, 3—most preferred; triad II: 4, 5, 6—least preferred). For each triad, the products were tasted consecutively one by one following the ranking order (e.g., 1-2-3). The interviewees (Panel 1) were then asked to initially concentrate on their emotions and describe how each product made them feel compared with the other two. When the respondents were found to be reticent or unclear, they were asked to explain what they meant exactly. The question was then repeated for context appropriateness. Panel 2 followed a similar procedure, but respondents were asked to concentrate on the perceived sensory properties. The interviewer took note of the consumers' answers. Moreover, to aid in analysis, all the interviews were audio-recorded. At the end of each interview, consumers in both panels were invited to rank the products in terms of complexity and then asked to explain what they meant by "complex". Written informed consent was obtained from all consumers before participating in the interview. For a schematic representation of the procedure see Figure 5.

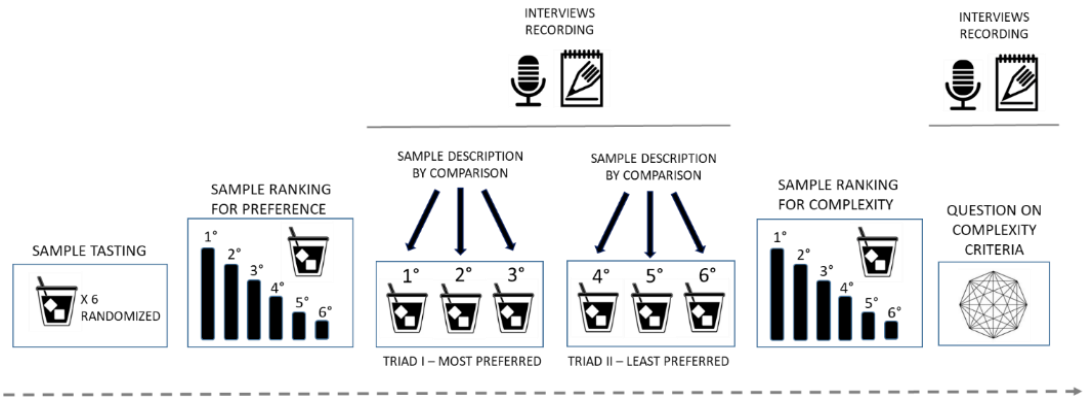

Fig.5. Schematic representation of one-on-one interviews.

3.4.2 Overview of data collection (consumer test)

Consumers preliminarily completed some questionnaires at home and came to the laboratory twice on two different days at least 7 days apart (Figure 6). Evaluations were performed in individual booths under white lights. All sessions took place in the afternoon (from 14:30 to 16:30). Data were collected with the software Fizz (ver.2.51 B, Biosystèmes, Couternon, France) and with E-Prime 2.0 software (E-Prime 2.0, Psychology Software Tools, Inc., Pittsburgh, PA, USA).

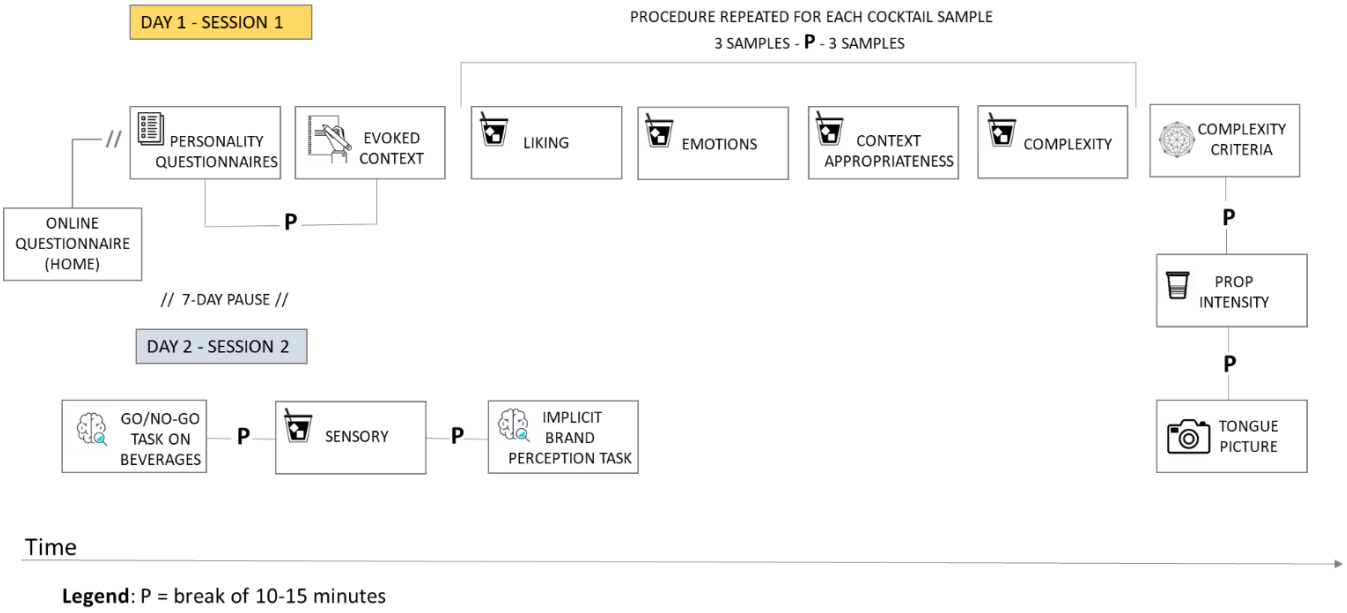

Fig.6. Overview of data collection.

3.4.3 Online questionnaire

First, all consumers filled out an online questionnaire where they provided information about their demographics and other characteristics of interest.

Familiarity: Familiarity with cocktails names was assessed using a 5-point labeled scale adapted from Tuorila, Lähteenmäki, Pohjalainen and Lotti (2001) (1 = *I do not recognize it*; 2 = *I recognize it, but I have never drunk it*; 3 = *I have tasted it, but I don't drink it*; 4 = *I occasionally drink it*; 5 = *I regularly drink it*) for each of 42 alcoholic cocktail names. The names of the cocktails were extracted from the official list proposed by the International Bartender Association (IBA, http://iba-world.com/), and other cocktails containing bitter as an ingredient were added to the list (Table 2).

Table 2. List of cocktail names presented in the online survey.

1	Alexander	16	Cuba libre	31	Mojito
2	Americano	17	Daiquiri	32	Moscow mule
3	Aperol spritz	18	Gin fizz	33	Negroni
4	Bellini	19	God father	34	Negroni sbagliato
5	Black russian	20	God mother	35	Old fashioned
6	Bloody Mary	21	Irish coffee	36	Old pal
7	Boulevardier	22	John collins	37	Pina colada
8	Caipirinha	23	Kir	38	Rusty nail
9	Campari on the rocks	24	Long island iced tea	39	Screwdriver
10	Campari orange	25	Mai-tai	40	Sex on the beach
11	Campari selz	26	Manhattan	41	Tequila sunrise
12	Campari shakerato	27	Margarita	42	Whiskey sour
13	Campari spritz	28	Martini dry	43	White lady
14	Campari&tonic	29	Mi To		
15	Cosmopolitan	30	Mimosa		

Alcoholic beverages consumption: Respondents were asked about the frequency of consumption of drinks of any alcoholic beverage during the last 12 months (everyday; 1/2/3-4/5-6/ per week; 1/1-2/3-11/ per month; never) as an index of general alcoholic beverage consumption (Cherpitel, Tam, Midanik, Caetano, & Greenfield, 1995). Data on weekly frequency of consumption for specific alcoholic beverages were also collected using the Survey of College Alcohol Norms and Behavior (SCANB, Huang, DeJong, Schneider, & Towvim, 2006). The questionnaire defined an alcoholic drink, respectively, as "a can of beer (330 ml)", "a glass of wine (125 ml)", "or a shot of liquor (40 ml)". Consumers answered the question: "On average, how many glasses of wine/cans of beer/shots of liquor do you drink per week?". Also, a question on the frequency of cocktails consumption per week was added. Response options ranged from "1 drink" to "22 or more drinks".

Involvement with cocktails: Two different measures of product involvement were used:

1) Mittal and Lee's (1989) product involvement scale, which has been used in previous food and beverage research (e.g., Aurifeille, Quester, Lockshin, & Spawton, 2002; Hollebeek, Jaeger, Brodie, & Balemi, 2007; Jaeger, Lee, & Ares, 2018; Lockshin, Spawton, & Macintosh, 1997). The three items of the scale

were adapted to reflect consumers' general interest in cocktails: (1) "I am not much of a cocktail drinker," (2) "I am very interested in cocktails," and (3) "Cocktails are important for me." All responses were scored on 7-point Likert scales (1 = *strongly disagree*; 7 = *strongly agree*).

2) Kähkönen and Tuorila, (1999) involvement scale, which has previously been used to measure this construct in alcoholic beverages (Goldsmith, d'Hauteville, & Flynn, 1998; Torri et al., 2013).

The scales were presented in Italian.

3.4.4 Personality traits

Validated questionnaires were administered to characterize consumers on selected personality traits: the BIS/BAS Scale, to measure behavioral inhibition and behavioral activation (Carver & White, 1994); the Barratt Impulsiveness Scale (BIS-11) (Patton, Stanford, & Barratt, 1995); the Sensation Seeking Scale, to measure the pursuit of varied, novel, complex, and intense sensations and experiences (SSS) (Aluja, Kuhlman, & Zuckerman, 2010); the Food Neophobia Scale, to measure the reluctance to eat unfamiliar foods (FNS) (Pliner & Hobden, 1992); and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) (Torrubia, Avila, Moltó, & Caseras, 2001). Validated Italian translations of the questionnaires were used (BIS-11: Fossati, Di Ceglie, Acquarini, & Barratt, 2001; FNS: Laureati et al., 2018; BIS/BAS: Leone, Pierro, & Mannetti, 2002; SSS: Rossier et al., 2016; SPSRQ: Spinelli et al., 2018). The internal reliability of each scale and subscale was assessed by the use of Cronbach's alpha statistic (Nunnally, 1978). After the calculation of the total score for each personality trait, consumers were divided into sub-groups representing low and high scores based on the median. Consumers with a score corresponding to the median were not considered. Scale and questionnaire details are reported in Table 3. Below, characteristics of the five personality scales and questionnaires employed are briefly presented.

Behavioral Inhibition and Behavioral Activation (BIS/BAS)

A behavioral approach system (BAS) is believed to regulate appetitive motives, in which the goal is to move toward something desired. A behavioral avoidance (or inhibition) system (BIS) is said to regulate aversive motives, in which the goal is to move away from something unpleasant. The BIS/BAS scale assesses individual differences in the sensitivity of these systems.

Impulsiveness (BIS-11)

Impulsiveness is essentially related to the control of thoughts and behavior (Barratt, Monahan, & Steadman, 1994). Patton et al. (1995) proposed a discipline-neutral model for synthesizing data from

different disciplines into a convergent construct of impulsiveness. The BIS-11 questionnaire scores could also assess differences between high and low levels of eating and alcohol consumption (Fossati et al., 2001).

Sensation Seeking (SSS)

Sensation seeking is a basic personality trait that has been defined as "the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience" (Zuckerman, 1994, p.27). The scale comprises four subscales: (1) *thrill and adventure seeking* (TAS), an expressed desire to engage in physical activities or sports that are sometimes risky but provide unusual sensations of speed or defiance of gravity (e.g., parachuting, scuba diving, downhill skiing); (2) *experience seeking* (ES), the seeking of sensations and experiences through the mind and the senses, as through music, art, and travel, and social nonconformity and unconventionality; (3) *disinhibition* (Dis), seeking sensation through social activities, sex, and drinking, and associating with people who share these hedonistic preferences; and (4) *boredom susceptibility* (BS), which represents an intolerance for repetitious experience or predictable and unexciting people.

Food Neophobia (FNS)

Food neophobia is a naturally occurring reaction in humans that protects individuals from the risk of poisoning by consuming potentially harmful foods. It accounts for a person's reluctance to consume either new or unusual foods based on one's culture and current diet. Food Neophobia (FN), was quantified using the Italian version of the 10-item instrument developed by Pliner & Hobden (1992).

Sensitivity to punishment and sensitivity to reward questionnaire (SPSRQ)

According to Gray's neuropsychological theory of personality (Gray, 1970), two basic brain systems control behavior and emotions: the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS). The responsiveness of these systems has been measured using the Sensitivity to punishment and sensitivity to reward questionnaire (SPSRQ, Torrubia et al., 2001). The Sensitivity to Punishment (SP) scale is formed by a set of items reflecting situations which describe individual differences in reactivity and responsivity to BIS. The Sensitivity to Reward (SR) scale was conceived as a single measure of the functioning of the BAS dealing with specific rewards (i.e., money, gender, social power and approval, and praise). For each subject, scores for each scale were obtained by adding all the *yes* answers. In the original version, the score for each scale ranges from 0 to 24. Here a shorter Italian

version of SPSRQ was used (Spinelli et al., 2018) where the scores range from 0 to 23 for SP and from 0 to 18 for SR, with higher scores reflecting, respectively, higher sensitivity to punishment and to reward.

Table 3. Psychological and personality traits measurements: Questionnaires with their relative acronym, items and domains, rating scale and references.

Scale	Items and domains	Scale/question format	References
BIS/BAS scale	20 items-2 subscales -Behavioral Inhibition System (BIS) -Behavioral Activation System (BAS)	4-point likert scale (1 = *strongly disagree*; 2 = *not completely disagree*; 3 = *only partially agree*; 4 = *completely agree*)	Carver & White (1994) Italian version: Leone, Pierro, & Mannetti. 2002
Barratt Impulsiveness Scale (BIS-11)	30 items	4-point Likert scale (1 = *never* / *rarely*; 2 = *sometimes*; 3 = *often*; 4 *almost always* / *always*)	Patton, Stanford & Barratt. 1995 Italian version: Fossati et al., 2001
Sensation Seeking Scale (SSS)	40 items	4-point likert scale (1 = *strongly disagree*; 2 = *not completely disagree*; 3 = *only partially agree*;4 = *completely agree*)	Aluja. Kuhlman. & Zuckerman. (2010) Italian version: Rossier et al., 2016
Food Neophobia Scale (FNS)	10 items	7-point Likert scale (1 = *disagree strongly*; 7 = *agree strongly*)	Pliner & Hobden. 1992 Italian version: Laureati et al., 2018
Sensitivity to Reward and Punishment (SPSRQ)	41 items (reduced version)-2 subscales -Sensitivity to Reward (SR) -Sensitivity to Punishment (SP)	Yes/No	Torrubia et al.,2001 Italian version: Spinelli et al., 2018

3.4.5 Evoked context

Before sample hedonic evaluation, consumers were asked to freely describe the most preferred situation for consuming a cocktail using an open-ended question. Consumers were asked to answer the open-ended question: "Describe the ideal situation in which you prefer to drink a cocktail." Consumers were encouraged to provide details in terms of time of day, place, company, etc. This was done to collect textual responses on the most preferred situation for consuming a cocktail, as well as to create an immersive scenario before the sensory evaluation of the six cocktail samples (Hein et al., 2010, 2012).

3.4.6 Cocktails evaluation

The cocktails samples were presented monadically in 100ml transparent glasses labeled with three-digit randomized numbers and served in individual sensory boots under white light. Consumers were instructed to mix each sample with a straw, take a regular sip through the straw, and start the evaluation. Serving order followed a fully-randomized and balanced design. After tasting a sample, water and plain crackers were served as palate cleansers.

a) Liking

On Day 1, before starting the hedonic evaluation of cocktail samples, consumers were introduced to and familiarized with the use of the Labelled Affective Magnitude scale (LAM; Cardello & Schutz, 2004; Schutz & Cardello, 2001). The scale anchors were spaced according to the values of Cardello & Schutz (2004), from *greatest imaginable dislike* (0) to *greatest imaginable like* (100), with neither liked nor disliked set at 50. Consumers were then asked to rate each of the six samples.

b) Emotions elicited by the products and context appropriateness

After the liking evaluation, consumers were asked to rate each of six samples for emotions and context appropriateness using the previously developed questionnaires. Sample descriptors for emotions elicited by the products and context appropriateness were scored on 7-point Likert scales (ranging from *not at all* to *very much*). On Day 2, consumers tasted the samples again and rated the intensity of the sensory descriptors on a 7-point Likert scale ranging from *not at all* to *very much*.

c) Complexity was evaluated using a 7-point scale ranging from *simple* to *complex* (adapted from Soerensen, Waehrens, & Byrne, 2015).

d) Complexity criteria were investigated by the use of the developed list of seven options, of which consumers could only select one, with the exception of writing a subjective criterion if the list was found to be not satisfactory.

e) Sensory descriptors intensity was evaluated on Day 2 by the use of the developed product-specific questionnaire using a 7-point Likert scale ranging from *not at all* to *very much*.

3.4.7 PROP taster status

After sample evaluation, consumers were introduced to the use of the generalized Labeled Magnitude Scale (gLMS; Bartoshuk et al., 2004). Instructions were given that the top of the scale represented the most intense sensation that consumers could ever imagine experiencing and a variety of remembered sensations from different modalities including loudness and oral pain/irritation were recalled to train the respondents (Bajec & Pickering, 2008; Kalva, Sims, Puentes, Snyder, & Bartoshuk, 2014; Webb, Bolhuis, Cicerale, Hayes, & Keast, 2015). To practice the use of the scale, consumers rated the intensities of the brightest light they had ever seen following the procedure described in Dinnella et al. (2018). Two replicates of the intensity rating of a 3.2 mM PROP solution were obtained using the gLMS Scale (Bartoshuk et al., 2004) and these were used to establish PROP taster status based on *a priori* cut-offs: Non-Taster (arbitrary cut-off gLMS < moderate, 17) and Super Taster (arbitrary cut-off gLMS > very

strong, 53) (Fischer et al., 2013; Monteleone et al., 2017).

3.4.8 Quantification of Fungiform Papillae density

A set of pictures of the tongue of each consumer were collected for assessing fungiform papillae density (FPD). Consumers were asked to rinse their mouths before the beginning of the test. Consumers were seated in a dark comfortable room and were asked to swab the anterior portion of the dorsal surface of the tongue with household blue food coloring, using a cotton-tipped applicator. Then, they were asked to position the tongue on a holder were pictures of the tongue were taken (Figure 7). Pictures were recorded using a portable USB digital microscope (2.0 megapixel image sensor, MicroCapture version 2.0 bundle software, ×20 to ×400 magnification ratio) (Masi, Dinnella, Monteleone & Prescott, 2015). Pictures captured the anterior part of the tongue and a ruler fixed behind the tongue provided a spatial calibration. The picture acquisition had a duration of around 5–10 min per subject. At least 5 digital pictures of the tongue were recorded. From each picture, a rectangle (400 × 200 pixels), orthogonal to the median line and located 0.5 cm from the tongue tip, was selected. The selected area was chosen as representative of fungiform papillae density (FPD) on the whole tongue (Correa, Hutchinson, Laing, & Jinks, 2013; Shahbake, Hutchinson, Laing, & Jinks, 2005). The elaborated pictures were automatically counted by the use of a specifically created Matlab script (Mathworks, ver. R2015a) based on the procedure used by Kraggerud et al. (2009) and adapted by Piochi et al., (2017). Circular-like elements counted by the script were converted into fungiform papillae density (FP/cm^2: FPD). To validate the data from the automated count, manual papillae counting (Nuessle, Garneau, Sloan, & Santorico, 2015) was performed on a sub-group of 50 randomly extracted pictures. Manual counts of FPD resulted significantly positively correlated with those derived from the automated counts ($R = 0.67$, $p < 0.001$). Data analyses in the following sections are based on the automated counts.

Fig.7. Set-up of standardized tongue-holder

3.4.9 Consumers' implicit reactions to pictures of alcoholic and non-alcoholic beverages

On Day 2, before the evaluation of sensory descriptor intensity, an implicit test following the Go/NoGo procedure was used to study consumers' implicit reactions to pictures representing alcoholic or non-alcoholic beverages.

3.4.9.1 Image selection

The stimulus set consisted of three pairs of grayscale pictures of alcoholic and non-alcoholic beverages forming a set of six images. These images were selected and adapted from the "Amsterdam Beverage Picture Set," a previously validated database of pictures of beverages (ABPS, Pronk, van Deursen, Beraha, Larsen, & Wiers, 2015). First, 26 images of alcoholic and non-alcoholic beverages were selected from the database. Each image represented a bottle or a drink carton presented near a glass filled with the corresponding beverage. To avoid the possible influence of colors and brands, images were transposed into grayscale pictures and the brand on the bottle was masked. Also, the chosen images were equated in size and central alignment within the image. The luminance of each image was equated to match the overall mean luminance of all pictures by employing gradation curve adjustments. For image modification, Adobe Photoshop® 7.0 was used. Six of the 26 images were selected by the means of a pilot study in which 30 participants were asked to look at each picture and answer a forced-choice question to evaluate whether the picture was related to an alcoholic or a non-alcoholic beverage or they were not sure. This was done to ensure that the transposition of the images in grayscale did not affect the ability of consumers to categorize the picture as alcoholic or non-alcoholic. Only the pictures that were correctly categorized by 100% of the subjects were selected for use in the experimental procedure, leaving three pairs of pictures of 1) beer vs orange juice_a; 2) champagne vs milk; 3) red wine vs orange juice_b. All the images were shown on a white background. All stimuli were centrally displayed and inscribed in a square of 280 × 280 pixels to equal the maximal extension corresponding to a picture size on the screen of about 10.3 × 10.3 cm. At a viewing distance of about 90 cm, the visual angle subtended was 6.5°.

3.4.9.2 Go/NoGo procedure

Consumers were seated in front of a computer screen located inside a sensory booth. The experimental procedure was divided into three blocks, randomly presented. Each block consisted of two phases: I) product presentation phase, and II) the implicit test phase (Go/NoGo), which was composed of two sub-sessions. In the first phase, consumers were required to observe a pair of images representing an alcoholic and a non-alcoholic beverage presented one after another for a duration of 5000ms and to report the name

of each beverage (e.g., “beer” or “orange juice”). In this phase, consumers were instructed to observe the products (and relative product name) that would then be presented in the subsequent phase to facilitate product recognition. In the following phase, the consumers underwent two sub-sessions following a Go-NoGo response procedure (Nosek & Banaji, 2001). Specifically, in each sub-session, one of the previously shown products was presented as a Standard-NoGo (75% = 75 trials) and the other product as a Target-Go (25% = 25 trials) for a total of 100 stimuli (per sub-session). Consequently, for one sub-session the alcoholic beverage was the Target-Go and the non-alcoholic beverage was the Standard-NoGo, whereas in the subsequent sub-session, the conditions were inverted and the non-alcoholic beverage was presented as the Target-Go and the alcoholic beverage version as the Standard-NoGo. This inversion was to ensure that the same beverages were presented in both conditions. The order of presentation of the alcoholic and non-alcoholic beverages as Target-Go or Standard-NoGo was randomized and counterbalanced across consumers. As in the classical Go-NoGo tasks, consumers were requested to respond to Target-Go stimuli (pressing the spacebar) and not to respond to Standard-NoGo stimuli. Each picture was presented for 500ms and intermixed by a variable inter-stimulus interval ranging from 1500 to 2500ms. The entire experiment lasted about 40 min. Before the experiment, the consumers were asked to perform a training session to familiarize them with the task. The stimuli used in the training were different from those used in the experiment. A representative image of the whole procedure is reported in Figure 8.

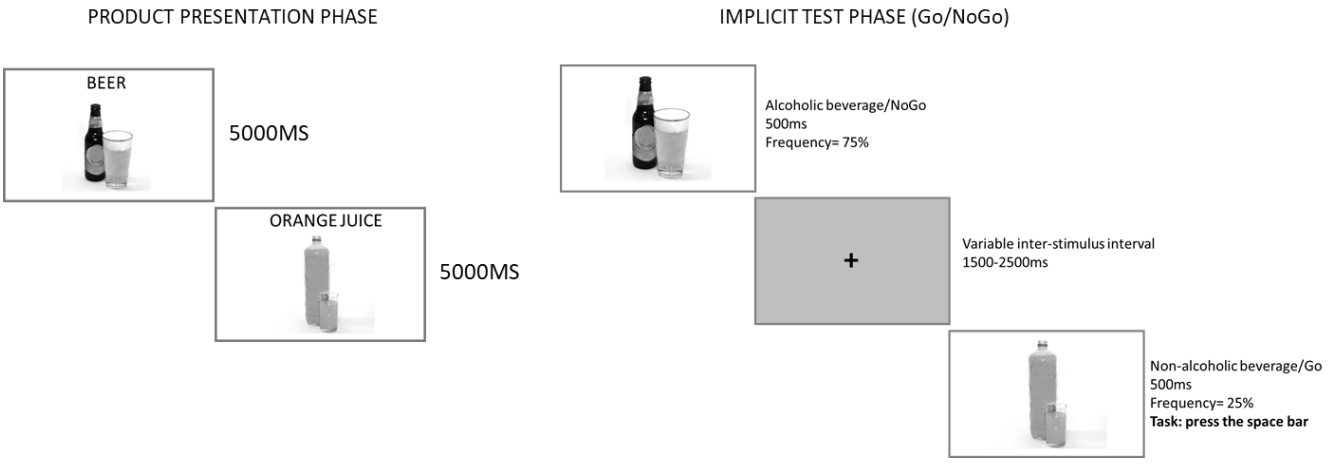

Fig.8. Experimental procedure for product presentation and Go/NoGo phase.

3.4.10 Implicit brand perception

On day 2, after the evaluation of sample sensory properties, consumer implicit attitudes for the bitter ingredient brand were investigated. The Affect Misattribution Procedure (AMP) (Payne, Cheng, Govorun, & Stewart, 2005) was employed to tap implicit emotional responses to the original brand and to a "neutral" brand. The AMP procedure was programmed using E-prime software (Psychological Software Tools, Pittsburgh, PA), which recorded consumer responses. Consumers were seated in front of the computer and they were told that they would see pairs of pictures flashed one after the other. The first image (prime stimulus) was alternatively the bitter ingredient brand (*Campari*) or a "neutral brand", whereas the second image was always a Chinese character. Brand image was composed of the original brand of the company (a rectangle containing the company brand name), whereas a neutral brand was composed of a rectangle of the same size of the original brand image containing a random letter string (same number of letters as the original brand). Random letters were selected to avoid the possibility of resembling existing Italian words. Consumers were told that the first image simply served as a warning signal for the Chinese character and that they should do nothing with that. Consumers were instructed to press a key labeled "negative emotion" if they judged the Chinese pictograph to be not emotionally pleasant and a key labeled "positive emotion" if they judged it to be emotionally pleasant. Consumers were additionally instructed that "Sometimes, the images presented prior to the Chinese characters can bias your responses on those characters. Thus, please try to make sure that your responses are not influenced by these images". During each trial of the priming task, the brand image appeared in the center of the screen for 20ms, followed by a blank screen for 125ms, and then a Chinese pictograph for 100ms. Following the pictograph, a pattern mask consisting of black and white "noise" appeared until the participant responded. The next trial began as soon as consumers made a response. Consumers completed a total of 100 randomly ordered trials, composed of 50 neutral and 50 original brand primes. One hundred different Chinese characters were used as targets. Each pictograph was paired with a prime picture in a new random order generated by the computer program for each participant. For a schematic representation of the experiment see Figure 9.

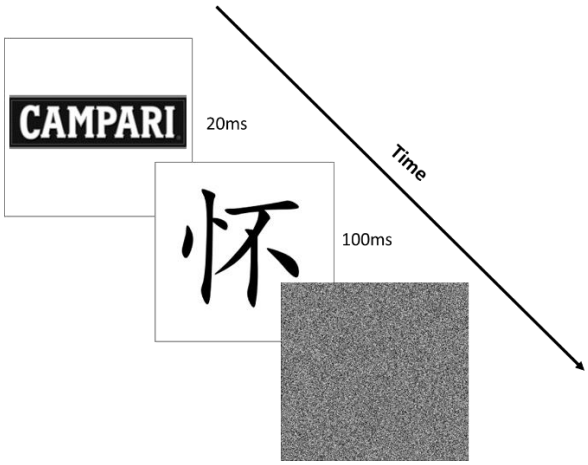

Fig.9. Representative stimuli used in the Affect Misattribution Procedure in the real brand condition.

3.5 Data analysis

Descriptive statistics were preliminarily applied to study all variables. Correlations between variables were explored with Pearson coefficient.

3.5.1 Questionnaire development

A semiotic methodology (Spinelli, Masi, Dinnella, Zoboli, & Monteleone, 2014) was used to analyze consumer responses in one-to-one interviews to determine which emotions respondents considered relevant to describe their product experience. The same methodology was applied to consumer responses about context, sensory characteristics and complexity. Furthermore, the semiotic methodology was used to identify seven complexity criteria based on the ranking according to complexity and the criterion provided to explain this ranking by consumers.

3.5.2 Consumers' implicit reactions to pictures of alcoholic and non-alcoholic beverages

Seven consumers were excluded by the analysis due to not having completed the experimental procedure, leaving a sample of 152 consumers. Trials with an RT of less than 150ms, reflecting anticipation, were excluded from analyses. The outcome variable was the reaction time (RT) in milliseconds during correct "go" trials for the different pictures. RT were analyzed by a two-way ANOVA mixed model (consumers as random factor). Fisher's LSD test was used for post-hoc comparison of means.

3.5.3 Individual differences in cocktail perception and liking

Individual differences in consumer liking for cocktails and their relationship with sensory attributes were analyzed by means of an Internal Preference Map (IPM). For this purpose a Principal Component Regression (PCR) was performed, liking data was used as the X matrix and mean sensory attribute data

as the Y matrix (IPM). Samples were included as dummy variables (down-weighted in the X data matrix) to improve the visual interpretation of the results (Martens & Martens, 2001). The output of the analysis is summarized in a map (correlation loading plot), in which samples, consumers and sensory properties are shown. Circles in the plot corresponding to 100% and 50% explained variance for each variable for the two components were drawn. The analysis was performed using Unscrambler™ (Camo ® Inc., Oslo, Norway) version 10.1. In order to identify groups of consumers who had similar liking patterns for the samples, a hierarchical cluster analysis (HCA) was performed on data on consumer coordinates for the first three PCR components. Euclidean distances and Ward's aggregation method (Ward, 1963) were considered.

Two-Way analysis of variance was performed on overall liking, emotions, sensory properties and context appropriateness scores considering consumer segment, sample and their interaction as fixed sources of variance. When significant effects were established, Fisher's LSD test was used for post-hoc comparison of means.

Three different Multiple Factor Analyses (MFAs) (Escofier & Pages, 1994) were computed to study differences between clusters as a function of descriptor domains (emotions, contexts and sensory). Each dataset contained data averaged across samples for each domain for the three consumer clusters. To do this, for each domain, the data table was built crossing the products, on rows, with the attributes on columns for the consumer clusters.

Three other MFAs were computed to further explore relationships between emotions elicited by the products, context appropriateness and sensory properties within the three consumer clusters. Each matrix included emotional, contexts and sensory attributes of one cluster. Every MFA dataset included data averaged across samples and only attributes that significantly discriminated between the samples assessed by ANOVA ($p \leq 0.05$).

The non-parametric Kruskal–Wallis test was applied to determine the statistical significance of differences in familiarity (online questionnaire) for the six names of cocktails being part of the experimental set and other thirty-seven cocktails between the three clusters identified. The Steel-Dwass-Critchlow-Fligner procedure was used for multiple pairwise comparisons (Gibbons & Chakraborti, 2011; Hollander & Wolfe, 1999).

Base-10 logarithm of annual consumption was calculated for general and specific alcoholic beverages (Cherpitel et al., 1995). Obtained scores were used to determine whether significant differences in general

and specific alcohol consumption ($p \leqslant 0.05$) between clusters were found throughout a one-way ANOVA (cluster as factor). Further One-way ANOVA models were employed to test differences in age, fungiform papillae density and involvement with cocktails (cluster as factor, α= .05).

ANOVA was used to evaluate differences in the proportion of "positive emotion" responses as a function of prime (Campari brand vs neutral brand) in the general population. Then, the positive effect of brand priming for each consumer was calculated by subtracting the proportion of "positive emotion" responses for the Chinese character preceded by the original brand and the proportion of "positive emotion" responses for the Chinese character preceded by the neutral brand (Payne et al., 2005). Then consumers were divided into sub-groups representing consumers that are characterized by low and high positive implicit brand effect based on the median.

Descriptive statistics were used to study PROP status distributions. The effect of the cluster on gender, PROP non-taster and supertaster status and membership of sub-groups for implicit brand effect and personality traits were tested using Chi-square test.

Statistical analyses were performed using XLSTAT software version 2018.1 (Addinsoft, Long Island, NY, USA).

3.5.4 Individual differences in the preferred context of cocktail consumption

3.5.4.1 Open-ended questions

The responses to the open-ended questions were analyzed by coupling semiotics (Greimas, Courtés, Crist, & Patte, 1982; Rastier, 2015; Violi, 2001) and statistical analysis. Semiotic analysis was conducted following the original approach proposed by Spinelli et al. (2017). First, a semiotic analysis was conducted on a subset of answers (10% of the whole sample) to identify the main semantic categories that underlay the texts (Greimas et al., 1982; Rastier, 2015; Rastier, Collins, & Perron, 2016). This qualitative analysis was performed to figure out the linguistic and semantic structure of the texts and the sources of ambiguities in the words used by consumers to guide the subsequent preprocessing procedure and the interpretation of the results. Then, a pre-processing of the textual data was performed to identify the lexical units that were meaningful to consider in the analysis. In this phase, four main steps of text analysis were performed: 1) normalization (text correction); 2) detection of multiwords (sequence of two or more lexemes that stand for only one meaning) and stopwords (words considered irrelevant to the analysis); 3) lemmatization (grouping of different inflected forms of a word); 4) selection of the keywords (=meaningful in this context) that will be included in the analysis. Text analysis was performed with T-

LAB 9.1 software (Lancia, 2012). Each step was supervised by an experienced and qualified researcher (PhD) in semiotics. For a more detailed description of the procedure see Spinelli et al. (2017). Statistical analysis was conducted applying a Thematic Classification (Lancia, 2012,2015) based on a not centered version of PDDP (Principal Direction Divisive Partitioning) cluster analysis as proposed by Boley (1998). The analysis procedure is based on six steps: 1) a data table was constructed containing the texts x lexical units (lemmas as decided in the preprocessing stage), with presence/absence values; 2) Term Frequency Inverse Document Frequency (TF-IDF) was applied for normalization and scaling of row vectors to unit length (Salton, 1989); 3) unsupervised clustering (PDDP) was used to assign each text to a theme, each of which should exhibit "internal homogeneity" and "external heterogeneity" (Savaresi & Boley, 2004; Steinbach, Karypis, & Kumar, 2000); 4) a partition in three thematic clusters was selected on the basis of the visual inspection of the dendrogram and qualitative evaluation of the coherence between the words grouped in the themes; 5) a contingency table was constructed (lemmas x themes); 6) Chi-square test was used to select the "characteristic" lemmas of each cluster applied on 2 × 2 contingency tables that have as row the considered lemma (1st row) and the other lemmas (2nd row) and as column the considered theme (1st column) and the other themes (2nd column). The label to indicate the theme was chosen by the inspection of the lexical units assigned to each theme considering their score (weight) and their characteristic lemmas.

3.5.4.2 Consumers' individual differences in the thematic clusters

General and specific alcoholic beverages consumption scores were computed by calculating the base-10 logarithm of annual consumption (Cherpitel et al., 1995).

One-way ANOVA models were employed to test differences between the clusters in: age, involvement with cocktails, alcoholic beverages consumption, reported bitterness intensity (PROP), fungiform papillae density and personality questionnaires scores (cluster as factor), (α= .05).

Two-way analysis of variance was used to determine the main effects of sample, cluster and their interaction on cocktails liking scores.

Statistical analyses were performed using XLSTAT software version 2018 1 (Addinsoft, Long Island, NY, USA).

3.5.5 Individual differences in perceived cocktail complexity

The non-parametric test of Kruskal–Wallis was applied to determine statistical significance of differences in cocktail name familiarity (online questionnaire) for the six cocktails of the experimental set at panel level. A familiarity index was then computed as the sum of familiarity scores for the six

evaluated cocktails, and consumers were divided into two sub-groups representing low and high scores of familiarity based on the median. Individuals with a score corresponding to the median were not considered.

Two-way ANOVA mixed models (factors: samples and consumers) with consumers as a random factor were carried out to detect significant differences between the samples in the perceived complexity, liking, emotions, context appropriateness, and sensory responses both at panel level and within each cluster. Post-hoc Fisher (LSD) multiple comparison tests ($\alpha = .05$) were carried out to determine significant differences between the samples.

Individual differences in complexity ratings were explored by means of a Principal Component Analysis (PCA) using products as rows and consumers as columns. Samples were included as dummy variables (down-weighted in the X data matrix) to improve the visual interpretation of the results (Martens & Martens, 2001). The output of the analysis is summarized in a map (correlation loading plot) showing samples and consumers. Individual respondents are represented on the map by points, which can be considered as the end points of vectors from the origin. The direction of the vector represents the direction of increasing personal "complexity" for a consumer, and the length indicates how well that individual is represented by the dimensions that are being plotted (i.e., how much variance is explained). If a participant's point is far from the origin, the scores of that person are explained well by one or two "complexity" dimensions (Monteleone, Frewer, Wakeling, & Mela, 1998). Moreover, the correlation plot allows the possibility of drawing circles in the plot corresponding to 100% and 50% explained variance for each variable for the two components.

First, hierarchical clustering was performed using Ward's method (Ward, 1963) on consumer coordinates for the first three components. An agglomeration schedule and dendrogram were inspected, allowing us to decide that a two-cluster solution would be optimal. Next, a K-means cluster analysis was performed (with two clusters). The K-means clustering partition method was selected as recommended by Wajrock et al. (2008). One-way ANOVA was employed to test age and personality trait differences between the two clusters (cluster as factor) ($\alpha = .05$).

In addition to its use to determine the statistical significance of differences in familiarity for the six cocktails, the Kruskal–Wallis was also applied to test the differences between clusters for 43 alcoholic cocktails.

Two-way analysis of variance was used to determine the main effects of sample, cluster, and their interaction on liking and questionnaire item scores (emotions, contexts, sensory). Post-hoc Fisher (LSD) multiple comparison tests ($\alpha = .05$) were carried out to determine significant differences between samples.

Chi-square tests were used to test the independence between the rows and columns of four contingency tables containing membership of the complexity clusters as columns and, alternatively, familiarity sub-groups, gender, choice of a specific complexity criterion, and PROP status as rows.

To explore complexity meaning in consumers, frequencies of choice, percentages, and cumulative distribution were computed on the choice of one option from the list of seven complexity criteria made by consumers.

To further explore the relationships between complexity scores, emotions elicited by the products, context appropriateness, and sensory data in the two consumer clusters, two different Multiple Factor Analyses (MFAs) (Escofier & Pages, 1994), one for each consumer cluster, were computed. Each matrix included the emotional, context, and sensory attributes of one cluster. Sensory attributes were divided into two groups, one for appearance and one for the other sensory properties (tastes, flavors, and mouthfeels). Liking and complexity were included as supplementary variables. Both datasets included data averaged across samples by cluster and only the attributes that significantly discriminated between the samples assessed by ANOVA ($p < 0.05$).

Three further MFAs were then computed to study differences between clusters as a function of descriptor domains (emotions, contexts, and sensory). Each dataset contained data averaged across samples for each domain for both consumer clusters. To do this, for each domain the data table was built crossing the products on rows, with the attributes on columns for both consumer clusters. This analysis provides a representation of each sample as a compromise between the two consumer clusters. The partial points (circles) relative to a same sample are connected to their center of gravity (squares). Principal Component Analysis was performed using Unscrambler version 10.1, Camo. All other statistical analyses were performed using XLSTAT software version 2018 1 (Addinsoft, Long Island, NY, USA).

4. Results

4.1 Development of product-specific questionnaires for emotions, sensory properties and context appropriateness

As a result of the semiotic analysis, semantic categories for each domain were selected (17 in the emotional field, 18 in contexts, and 23 in sensory properties). Samples were found to elicit a variety of emotions covering both negative and positive valence and different degrees of arousal (e.g., *calm/merry*). An important dimension in describing context appropriateness was the social dimension (appropriate to be drunk alone/with friends/with one's partner). In addition, locations (e.g., *at the disco*) were listed, as well as situations (e.g., *on holiday*). The interviews showed that consumers were able to describe a variety of sensory differences between the samples covering aspects related to appearance, tastes, flavors, and texture. The developed questionnaires are reported below.

Table 4. Developed questionnaires for emotions (A), context appropriateness (B), and sensory properties (C). In the second column sentences of the questionnaire are reported. For readability, a word summarizing its meaning in figures and discussion is reported in the second column for each, but consumers exclusively evaluated the complete sentences.

EmoSemio questionnaire for alcoholic cocktails.

A	EmoSemio questionnaire real sentences	Emotions labels
Question	**How does it make you feel?**	
1.	It makes me merry	Merry
2.	It makes me happy	Happy
3.	It reassures me	Reassured
4.	It relaxes me	Relaxed
5.	It calms me	Calm
6.	It relief me	Relieved
7.	It makes me feel carefree	Carefree
8.	It makes me feel confident	Sure of myself
9.	It makes me curious	Curious
10.	It surprises me	Surprised
11.	It makes me feel indifferent	Indifferent
12.	It bores me	Bored
13.	It disappoints me	Disappointed
14.	It annoys me	Annoyed
15.	It disgusts me	Disgusted
16.	It makes me feel uncomfortable	Uncomfortable
17.	It makes me feel sad	Sad

Context appropriateness questionnaire for alcoholic cocktails.

B	Context appropriateness questionnaire Complete item	Context appropriateness Labels
Question B1	**It seems a cocktail proper to be drunk:**	
1.	When I am alone	Alone
2.	In couple	Couple
3.	With friends	Friends
Question B2	**How much this cocktail seems appropriate in each situation?**	**Contexts**
4.	As an aperitif before dinner	Aperitif
5.	After dinner	After dinner
6.	As a digestive	Digestive
7.	In the disco	Disco
8.	At a party	Party
9.	At home	Home
10.	On holiday	Holiday
11.	In a business meeting	Meeting
12.	In a cocktail bar	Cocktail bar
13.	On summer	Summer
14.	On winter	Winter
15.	When I want to have fun	Fun
16.	When I want to relax	Relax
17.	In a pub	Pub
18.	When I want to take a moment for myself	Moment for myself

C	Sensory questionnaire real sentences	Sensory labels
Question 1	**Look at this cocktail. how does it seem the colour?**	**Appearance**
1.	Clear	Clear
2.	Inviting	Inviting
3.	Intense	Intense
Question 2	**Taste this cocktail. how it seems to you?**	**Sensory**
4.	Bitter	Bitter
5.	Sweet	Sweet
6.	Sour	Sour
7.	Alcoholic	Alcoholic
8.	It tastes like herbs	Herbs
9.	It tastes like chinotto	Chinotto
10.	It tastes like rhubarb	Rhubarb
11.	It tastes like medicine	Medicine
12.	It tastes like peach	Peach
13.	It tastes like citrus	Citrus
14.	It tastes like cherries	Cherries
15.	It tastes like aged	Aged
16.	It tastes like spices	Spices
17.	Sparkling	Sparkling
18.	Leave the mouth clean	Clean mouth
19.	Dense	Dense
20.	Fresh	Fresh
21.	It tingles the throat	Tingles
22.	Light	Light
23.	It has a persistent taste	Persistent

Also, from the interview analysis, it emerged that the criteria behind the consumer concepts of complexity were mainly related to sensory aspects (more bitter taste; darker color; alcohol content), preparation (difficult to prepare), number of ingredients, and unfamiliarity. This aspect was studied to develop a question to investigate consumer complexity criteria (Table 5).

Table 5. Complexity criteria forced-choice question

Has a greater alcohol content	☐
Is not familiar to me	☐
Is more bitter	☐
Has a darker color	☐
Has a larger number of ingredients	☐
Is more difficult to prepare	☐
Other [Text entry]	☐

4.2 Consumer characterization

Consumers were characterized for demographics, oral responsiveness measures, alcoholic beverages consumption and personality traits. The general PROP taster status distribution was relatively different compared to the expected values reported in population studies, with a higher percentage of non-taster (25% expected; 33% observed), a quite lower percentage of medium taster (50% expected; 46% observed) and supertasters (25% expected; 20% observed). Mean fungiform papillae density (FDP) from automated count showed the same normal distribution ($W \geq 0.991$; $p = 0.37$), and comparable descriptive statistic values as the general population (Piochi et al., 2017). An adequate internal consistency as measured using Cronbach's alpha (Nunnally, 1978) was found for psychological scales and questionnaires: Behavioral Inhibition System subscale (BIS)= 0.76; Behavioral Activation System subscale (BAS)= 0.66; Barratt Impulsiveness Scale (BIS-11)= 0.80; Sensation Seeking Scale (SSS)= 0.89; Sensation Seeking subscales: Thrill and Adventure-Seeking (TAS)= 0.83; Disinhibition (Dis)= 0.73; Boredom Susceptibility (BS)= 0.74; Experience Seeking (ES)= 0.62 was not considered due to low internal consistency. Food Neophobia Scale (FNS)= 0.89; Sensitivity to Reward subscale (SR)=0.92 and Sensitivity to Punishment subscale (SP)= 0.84. BIS and BAS showed comparable descriptive statistic values as Italian and non-Italian populations (Balconi & Vanutelli, 2016; Tapper et al., 2015). Descriptive statistics of consumers impulsivity scores, measured with BIS-11, were in line with studies both on Italian and U.S. nonclinical participants (Fossati et al., 2001; Patton et al., 1995). Sensation seeking mean score (mean= 100.72, sd= 16.2) was found to be higher as compared to the Italian population (mean=92.8 ,sd= 15.7) and several non-Italian countries (Rossier et al., 2016, for details). Food neophobia was lower (mean= 22.41, range= 10-56) than in the general population (mean= 27.4, range= 10-69, Monteleone et al., 2017). Sensitivity to Punishment (SP) was in line with previous studies involving Italian participants whereas Sensitivity to Reward (SR) was found to be higher in our sample (mean= 8.48, sd= 3.58) as compared to the Italian population (mean= 5.64, sd= 3.56) as reported in studies that used the same version of the questionnaire (SPSRQ reduced version, Spinelli et al., 2018). For details on consumer characteristics and alcoholic beverages consumption data see Table 6.

Table 6. Consumer characteristics

Sex	**Males**		**Females**						
	46.54%		53.46%						
Age	**Mean**	**SD**	**Range**						
	25.39	5.24	19-40						
Fungiform papillae density (FPD)	**Mean**	**SD**	**Range**						
	42.82	16.93	3.5-88						
PROP status	**Nontasters**			**Medium tasters**			**Superstasters**		
	%	**Mean**	**Range**	**%**	**Mean**	**Range**	**%**	**Mean**	**Range**
	33.77	6.14	0-17	46.36	33.98	18-52.5	19.87	66.42	53-94
General alcohol consumption									
Alcoholic beverages of any kind	**Low (0-11/year)**			**Medium (15-52/year)**			**High (104-312/year)**		
	29.94%			27.39%			42.68%		
Weekly alcohol consumption									
Cans of beer (330ml)	**0-2**			**3-4**			**5 or more**		
	66.24%			20.38%			13.38%		
Glasses of wine (125ml)	**0-2**			**3-4**			**5 or more**		
	61.15%			21.66%			17.20%		
Shots of liquor (40ml)	**0-1**			**2-3**			**4 or more**		
	66.88%			29.94%			3.18%		
Cocktails (1 unit)	**0-1**			**2-4**			**5 or more**		
	63.69%			26.75%			9.55%		
Personality									
	Mean			**SD**					
Barrat Impulsiveness Scale (Bis-11)	63.43			9.70					
BIS/BAS scale									
Behavioral Inhibition System (BIS)	21.00			3.79					
Behavioral Activation System (BAS)	41.92			3.64					
Sensation Seeking Scale (SSS)	100.72			16.20					
Sensitivity to Reward and Punishment (SPSRQ)									
Sensitivity to Reward (SR)	8.48			3.58					
Sensitivity to Punishment (SP)	10.23			5.37					
Food Neophobia Scale (FNS)	22.41			10.81					

Table 7. Pearson correlation coefficients within the personality traits, taste functions and measures of alcoholic beverages consumption. Significant correlations are emboldened ($p < 0.05$).

	PROP	FPD	BIS	BAS	BIS-11	SR	SP	SSS	FNS
PROP	**1**								
FPD	-0.025	**1**							
BIS	**0.178**	0.067	**1**						
BAS	-0.032	0.034	0.074	**1**					
BIS-11	0.092	0.028	0.146	**0.283**	**1**				
SR	**-0.177**	0.039	-0.044	**0.430**	**0.275**	**1**			
SP	0.117	0.035	**0.620**	-0.024	**0.260**	-0.098	**1**		
SSS	-0.154	-0.054	**-0.296**	**0.411**	**0.384**	**0.368**	**-0.322**	**1**	
FNS	0.034	0.021	**0.197**	0.024	**-0.164**	0.072	**0.204**	**-0.264**	**1**

4.3 Consumers' implicit reactions to pictures of alcoholic and non-alcoholic beverages and brand

An effect of product images category (alcoholic vs non-alcoholic) was found ($F_{(5,151)} = 334.53$, $p < 0.001$) showing that reaction times were faster for alcoholic as compared to non-alcoholic beverage images. Post hoc test revealed that the faster reaction times were recorded for *beer* and *red wine* images, followed by *champagne* image. The slowest reaction times were observed for orange juice_a and milk while for orange juice_b responses were faster, but slower as compared to alcoholic beverages (Figure 10).

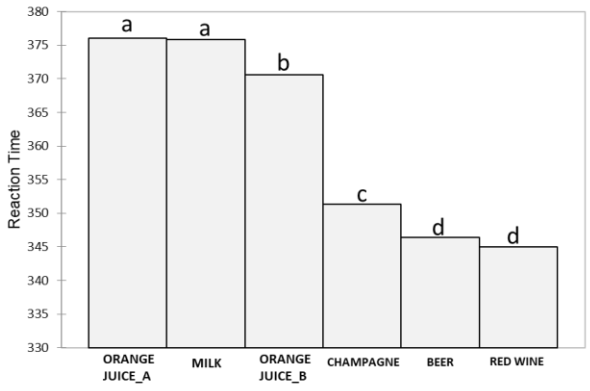

Fig.10. Mean reaction times for beverages pictures as a function of product typology. Different letters indicate significance at 0.05 level by Fisher's LSD.

Data on implicit reaction to *Campari* brand was calculated on 154 consumers. due to missing data of five consumers. A significant effect of prime was found ($F_{(1,153)}= 11.84$, $p< 0.001$) indicating that *Campari* brand prime has determined a higher number of "positive emotion responses" as compared to the neutral brand prime (Figure 11).

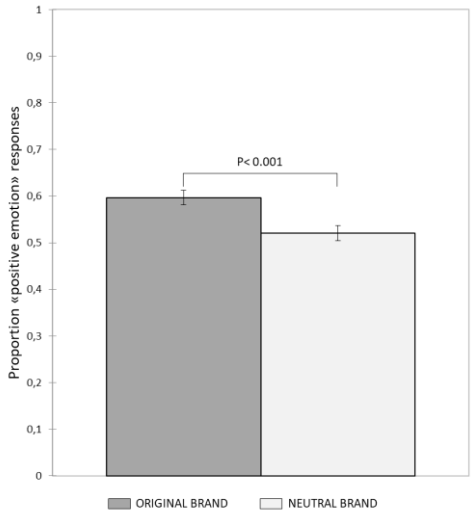

Figure 11. Proportion of "positive emotions" responses as a function of prime typology

4.4 Sample complexity, liking and familiarity at panel level

Complexity. Percentage distribution for the complexity criteria chosen by consumers after samples evaluation from the list of 7 selected items were computed (Figure 12). The item "has a larger number of ingredients" was the most selected followed by "is more difficult to prepare" These two items were selected cumulatively by 81.6% of the panel, with the other 5 items that were chosen by a smaller number of consumers (0-10.7%).

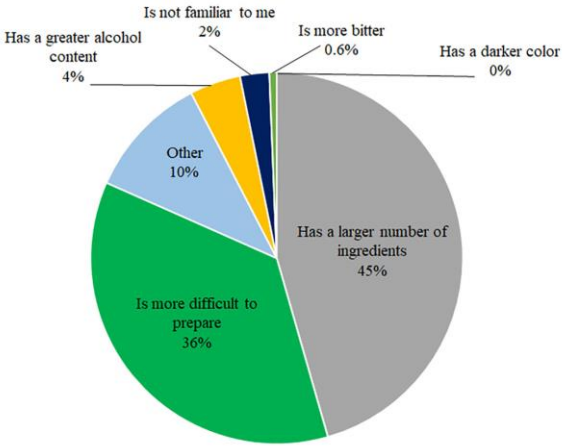

Fig.12. Distribution for the complexity criteria chosen by consumers.

Significant differences were found in consumer overall complexity perception for the products ($F_{(5,158)} = 15.45$, $p < 0.001$) (Figure 13). Sample F was found to be the most complex, followed by E. Sample D was perceived as less complex than F and E, but more complex than A and B. No differences in complexity between samples A, B and C and between C and D were found.

Liking. Significant differences were found in liking for the samples ($F_{(5,158)} = 40.62$, $p < 0.001$), D, C and B were found to be the most liked products, A and E were moderately liked, while F was the least liked product, see Figure 13.

Familiarity. Consumers significantly differed with respect to their familiarity with the cocktails included in the experimental set (Kruskal-Wallis test: $X^2 = 11.07$, $p < 0.0001$). Consumers were more familiar with cocktails C and E, followed by cocktails B, D, A and F (Figure 13).

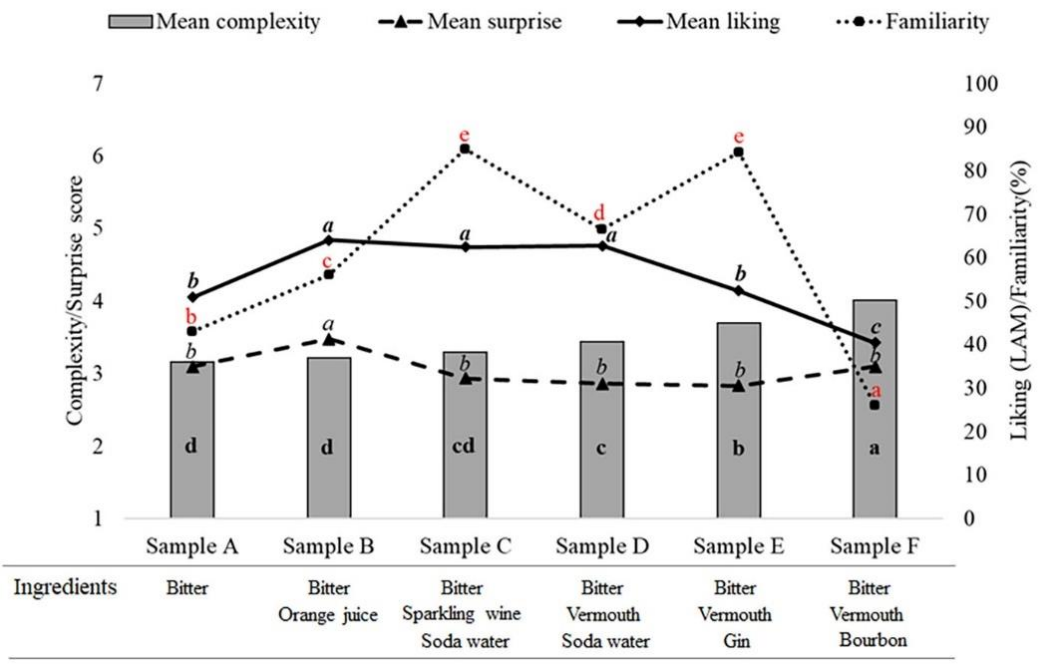

Fig.13. Complexity, surprise and liking mean scores for the six samples. Different letters (complexity = **bold**; surprise = *italic*; liking = ***bold/italic***) indicate significance at 0.05 level by Fisher's LSD post hoc test. Sum of ranks for familiarity is expressed as proportion on theoretical maximum of each sample. Different letters (familiarity = regular in red) represent significant differences between samples as result of Dwass-Steel-Critchlow-Fligner post-hoc test ($p<0.05$).

4.5 Sensory drivers of consumer liking for cocktail samples

In order to explore the relationship between liking and sensory profile, a principal component regression (PCR) was computed. This is an Internal Preference Map. The correlation loading plot from the PCR of the significant sensory attributes for the six cocktail samples is presented in Fig. 14. The first dimension indicates that consumer liking was oriented towards samples B, C and D, on the right side of the map in opposition to samples located on the left side of the plot (Sample A, E and F). Most consumers were located on the right of the first component and their preference was mainly driven by *clean mouth, fresh, light inviting* color and *sparkling.* Consumers were widely spread along PC2 in which Sample A was in opposition to Sample B. Consumers in the bottom right of the plot showed a clear preference toward Sample B, thus both sweet taste, *peach* and *citrus* flavor positively drove the liking of these consumers. PC3 contributed to the separation of Sample A and E on the second dimension (Figure 15). The results from the PCR plot showed a good separation among samples as a function of liking data and indicated that different sensory attributes drove consumers' preferences for the cocktails.

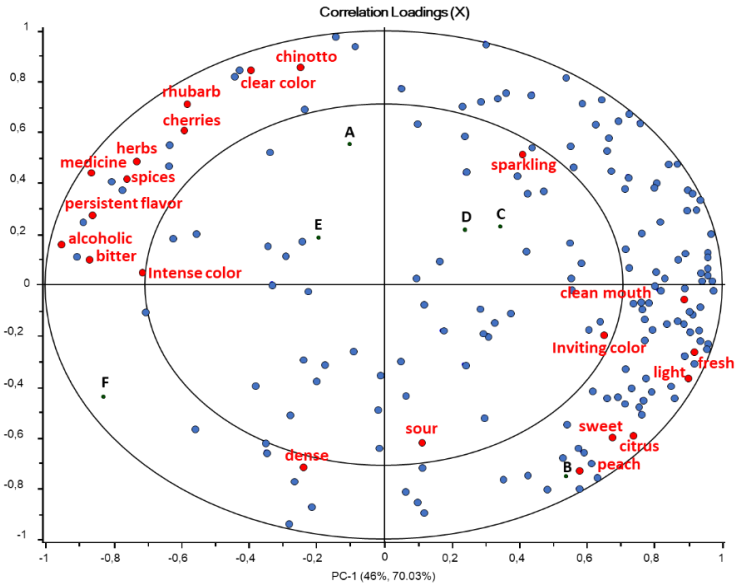

Fig.14. Principal component regression (PCR) correlation loading plot on the first two dimensions (PCs 1 and 2). Coordinates: liking data (X) and sensory properties (Y) of samples. Capital letters indicate the six different samples.

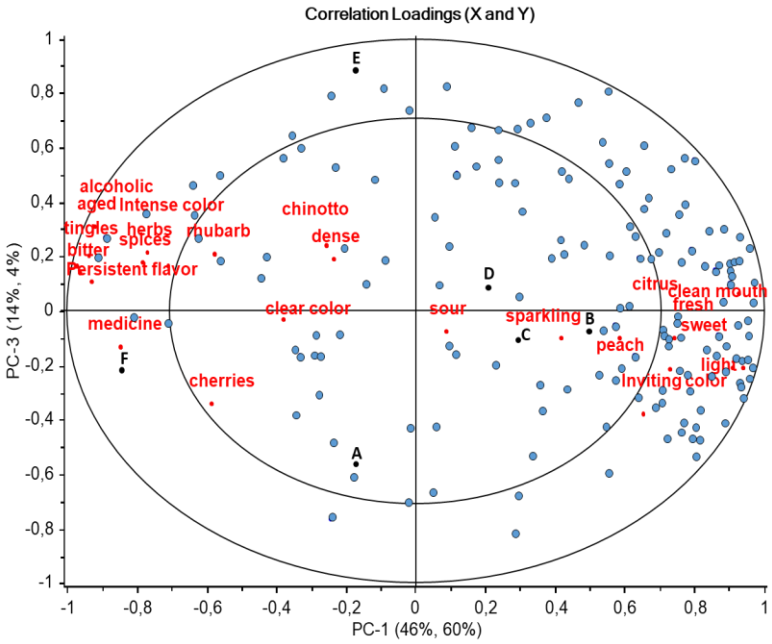

Fig.15. Principal component regression (PCR) correlation loading plot on first and third dimensions (PCs 1 and 3). Coordinates: liking data (X) and sensory properties (Y) of samples. Capital letters indicate the six different samples.

4.6 Consumer clustering

The HCA of consumer coordinates for the first three IPM components identified three clusters of consumers who were relatively homogenous in their liking, hereafter named "Fruit-bitter lovers." composed of 79 consumers (50%); "New-bitter lovers," composed of 35 consumers (22%); and "Classic-bitter lovers," composed of 45 consumers (28%). "Fruit-bitter lovers" liked Sample B (the only fruit-based one) more than the "Classic-bitter lovers," and Samples F and E (the most alcoholic ones) less than the other clusters. "New-bitter lovers" liked Sample F more than both other clusters and Sample B more than the "Classic-bitter lovers." Sample B and F have been more recently introduced to the Italian market, and thus we described this cluster as lovers of "new" cocktails. "Classic-bitter lovers" showed higher hedonic ratings for Samples A, C, D, and E (all classical bitter-based cocktails) than the other groups. In Figure 16, mean hedonic ratings for these three clusters are reported.

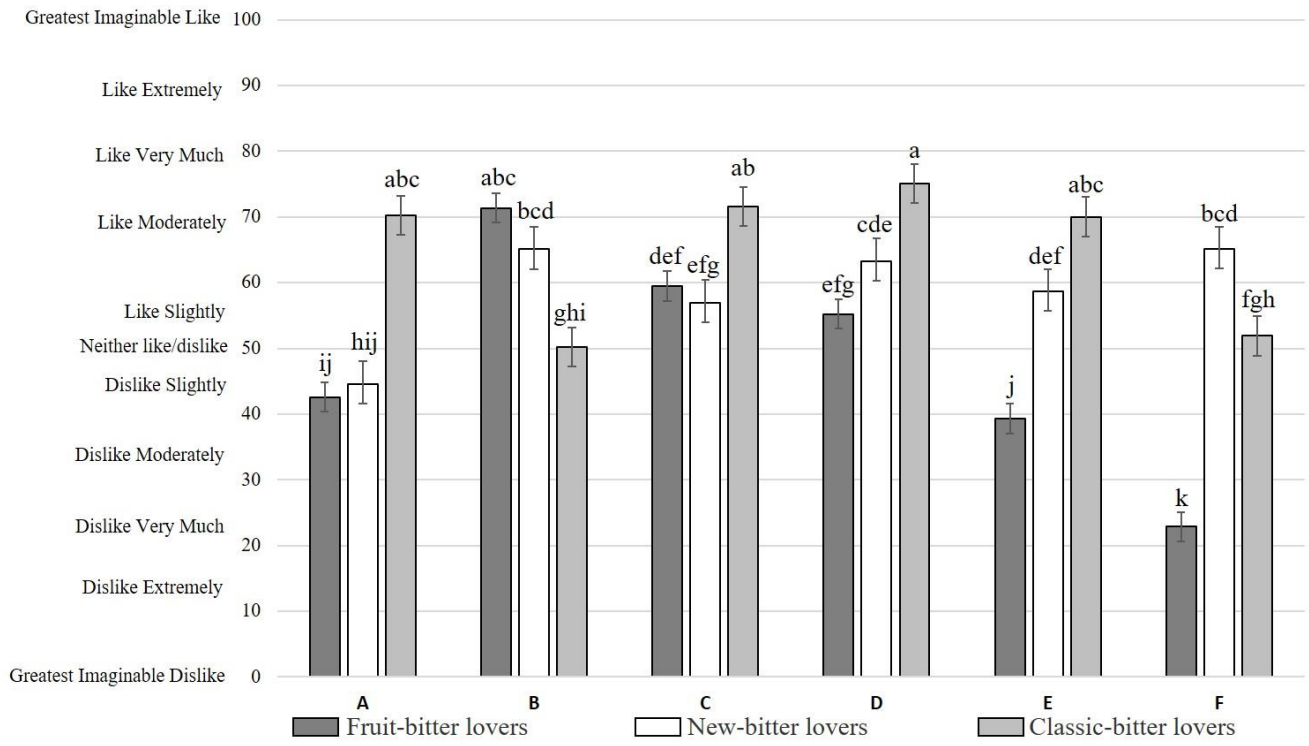

Fig.16. Mean liking scores for the six cocktail samples (A,B,C,D,E,F) expressed by each cluster. [abcdefghijk]Different letters indicate a significantly difference at $\alpha = 0.05$ as determined by Fisher's least significant difference (LSD) test.

4.6.1 Differences in product experience among clusters

To study differences among clusters on the perceived intensity of emotions and sensory properties as well as on context appropriateness, a two-way analysis of variance with interaction on questionnaire scores (cluster and sample as factors) was performed (Table 8). Small differences between the clusters were found in perceived sensory properties, while larger differences were found for emotions and context appropriateness.

Table 8. Two-way ANOVA with interaction (Sample x Cluster): F and p value for each item of the three questionnaires: emotions, contexts, sensory properties (appearance and taste, flavor and mouthfeel). Significant effects are reported in bold ($p<0.05$).

	Effect					
	Sample		**Cluster**		**Sample x Cluster**	
Emotions	F	p-value	F	p-value	F	p-value
Merry	11.803	**< 0.0001**	4.603	**0.032(1)**	3.355	**0.005**
Happy	8.983	**< 0.0001**	4.350	**0.037(1)**	2.373	**0.038**
Reassured	13.595	**< 0.0001**	2.686	0.102	2.685	**0.020**
Relaxed	11.188	**< 0.0001**	2.400	0.122	1.816	0.107
Calm	6.367	**< 0.0001**	4.957	**0.026(1)**	0.495	0.780
Relieved	10.718	**< 0.0001**	2.652	0.104	2.572	**0.025**
Carefree	8.074	**< 0.0001**	4.036	**0.045(1)**	2.648	**0.022**
Confident	4.661	**0.000**	0.746	0.388	2.760	**0.017**
Curious	8.442	**< 0.0001**	3.010	0.083	2.812	**0.016**
Surprised	3.577	**0.003**	0.366	0.545	3.401	**0.005**
Indifferent	3.232	**0.007**	1.407	0.236	1.374	0.232
Bored	0.628	0.678	9.574	**0.002(2)**	2.059	0.068
Disappointed	8.509	**< 0.0001**	4.102	**0.043(2)**	2.276	**0.045**
Annoyed	21.799	**< 0.0001**	7.477	**0.006(2)**	1.241	0.288
Disgusted	24.284	**< 0.0001**	4.315	**0.038(2)**	0.508	0.771
Uncomfortable	12.284	**< 0.0001**	5.158	**0.023(2)**	0.742	0.592
Sad	7.539	**< 0.0001**	2.053	0.152	1.201	0.307

	Factors					
	Sample		**Cluster**		**Sample x Cluster**	
Contexts	F	p-value	F	p-value	F	p-value
Alone	1,57	0,165	15,31	**< 0,0001**	7,81	**< 0,0001**
Couple	11,30	**< 0,0001**	5,61	**0,004**	8,50	**< 0,0001**
Friends	4,75	**0,000**	0,52	0,592	6,14	**< 0,0001**
Aperitif	38,81	**< 0,0001**	8,80	**0,000**	4,41	**< 0,0001**
After dinner	14,94	**< 0,0001**	2,47	0,085	3,36	**0,000**
Digestive	23,76	**< 0,0001**	10,38	**< 0,0001**	0,43	0,932
Disco	1,99	0,077	0,06	0,936	3,24	**0,000**
Party	2,64	**0,022**	0,86	0,421	2,94	**0,001**
Home	1,24	0,286	19,50	**< 0,0001**	3,91	**< 0,0001**
Holiday	11,05	**< 0,0001**	1,20	0,300	5,50	**< 0,0001**
Meeting	7,33	**< 0,0001**	10,91	**< 0,0001**	3,16	**0,001**
Cocktail bar	1,69	0,132	0,29	0,743	5,45	**< 0,0001**
Summer	29,25	**< 0,0001**	0,61	0,540	4,52	**< 0,0001**
Winter	28,31	**< 0,0001**	10,43	**< 0,0001**	1,97	**0,033**
Fun	1,70	0,131	4,75	**0,009**	5,97	**< 0,0001**
Relax	2,60	**0,024**	7,02	**0,001**	9,78	**< 0,0001**
Pub	4,51	**0,000**	0,55	0,576	1,92	**0,039**
Moment for me	129,24	**< 0,0001**	3,40	**0,034**	0,87	0,557

	Factors					
	Sample		**Cluster**		**Sample x Cluster**	
Appearance	F	p-value	F	p-value	F	p-value
Clear	129,24	< **0,0001**	3,40	**0,034**	0,87	0,557
Inviting	0,66	**0,650**	1,64	0,194	8,63	< **0,0001**
Intense color	13,91	< **0,0001**	0,52	0,592	1,28	0,237
Sensory						
Bitter	56,78	< **0,0001**	2,35	0,096	0,74	0,682
Sweet	49,63	< **0,0001**	3,79	**0,023**	0,90	0,525
Sour	3,63	**0,003**	11,16	< **0,0001**	1,44	0,155
Alcoholic	110,52	< **0,0001**	0,85	0,427	0,35	0,964
Herbs	41,42	< **0,0001**	5,07	**0,006**	0,38	0,954
Chinotto	34,64	< **0,0001**	4,71	**0,009**	0,69	0,727
Rhubarb	9,74	< **0,0001**	2,96	0,052	0,94	0,494
Medicine	15,61	< **0,0001**	20,97	< **0,0001**	3,88	< **0,0001**
Peach	88,55	< **0,0001**	1,23	0,293	0,71	0,709
Citrus	73,84	< **0,0001**	6,51	**0,002**	0,43	0,932
Cherries	5,23	< **0,0001**	0,29	0,747	0,47	0,906
Aged	93,64	< **0,0001**	0,18	0,834	0,53	0,867
Spices	19,63	< **0,0001**	3,46	**0,032**	0,37	0,957
Sparkling	30,14	< **0,0001**	1,56	0,210	0,21	0,995
Clean mouth	11,92	< **0,0001**	2,80	0,061	0,62	0,792
Dense	24,54	< **0,0001**	0,77	0,460	0,85	0,573
Fresh	53,41	< **0,0001**	1,62	0,197	0,47	0,908
Tingles	25,79	< **0,0001**	0,34	0,707	0,44	0,922
Light	117,58	< **0,0001**	2,94	0,053	0,60	0,813
Persistent	51,35	< **0,0001**	0,30	0,735	0,43	0,928

Sensory properties. A significant effect of cluster was found for 34.8% of the sensory properties included in the questionnaire: *medicine* higher and *sweet* and *citrus* lower in Fruit-bitter lovers; *chinotto* higher in Fruit-bitter lovers than Classic-bitter lovers, with no significant difference between New-bitter lovers and other clusters; *herbs* and *spices* lower in New-bitter lovers than the other clusters; *clear* higher in New-bitter lovers than Classic-bitter lovers, with no significant difference between Fruit-bitter lovers and other clusters; and *sour* lower in Classic-bitter lovers. A significant interaction between cluster and sample was found only in two cases, *inviting* and *medicine*, with higher scores for *inviting* and lower

scores for *medicine* in Fruit-bitter lovers than other clusters for Sample B. This may be explained by the hedonic connotation of these sensory descriptors.

Emotions. A significant effect of cluster was observed for 88.2% of the emotions included in the questionnaire. When differences in emotions were found, Fruit-bitter lovers reported lower positive as well as higher negative emotions than other clusters for all samples, with Sample B the only exception. Conversely, Classic-bitter lovers showed higher scores for descriptors that highlight a positive emotional engagement with the cocktails of the sample set in line with the liking pattern. In particular, we found *merry*, *confident*, and *reassured* higher in Classic-bitter lovers; *happy*, *relaxed*, *calm*, *relieved*, *carefree*, *curious*, and *surprised* lower in Fruit-bitter lovers; and *disappointed*, *annoyed*, *disgusted*, *uncomfortable*, and *sad* higher in Fruit-bitter lovers. An interaction between cluster and sample was found for each emotion; Sample B showed higher scores for positive as well as lower scores for negative emotions in Fruit-bitter lovers and New-bitter lovers than Classic-bitter lovers, and Sample F showed the same pattern for New-bitter lovers as the other clusters.

Context appropriateness. A significant effect of cluster was observed for 55.5% of the contexts included in the questionnaire, with *couple*, *aperitif*, *digestive*, *home*, *winter*, *fun*, and *moment for myself* higher in Classic-bitter lovers; *alone* and *meeting* lower in Fruit-bitter lovers than the other two clusters; and *relax* lower in Fruit-bitter lovers than Classic-bitter lovers, with no significant difference between New-bitter lovers and other clusters. A significant interaction between cluster and sample was present mainly for Samples B and F. For Sample B, higher scores for 10 of the 18 contexts were reported by Fruit-bitter lovers than the other clusters; this means that this sample was considered more appropriate for the vast majority of the contexts for this cluster. New-bitter lovers considered Sample F more appropriate for some contexts such as *home* and *pub*, as well as for an *aperitif*. In addition, they considered this cocktail more appropriate to be consumed both *alone* and *as a couple*, during *summer*, and in a *fun* context.

MFA superimposed a representation of the score plot of each cluster to study differences among clusters in the association between samples and, respectively, sensory properties, emotions, and context appropriateness. The three different MFA partial point representations showed that the three clusters did not differ greatly in their sensory responses to samples (Figure 17), while some differences were found on the first (Samples D and E) and second (Samples A and B) dimensions, or on both (Sample F), in the emotional responses (Figure 18a). In addition, Fruit-bitter lovers reported higher similarity between Samples A, E, and F than the other clusters for emotional responses. Furthermore, differences on the first

(Sample A) and second dimension (all samples with the exception of C) were found to a lower extent for context appropriateness (Figure 18b).

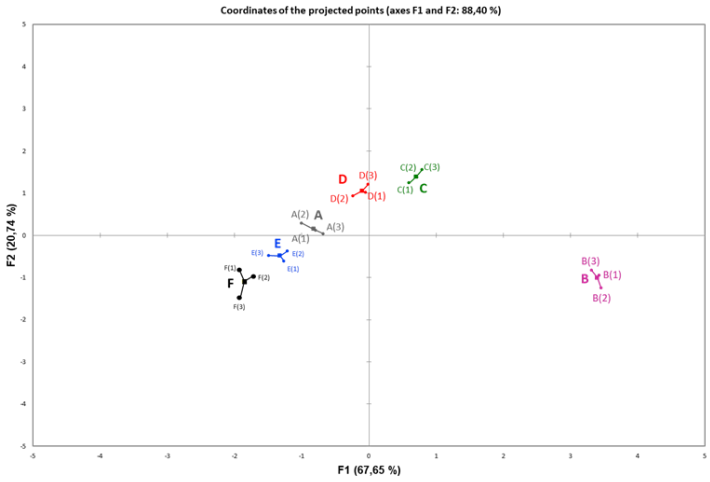

Fig. 17. Superimposed representation of the first two dimensions of the MFA score plots for cocktail sensory properties. Each point represents a cocktail sample (A, B, C, D, E, F). For each cocktail, there are three partial points. Each partial point represents one cluster: Fruit-bitter lovers (1), New-bitter lovers (2) and Classic-bitter lovers (3).

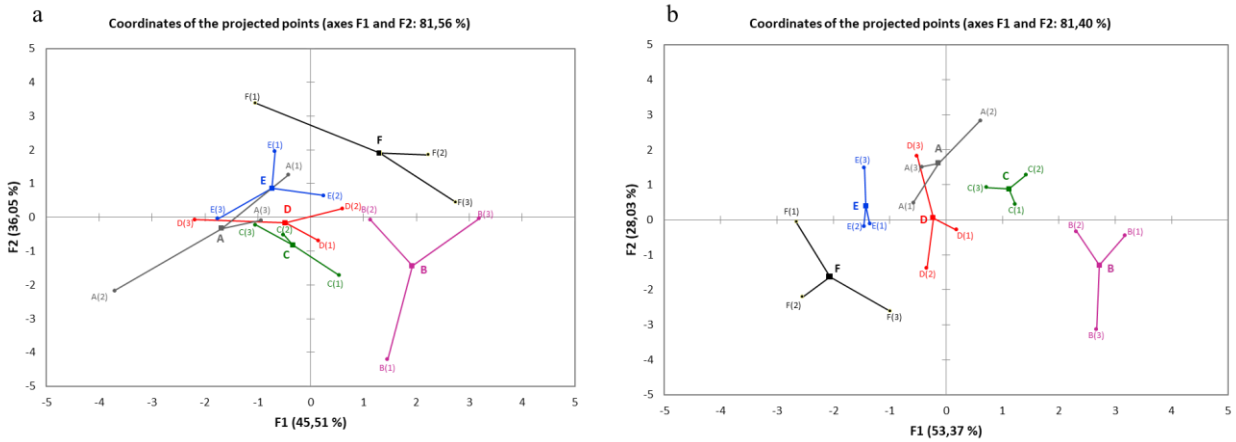

Fig.18. Superimposed representation of the first two dimensions of the MFA score plots for emotions (a) and contexts (b). Each point represents a cocktail sample (A, B, C, D, E, F). For each cocktail, there are three partial points. Each partial point represents one cluster: Fruit-bitter lovers (1), New-bitter lovers (2) and Classic-bitter lovers (3).

Furthermore, MFA correlation circles and score plots were computed to study which cocktails were associated with different emotions and contexts among clusters. New-bitter lovers and Classic-bitter lovers differed greatly in their emotional response to products. MFA clearly shows that the emotions

elicited by products differed according to liking; this is particularly evident in terms of valence, but there are also cases in terms of arousal. For example, *indifference* expressed by Classic-bitter lovers was associated with *surprise* expressed by Fruit-bitter lovers. MFA correlation circles for emotions showed that positive and negative emotions were separated along the second component in Fruit-bitter lovers, with positive emotions located in the lower part of the plot (Fig.19a). The first component instead separated positive and negative emotions in New-bitter lovers and Classic-bitter lovers, but in an inverse way: Positive emotions of New-bitter lovers were associated with negative emotions of Classic-bitter lovers.

Different configurations in the MFA plots among clusters were also found for contexts. The difference in the configuration was smaller than for emotions and with some agreement between clusters, e.g., for the *digestive* and, to a lower extent, the *winter*, *aperitif*, and *summer* contexts. In some cases, similarities were found between two clusters, as between Fruit-bitter lovers and New-bitter lovers for *after dinner* and *pub*. The MFA showed that Fruit-bitter lovers found Sample B appropriate to most contexts (Figure 19b). New-bitter lovers also linked most contexts to a particular Sample (F) but to a lower extent than Fruit-bitter lovers. In agreement with Fruit-bitter lovers, they related Sample B to the context of *aperitif* as well as with *summer* and *party* items. New-bitter lovers and Classic-bitter lovers were opposed along the second component (see for example, *couple*), highlighting that the perceived context appropriateness for these two clusters varied substantially, with the exception of the contexts *digestive*, *after dinner*, *winter*, and *aperitif*.

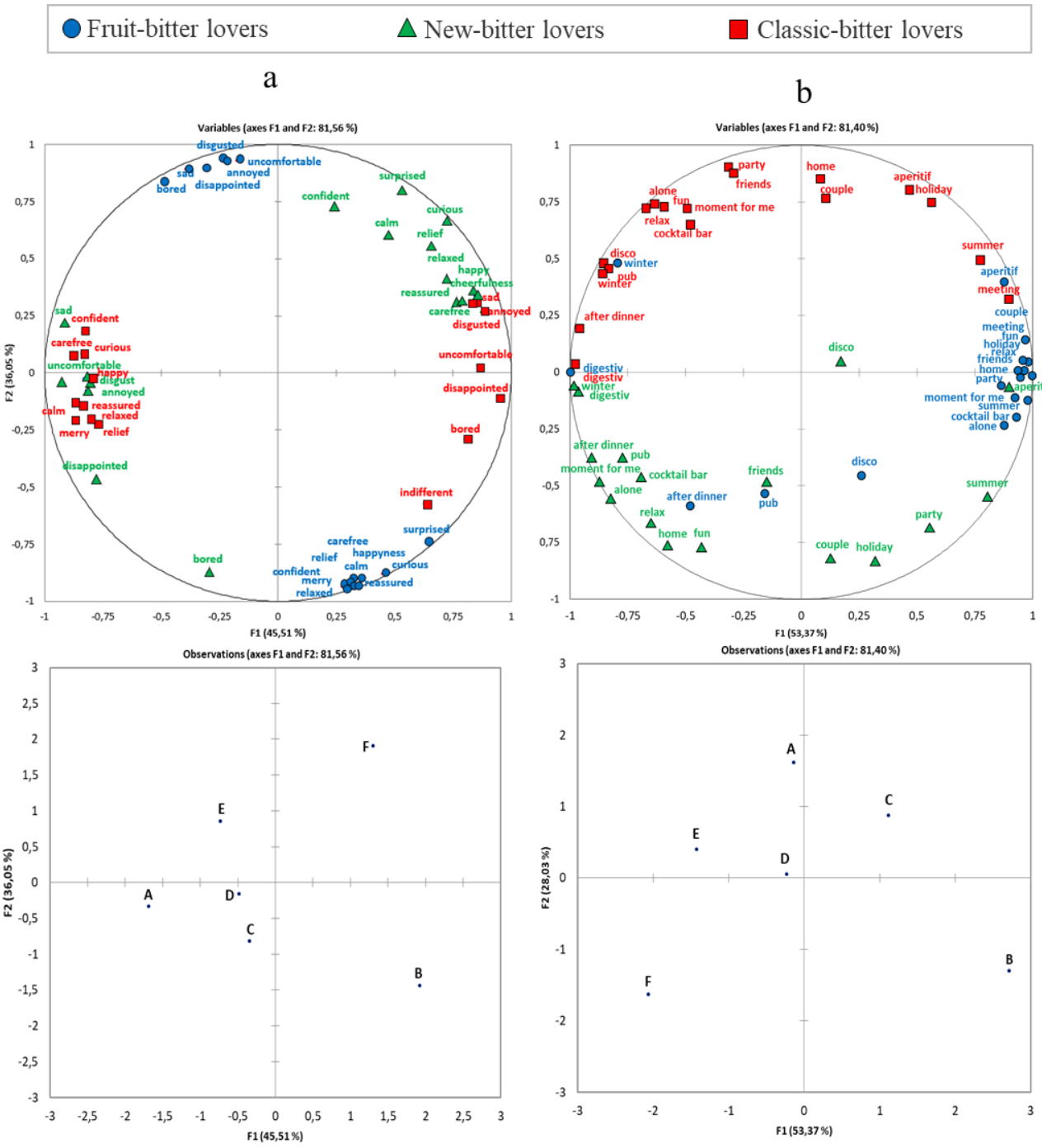

Fig.19. MFAs correlation circles and score plots for emotions (a) and contexts (b). Each cluster is represented with a different shape and color.

4.6.2 Differences in product experience within each cluster and linkages between sensory properties, emotions and context appropriateness

When samples differed in liking within a cluster, they differed largely in emotions and context appropriateness. However, even when two samples were found not to differ in liking within a cluster, some differences in terms of emotion intensity and context appropriateness were found.

Thus, for New-bitter lovers who equally liked samples (Samples B and F) differed in the intensity of some emotions and in the appropriateness of various contexts: Sample F was less associated with *indifferent* and *bored* and more associated with *confident*, *curious*, and *surprised* than Sample B. Considering the contexts, Sample B was found more appropriate for *aperitif* and *summer* than Sample F, which was instead more suitable to be consumed *alone*, *after dinner*, as a *digestive*, in a *cocktail bar*, *during winter*, and in a *relaxing* context. The same samples did not differ in liking also for Classic-bitter lovers, but in this case Sample B was more associated with *indifferent* than Sample F. For these consumers as well, large differences in context appropriateness were found. As for New-bitter lovers, Sample B was found more appropriate for *aperitif* and *summer* and less appropriate for *after dinner* and *digestive* than Sample F. Furthermore, comparing the two samples, it is possible to observe that Sample B was considered more appropriate for *holiday* and *meeting* contexts, whereas Sample F was found more appropriate to be consumed in a *dance club* or in a *pub*, during *winter*, taking *a moment for myself*, or in a *fun* context (Table 9).

Table 9.Mean scores for the six cocktail samples within clusters for each item of the questionnaires on emotions and contexts. [abcdefghij] Different letters indicate statistically significant differences between samples, (p= 0.05) by Fisher's Least Significant Difference post hoc test.

	Fruit-bitter lovers						New-bitter lovers						Classic-bitter lovers					
	Sample						Sample						Sample					
	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
Emotions																		
Merry	2.58 fg	4.29 a	3.49 bcde	3.16 def	2.25 gh	1.85 h	2.40 gh	3.60 bcd	3.17 def	3.46 cde	3.17 def	3.94 abc	3.93 abc	2.89 efg	4.07 abc	4.07 abc	4.13 ab	2,71 fg
Happy	2.54 ghi	4.09 ab	3.44 bcde	2.99 efgh	2.21 ij	1.87 j	2.51 hij	3.49 bcde	3.20 defg	3.37 cdef	3.17 defgh	3.83 abcd	3.6 abcde	2.53 hi	3.91 abc	4.16 a	3.91 abc	2,78 fghi
Reassured	2.47 f	4.11 a	3.4 bcd	3.04 de	2.25 f	1.66 g	2.26 f	3.54 abcd	3.11 cde	3.40 bcd	3.40 bcd	3.67 abc	3.67 abc	2.49 ef	4.02 a	3.99 ab	3.87 ab	2,53 ef
Relaxed	2.56 de	4.06 a	3.32 bc	3.21 bc	2.24 ef	1.78 f	2.20 ef	3.46 abc	3.14 bcd	3.31 bc	3.51 abc	3.77 ab	3.67 ab	2.91 cd	3.62 ab	4.07 a	4.04 a	2,53 de
Calm	2.28 ghi	3.58 abcd	3.08 def	2.89 ef	2.14 hi	1.85 i	2.23 ghi	3.00 def	3.11 cdef	3.26 bcdef	3.54 abcd	3.66 abcd	3.78 abc	2.78 efg	3.42 abcde	3.99 a	3.93 ab	2,56 fgh
Relieved	2.33 ghi	3.76 ab	3.16 bcdef	2.9 defg	2.11 hi	1.70 i	2.27 ghi	3.20 bcdef	2.97 cdef	3.29 bcde	3.37 bcd	3.71 ab	3.56 abc	2.69 efgh	4.02 a	4.13 a	3.80 ab	2,58 fgh
Carefree	2.57 ef	3.99 ab	3.54 bc	3.00 de	2.20 fg	1.94 g	2.40 efg	3.66 abc	3.03 cde	3.63 abc	3.40 bcd	3.80 abc	3.82 ab	2.53 efg	3.91 ab	3.89 ab	4.33 a	2,82 de
Confident	2.32gh	3.43 abc	3.01 cdef	2.9 cdefg	2.35 fgh	1.97 h	2.06 h	2.43 efgh	2.74 defg	3.03 cde	3.26 bcd	3.34 bcd	3.47 abc	2.33 gh	3.53 abc	3.82 ab	4.09 a	2,76 defg
Curious	2.57 efg	4.57 a	3.43 bcd	3.18 bcd	2.37 fg	2.08 g	2.54 efg	3.66 bc	3.26 bcd	3.43 bcd	3.77 bc	4.66 a	3.49 bcd	2.82 def	3.53 bc	3.8 b	3.62 bc	3,07 cde
Surprised	2.67 fgh	3. 9 ab	3.06 defg	2.58 gh	2.32 h	2.59 gh	2.71 fgh	3.29 bcdef	2.77 efgh	3.03 defg	3.77 abc	4.29 a	3.2 cdefg	2.87 defgh	3.4 bcde	3.47 bcd	3.11 cdefg	3,04 defg
Indifferent	2.94 b	2.52 bcd	2.76 bc	2.65 bcd	2.65 bcd	2.25 cd	2.77 bc	3.00 b	2.54 bcd	2.71 bcd	2.54 bcd	2.03 d	2.62 bcd	3.89 a	2.79 bc	2.07 d	2.53 bcd	2,53 bcd
Bored	2.89 abc	1.97 de	2.57 abcd	2.89 abc	2.95 abc	3.13a	3.09 ab	2.94 abc	2.80 abc	2.29 cde	2.31 cde	1.69 e	2.38 bcde	3.20 a	2.60 abcd	2.02 de	2.04 de	2,8 abc
Disappointed	4.09 ab	2.13 g	2.81 cdefg	3.05 cd	4.24 ab	4.73 a	3.83 b	2.80 cdefg	2.97 cde	2.91 cdef	2.97 cde	2.23 efg	2.27 efg	4.04 ab	2.62 defg	2.18 fg	2.22 efg	3,51 bc
Annoyed	3.86 b	1.73 f	2.66 de	2.68 de	3.99 b	5.2 a	3.54 bc	2.11 ef	2.74 cde	2.23 ef	2.71 cde	2.29 ef	1.93 f	3.11 cd	1.82 f	1.58 f	2.02 ef	3,47 bc
Disgusted	4.13 bc	1.57 h	2.67 ef	3.09 de	4.39 b	5.51 a	3.8 bcd	1.94 gh	2.74 ef	2.2 fgh	2.6 efg	2.17 fgh	1.93 gh	3.16 de	1.96 gh	1.67h	1.93 gh	3,49 cd
Uncomfortable	3.11 bc	1.51 g	2.21 def	2.34 def	3.19 b	3.95 a	2.8 bcd	1.51 g	2 efg	1.8 fg	1.94 efg	1.74 fg	1.76 fg	2.6 bcde	1.82 fg	1.38 g	1.56 g	2,53 cde
Sad	2.83 ab	1.58 e	2.10 cde	2.33 bcd	2.92 ab	3.15 a	2.74 abc	1.63 e	2.09 cde	2.09 cde	2.4bcd	1.97 de	1.98 de	2.73 abc	1.78 de	1.82 de	2.02 de	2,91 ab
Contexts																		
Alone	2.21 e	3.71 ab	2.95 cd	3.13 cd	2.35 e	2.05 e	2.69 de	2.74 de	2.49 de	3.23 bcd	3.66 abc	4.26 a	3.76 ab	2.6 de	3.00 abc	3.8 ab	3.89 ab	3,27 bcd
Couple	3.30 ef	5.20 a	4.59 bc	4.01 cd	2.99 f	2.37 g	2.86 fg	4.26 bcd	3.77 de	4.20 bcd	3.77 de	4.14 bcd	4.33 bcd	3.64 def	4.78 ab	4.84 ab	4.84 ab	2,87 fg
Friends	4.75 def	5.73 a	5.39 abcd	5.09 abcde	4.63 efg	4.16 fg	4.26 fg	4.83 bcdef	4.8 cdef	5.54 a	4.8 cdef	5.06 abcde	5.53 ab	3.93 g	5.44 abcd	5.60 a	5.49 abc	4,27 fg
Aperitif	4.34 d	4.99 abcd	5.39 a	4.25 d	2.89 ef	2.05 g	3.46 e	5.11 abc	4.54 bcd	4.6 bcd	3.29 ef	2.94 ef	5.24 ab	4.31 d	5.58 a	5.24 ab	4.40 cd	2,56 fg
After dinner	3.46 fg	3.97 def	3.39 fg	4.53 bcd	4.34 cde	4.35 bcde	4.00 cdef	3.29 fg	3.77 defg	4.40 bcde	4.63 bcd	5.97 a	4.49 bcde	2.93 g	3.71 efg	4.36 bcde	5.07 b	4,84 bc
Digestive	2.66 def	1.77 g	2.48 def	3.00 cde	3.39 bc	3.39 bc	3.20 bcd	2.11 fg	2.94 cde	3.94 ab	4.14 a	4.46 a	2.93 cde	1.79 g	2.38 efg	3.00 cde	3.69 ab	3,76 ab
Disco	3.00 cd	4.51 a	3.54 d	4.14 abcd	4.30 abc	3.78 bcd	3.71 bcd	3.89 abcd	4.23 abcd	4.11 abcd	3.94 abcd	3.89 abcd	4.16 abcd	2.69 e	4.00 abcd	4.44 ab	4.76 a	4,13 abcd
Party	4.35 defgh	5.39 a	4.59 bcdefg	4.67 abcdefg	4.57 cdefg	3.83 h	4.29 efgh	5.31 ab	4.51 cdefgh	5.00 abcde	4.51 cdefgh	4.66 bcdefg	5.11 abc	4.13 gh	4.84 abcdefg	4.96 abcdef	5.07 abcd	4,27 fgh
Home	2.35 fgh	3.39 abcd	2.96 bcdefg	2.77 defg	2.42 efgh	1.91 h	2.31 gh	2.8 cdefg	2.4 efgh	3.09 bcde	3.06 bcdef	3.49 abc	3.80 a	3.16 abcd	3.62 ab	3.82 a	3.38 abcd	3,02 bcdefg
Holiday	4.37 cd	5.90 a	5.04 b	4.51 bcd	3.61 ef	3.34 f	3.49 ef	5.20 ab	4.43 bcd	4.94 bcd	4.11 de	4.83 bcd	4.96 bc	4.73 bcd	5.13 b	4.89 bcd	4.73 bcd	3,60 ef
Meeting	2.70 efg	3.63 ab	3.42 abcd	2.83 cdef	2.02 gh	1.76 h	2.97 bcdef	3.34 abcde	3.00 bcdef	3.67 ab	3.37 abcde	3.51 abc	3.22 abcde	3.69 ab	3.91 a	3.36 abcde	2.76 def	2,40 fgh
Cocktail bar	4.58 cde	5.49 a	4.72 bcde	4.81 abcde	4.52 de	4.24 ef	4.49 de	4.46 de	4.54 de	5.31 abc	4.8 abcde	5.43 ab	5.13 abcd	3.60 f	4.78 abcde	5.13 abcd	5.39 ab	4,36 e
Summer	4.02 efg	6.28 a	5.04 bc	4.28 defg	3.32 h	3.16 h	3.69 fgh	5.63 ab	4.66 cde	4.51 cdef	3.57 gh	4.23 defg	4.71 cd	5.11 bc	5.02 bc	4.84 bcd	4.40 cdef	2,91 h
Winter	4.19 cd	2.78 fg	4.05 de	4.42 bcd	4.3 bcd	4.16 d	3.77 de	2.63 fg	3.40 ef	4.29 bcd	4.51 abcd	4.89 abc	5.11 a	2.53 g	4.27 bcd	5.20 a	5.22 a	4,89 ab
Fun	3.61 cdef	4.62 ab	4.06 bcd	4.00 bcd	3.62 cdef	3.02 ef	3.03 ef	3.66 cdef	3.51 def	4.03 bcd	3.77 cde	4.29 abcd	4.60 ab	2.91 f	4.38 abc	4.62 ab	4.87 a	3,87 bcd

To study differences in the linkages between emotions, contexts, and sensory properties across clusters, three separated MFAs were computed (Figure 20). A clear linkage between sensory properties and emotions was found in Fruit-bitter lovers, mainly organized according to valence. The first dimension

was positively correlated with descriptors related to positive emotions (e.g., *happy*, *curious*, *relaxed*, *confident*), contexts (such as *summer*, *home*, *fun*, *holiday*), *sweet* taste, and *peach* and *citrus* flavor, and with several mouthfeel descriptors (*light*, *fresh*, *clean mouth*). Furthermore, the first dimension of MFA was negatively correlated with negative emotions (*disgusted*, *sad*, *bored*, *disappointed*), contexts (*digestive*), specific flavors (*aged*, *rhubarb*, *spices*, *herbs*), and mouthfeel descriptors (*alcoholic*, *tingles*, *persistent*). The second dimension was positively correlated with *dense* and negatively correlated with *sparkling mouthfeel*. For these consumers, *rhubarb*, *bitter*, *spices*, *herbs*, and *medicine* were associated with *bored*, while *aged*, *alcoholic*, *tingles*, and *persistent* were associated with *disgusted*, *sad*, *disappointed*, and *uncomfortable*. *Peach* and *citrus* were associated with *surprised* and *curious*, *sparkling* with *indifference.*

In New-bitter lovers a clear linkage between sensory properties and emotions was less evident. The first dimension was negatively correlated with positive emotions (such as *curious, surprised, confident,* and *calm*), contexts (such as *cocktail bar, relax,* and *pub*) and sensory properties (*bitter, intense*) and positively correlated with *bored* and *sour* taste. The second dimension was positively correlated with negative emotions (*sad*, *annoyed*) and with *cherries*, *medicine*, and *clear* sensory descriptors. Furthermore, the second dimension was negatively correlated with *light*, *sweet*, *peach,* and *citrus* sensory descriptors and *summer*, *party*, and *holiday* contexts. For these subjects, *sour* was associated with *bored*, while *cherries* was associated with *uncomfortable, disgusted, annoyed,* and *sad*. In addition, *citrus, light, peach, clean mouth*, and *fresh* were associated with *aperitif* and *summer* contexts.

In Classic-bitter lovers, a different configuration was observed. As with Fruit-bitter lovers, the first dimension was positively correlated with descriptors related to positive emotions (e.g., *happy*, *curious*, *relaxed, confident*) and negatively with negative emotions (*indifferent*, *bored, disappointed*). The first dimension was positively correlated with similar contexts as Fruit-bitter lovers (*cocktail bar*, *party*, *fun*) but also with *winter*. In contrast, in this cluster, Dimension 1 was positively correlated with *chinotto* and *rhubarb* flavor and *clear* and *inviting* color and negatively correlated with *peach*, *sweet*, and *sour*. The second dimension was positively correlated with *summer, holiday*, and *meeting* contexts and with the *clean mouth mouthfeel* descriptor. Finally, the second dimension was negatively correlated with flavors such as *medicine*, *alcoholic*, and *bitter* taste. In these consumers, we found an association between *sparkling* and many positive emotions, while *sour, sweet,* and *peach* were associated with *indifferent*. The negative emotions were mainly associated with *dense*, while there were many associations between

sensory properties and contexts. This means that for these consumers, different sensory properties were positively associated with different contexts.

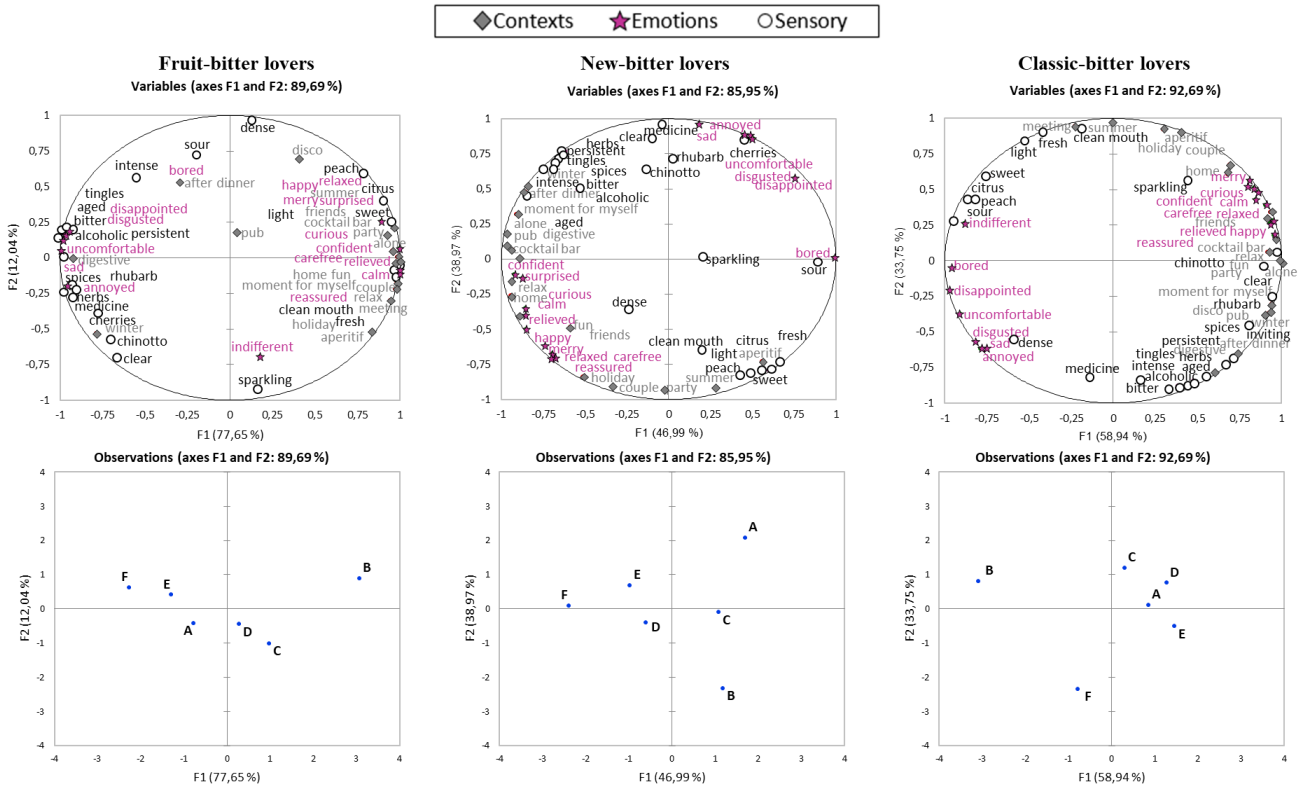

Fig. 20. Correlation circle and score plot on the first and second dimensions of the MFA computed on the scores for emotions, contexts, and sensory properties for each cluster.

4.6.3 Cluster characterization

Gender and Age: The three clusters differed by gender: Classic-bitter lovers included more males, while Fruit-bitter lovers had more females (Table 10). No significant age difference between the three clusters was found (Table 10).

PROP Status: Females and males did not significantly differ in PROP non-taster and supertaster distribution (χ^2= 3.84; p= 0.161). Also, no difference was found for the distribution of non-taster and supertaster in the three clusters (χ^2= 5.99; p= 0.212) (Table 10). The general PROP taster status distribution was quite different compared to the expected values reported in a large sample study on the same age range in Italy (Italian Taste study), with a higher percentage of non-taster (23.2% expected; 32.7% observed), a slightly lower percentage of medium taster (43.6% expected; 46.5% observed) and

quite lower proportion of supertasters (33.2% expected; 20.8% observed). When compared to this population, Fruit-bitter lovers and Classic-bitter lovers were found to significantly differ, with a higher proportion of non tasters (p=0.039) and a lower of supertasters (p=0.008) compared to the expected values.

Table 10. Mean age (ANOVA) and percentages of Gender and PROP status in the three clusters (Chi Square Test) < and > indicate that the observed value is significantly lower or higher than the expected theoretical value (Chi-square per cell significant for α= 0.05; Fisher Exact Probability Test). For PROP status mean values (perceived intensity) and range are also reported.

	Fruit-bitter lovers			New-bitter lovers			Classic-bitter lovers			χ^2	*F*	*p*-value
Variables	**%**	**Mean**	**Range**	**%**	**Mean**	**Range**	**%**	**Mean**	**Range**			
Age		24.75			25.57			26.38			1.42	0.244
Gender										11.93		**0.003**
Females	67.09 >			42.86			37.78 <					
Males	32.91 <			57.14			62.22 >					
PROP status										3.2		0.525
Non tasters	32.91	5.71	0-17	25.71	5.50	1-13	37.78	7.15	0.5-17			
Medium tasters	45.57	34.76	18.5-52.5	45.71	36.03	18-50	48.89	31.2	20-47.5			
Supertasters	21.52	65.30	53-94	28.57	67.4	53.5-82	13.33	68.00	54.5-93.5			

Cocktail familiarity and involvement: Evidence of differences in cocktail familiarity between the three clusters for the cocktails included in the sample set (presented using names) were found (Table 11). No difference in familiarity was found between the three clusters for Sample B. Classic-bitter lovers were highly familiar with all the samples. New-bitter lovers were highly familiar with sample F and A, while Fruit bitter lovers were less familiar with sample F than New-bitter lovers and with all the samples compared to cluster Classic-bitter lovers. For the other 37 cocktails (evaluated as names), Fruit-bitter lovers were more familiar with *Bellini* and *Long Island Iced Tea* as compared to New-bitter lovers, and less familiar with *Old Fashioned* as compared to the other clusters. Classic-bitter lovers were the most familiar with *Negroni Sbagliato* and with *Campari Shakerato*, *Cuba libre*, *John Collins*, *Manhattan*, *Martini dry*, *Old fashioned*, *Old Pal*, *Rusty Nail* and *Whiskey Sour* as compared to Fruit-bitter lovers. No difference in familiarity for cocktail names was found among New-bitter lovers as compared to other clusters. A significant difference between clusters as a function of involvement with cocktails was found ($F_{(2,158)}$ = 4.29, p= 0.016). Post-hoc test showed that involvement with cocktails in New-bitter lovers (mean = 11.04) was lower as compared to Fruit-bitter lovers (mean= 14.12) and Classic-bitter lovers (mean= 13.78).

Table 11. Mean of ranks for familiarity for the samples (Kruskal-Wallis test). Different letters in a row indicate significant differences between clusters as result of Dwass-Steel-Critchlow-Fligner post-hoc test ($p < 0.05$).

Sample	Fruit-bitter lovers	New-bitter lovers	Classic-bitter lovers	p-value
A	70.44 [b]	79.83 [ab]	96.92 [a]	**0.005**
B	77.81	74.71	87.96	0.349
C	77.63 [ab]	68.64 [b]	92.99 [a]	**0.041**
D	71.13[b]	75.44 [b]	99.12 [a]	**0.003**
E	64.30 [b]	78.49 [b]	108.73 [a]	**< 0.0001**
F	72.80 [b]	91.62 [a]	83.60 [ab]	**0.006**

Alcoholic beverages consumption: significant differences were found between the clusters. In Classic-bitter lovers, a higher consumption of beer as compared to the other clusters and liquors as compared to Fruit-bitter lovers was observed. In addition, general alcohol consumption score was found higher for Classic-bitter lovers as compared to Fruit-bitter lovers. No differences were found between clusters for wine and cocktails consumption (Table 12).

Table 12. Alcohol consumption in the three clusters**.** Base-10 logarithm of annual consumption is calculated for general and specific alcoholic beverages (alcohol consumption index). *F* and *p*-values from one-way ANOVAs are reported. Different letters in a row indicate statistically significant differences ($p < 0.05$) in Fisher's Least Significant Difference post hoc test.

Alcohol consumption index	**Fruit-bitter lovers**	**New-bitter lovers**	**Classic-bitter lovers**	***F***	***p*-value**
General alcohol consumption	1.96[b]	1.97[ab]	2.13[a]	3.23	**0.042**
Cans of beer (330 ml) for week	1.53[b]	1.35[b]	1.92[a]	4.47	**0.013**
Glasses of wine (125 ml) for week	1.67	1.72	1.89	0.980	0.377
Shots of liquor (40 ml) for week	1.29[b]	1.43[ab]	1.69[a]	3.41	**0.035**
Glasses of cocktails for week	1.62	1.37	1.64	1.58	0.209

Psychological and personality traits: An adequate internal consistency as measured using Cronbach's alpha was found for Behavioral Inhibition System subscale (BIS)= 0.76; Behavioral Activation System subscale (BAS)= 0.66; Barratt Impulsiveness Scale (BIS-11)= 0.80; Sensation Seeking Scale (SSS)= 0.89; Food Neophobia Scale (FNS)= 0.89; Sensitivity to Reward subscale (SR)=0.92 and Sensitivity to Punishment subscale (SP)= 0.84.

The three clusters differed in their proportion of consumers with high and low BIS scores (χ^2= 6.83, p= 0.033). Classic-bitter lovers was composed of a higher number of consumers with a low BIS score, whereas Fruit-bitter lovers was composed of a higher number of consumers with high BIS score. No significant difference in the proportion of consumers with high or low BAS (χ^2= 0.73, p= 0.692); BIS-11 (χ^2= 4.85 , p= 0.089); SSS (χ^2= 2.08 , p= 0.366); FNS (χ^2= 0.1 , p= 0.608); SR (χ^2= 0.374 , p= 0.829) and SP (χ^2= 1.23 , p= 0.54) was found.

Implicit brand effect: Five consumers were discarded due to missing data, leaving a sample of 154 consumers. A significant effect of prime was found ($F_{(1,153)}$= 11.84, p< 0.001) indicating that *Campari* brand prime has determined a higher number of "positive emotion responses" as compared to the neutral brand prime. A higher number of consumers with a high positive implicit brand effect was found in Classic-bitter lovers as compared to the other clusters (χ^2= 5.99 , p= 0.047).

4.7 Clustering based on preferred context to have cocktails

One hundred and fifty-one text were considered in the analysis, for a total of 8022 words (on average, 52.77 per subject). Data of eight consumers were not included because their answers were too short to be submitted to text analysis. The Thematic Classification allowed the identification of the most frequent themes on preferred contexts of cocktail consumption among consumers. Three thematic clusters were identified, respectively composed of 36.42%, 21.19% and 42.38% of the consumers. Each theme was labeled according to the focus on the preferred context, as follows:

- Theme 1: RELAX: this cluster focuses on an experience of relaxation, comfort (with the characteristic lemmas /not too noisy/, /nicely/, /suffuse light/, /intimate/) and on the social dimension (/chatting/). These individuals describe their preferred context as a not too crowded situation, with sofas, soft background music and the possibility to eat something (/buffet/).
- Theme 2: SOCIABILITY: this cluster focuses mostly on the social aspects of cocktail consumption (e.g. /new acquaintances/, /social/, /laugh/, /joke/). These individuals describe their preferred context as a party or a disco at night where they can seek new experiences. Feelings such as /cheerfulness/ and /carefree/ are also related to their preferred context.
- Theme 3: APERITIF: this cluster focuses on a before dinner situation (e.g. /aperitif/, /evening/, /friends/). They describe their preferred context as an open-air popular place or a home situation where they can meet friends to recover from work. They focus on the capacity of cocktails in stimulating appetite, but they report also beer or wine as an alternative.

Table 13 presents the characteristic lemmas for each theme, i.e. the lemmas significantly associated with each theme based on the Chi-square test.

Table 13. Characteristic lemmas of each theme: lemmas [English translation] significantly associated with each theme. chi-square and examples of words grouped in each lemma are reported. Asterisks indicate significance (*** = $p < 0.001$; ** = $p < 0.01$; * = $p < 0.05$).

Theme	Lemma	X^2	Examples of words grouped in each lemma
1	*musica [music]*	23.012^{***}	canzone; canzoni; musica; musicale
1	*sottofondo [background music]*	19.062^{***}	sottofondo; soft
1	*non troppo rumoroso [not too noisy]*	14.537^{***}	senza interferire mentre conversiamo; non troppo alto; non troppo assordante; non troppo elevato
1	*luce [light]*	14.319^{***}	luce; luci
1	*soffuso [suffuse light]*	12.721^{***}	soffusa; soffuso; soffuse
1	*chiacchierare [chatting]*	10.189^{**}	chiacchiera; chiacchierare; chiacchiere; conversazione
1	*intimo [intimate]*	9.597^{**}	intima; intimamente; intimi; intimo
1	*non alto volume [not at high volume]*	9.597^{**}	basso volume; non molto alta; non sia troppo alta
1	*divanetti [sofas]*	8.06^{**}	divanetti; divanetto; divano; poltrona; poltroncine
1	*buffet*	7.799^{**}	cibo; crostino; salatini; noccioline; patatine; stuzzichino; tacos
1	*vecchio [old]*	6.345^{*}	vecchia; vecchie; vecchio
1	*consumare [consuming]*	5.988^{*}	consumare; consumato; consumo
1	*rock*	5.05^{*}	rock
1	*non troppo affollato [not too crowded]*	4.458^{*}	non sicuramente molto affollato; non troppo affollato; non troppo pieno di persone
1	*sentire [hear]*	4.458^{*}	senti; sentire; sento

Theme	Lemma	X^2	Examples of words grouped in each lemma
2	*nuovo [new]*	28.665***	nuova; nuove; nuovi; nuovo
2	*stagione [season]*	20.047***	stagione
2	*scherzare [joke]*	16.696***	scherzo; scherzando; scherzare
2	*nuove conoscenze [new acquaintances]*	15.698***	conoscenze; conoscere; persone mai incontrate prima
2	*ridere [laugh]*	15.515***	ride; ridendo; ridere; risate
2	*assaggiare [to taste]*	13.348***	assaggiare; assaggio
2	*diverso [different]*	13.348***	diversa; diverse; diversi; diverso
2	*sociale [social]*	13.348***	sociale; sociali
2	*senza_pensieri [carefree]*	12.19***	senza pensare; senza pensieri; spensieratezza
2	*dopo_una_giornata [after a day]*	9.243**	dopo una giornata
2	*festa [party]*	8.647**	festa; feste; festeggiare
2	*notte [night]*	6.434*	nottata; notte
2	*discoteca [disco]*	6.273*	disco; discopub
2	*allegria [cheerfulness]*	6.08*	allegria; allegro; felici
2	*giardino [garden]*	6.08*	giardino

Theme	Lemma	X^2	Examples of words grouped in each lemma
3	*vino. birra [wine. beer]*	14.657^{***}	birra; prosecco; vino
3	*aperto [open-air]*	10.421^{***}	aperte; aperti; aperto
3	*casa [home]*	10.271^{***}	casa
3	*inverno [winter]*	9.753^{**}	invernale; inverno
3	*aperitivo [aperitif]*	8.753^{**}	aperitivo
3	*gioco [game]*	8.123^{**}	giocando; giochi; giochiamo; gioco
3	*sera [evening]*	6.887^{**}	sera; serata; serate; sere
3	*frequentato [popular]*	6.494^{*}	frequentate; frequentato
3	*superalcolici [spirits]*	6.494^{*}	liquori; superalcolici
3	*estate [summer]*	5.539^{*}	estate; estivo; estiva; estive
3	*lavorativo [working day]*	5.355^{*}	lavorativa; lavoro
3	*amici [friends]*	4.545^{*}	amica; amici; amico; amiche

4.7.1 Cluster characterization for socio-demographics, PROP responsiveness, FPD, alcohol consumption and involvement for cocktails

The three thematic clusters did not differ in gender (X^2= 4.26 p= 0.119), age and reported PROP intensity. No significant relationship was found between FPD and PROP responsiveness (r = -0.3, p = 0.702). No differences were observed for FPD between the three clusters ($F_{(2,150)} = 2.57$, $p < 0.080$).

Significant differences between clusters as a function of involvement with cocktails measured with Kähkönen & Tuorila, (1999) involvement scale were found. Post-hoc test showed that consumers belonging to thematic cluster SOCIABILITY were less involved with cocktails as compared to other clusters.

No significant differences were found between the thematic clusters for alcoholic beverages consumption in general. On the contrary, for specific alcoholic beverages consumption, a significant difference was found only for spirits, with the consumers in the cluster SOCIABILITY that reported a higher intake of spirits than the APERITIF cluster whereas no difference was found between RELAX and other clusters. Also, no difference was found for the intake of beer, wine or cocktails among the three clusters.

Results from one-way ANOVAs are reported in Table 14.

Table 14. Consumers characteristics in the three thematic clusters. Base-10 logarithm of annual consumption is calculated for general and specific alcoholic beverages (alcohol consumption index). Different letters indicate significance at 0.05 level by Fisher's LSD post hoc test.

Variables	**RELAX**			**SOCIABILITY**			**APERITIF**			**p-value**	χ^2
Age	25.67			24.87			25.72			0.742	
Involvement with cocktails	34.95 [a]			26.00 [b]			34.22 [a]			**0.013**	
Alcohol consumption index											
General alcohol consumption	2.00			2.07			1.96			0.439	
Cans of beer (330 ml) for week	1.58			1.68			1.57			0.832	
Glasses of wine (125 ml) for week	1.69			2.05			1.63			0.063	
Shots of liquor (40 ml) for week	1.47 [ab]			1.79 [a]			1.24 [b]			**0.009**	
Glasses of cocktails for week	1.61			1.67			1.55			0.755	
PROP status										0.369	0,428
	%	Mean	Range	%	Mean	Range	%	Mean	Range		
Non tasters	40	6,68	0-17	37,50	5,96	0-16	26,56	5,91	0-15		
Medium tasters	45,45	36,92	21-52.5	46,88	30,67	18.5-51.5	46,88	32,83	18-46.5		
Supertasters	14,55	64,31	53.5-83	15,63	59,50	56.5-68.5	26,56	69,76	53-94		

4.7.2 Cocktails liking by clusters differing in preferred context

Significant effects of sample ($F_{(5,2)} = 23.86$, $p < 0.0001$) and cluster ($F_{(5,2)} = 3.05$, $p = 0.048$) were found on liking ratings, while no significant interaction was observed ($F_{(5,2)} = 0.29$, $p < 0.982$). Post-hoc test (Fisher LSD) indicated that mean liking for the six evaluated cocktails was higher in the cluster APERITIF as compared to RELAX whereas no significant differences between SOCIABILITY cluster and other clusters were found (Figure 21).

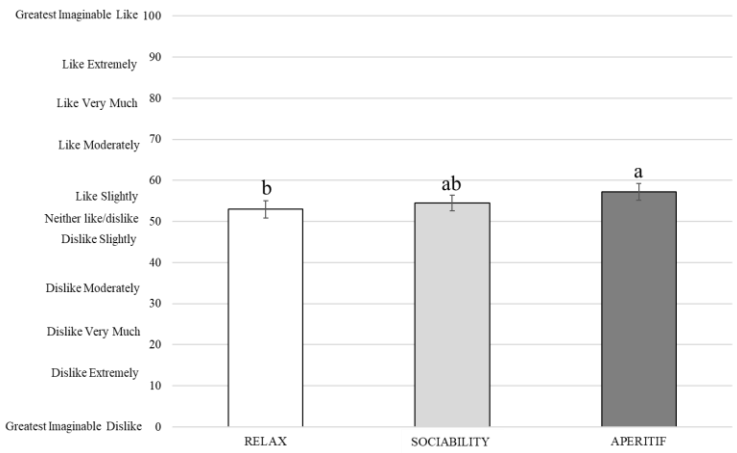

Fig.21.Mean liking ratings for the six cocktail samples in the three thematic clusters. Different letters indicate significant difference at 0.05 level by Fisher's LSD post hoc test.

4.7.3 Personality traits

An adequate internal consistency as measured using Cronbach's alpha (Nunnally, 1978) was found for the Barratt Impulsiveness Scale (BIS-11)= 0.81, the Sensation Seeking Scale (SSS)= 0.89 and Sensation Seeking subscales: Thrill and Adventure-Seeking (TAS)= 0.83; Disinhibition (Dis)= 0.73; Boredom Susceptibility (BS)= 0.74. Mean scores for each cluster are reported in Table 15.

Table 15. Differences in personality traits in the three thematic clusters. BIS-11= impulsivity; TAS =Thrill and Adventure Seeking; Dis = Disinhibition; BS = Boredom Susceptibility; SSS = total Sensation Seeking score.; Different letters indicate significant difference at 0.05 level by Fisher's LSD post hoc test.

	RELAX	**SOCIABILITY**	**APERITIF**	***F***	***p*-value**
BIS-11	62.56	66.72	61.8	3.039	0.051
TAS	23.13	26.12	22.78	2.924	0.057
Dis	23.40^{b}	26.00^{a}	23.97^{b}	3.249	**0.042**
BS	21.54	23.16	21.48	1.504	0.226
SSS	98.56^{b}	107.87^{a}	98.47^{b}	4.359	**0.014**

Individuals in the SOCIABILITY cluster showed higher scores in *sensation seeking* and particularly in the *disinhibition* (Dis) subscale than did the other clusters, suggesting that these individuals were characterized by a desire to engage in disinhibited social behaviors. These individuals tended also to be higher in impulsivity and thrill and adventure seeking compared to the other clusters. No significant difference between clusters was found for boredom susceptibility (BS) subscale.

A weak but significant negative correlation was found between PROP bitterness rating and, respectively, total sensation seeking, thrill and adventure SSS subscale, and specific alcohol intake (shots of liquor and glasses of cocktails for week); see Table 16

Table 16. Pearson correlation coefficients (r^2) within PROP intensity, personality traits and alcohol intake. Significant correlations are enboldened ($\alpha = 0.05$).

	PROP bitterness rating	
	r^2	**p-value**
Barratt Impulsiveness Scale (BIS-11)	0.106	0.246
Thrill and Adventure Seeking (TAS)	**-0.260**	**0.004**
Disinhibition (Dis)	-0.101	0.271
Boredom Susceptibility (BS)	-0.049	0.597
Total Sensation Seeking Scale (SSS)	**-0.205**	**0.024**
General alcohol consumption	-0.066	0.471
Cans of beer (330 ml) for week	-0.027	0.765
Glasses of wine (125 ml) for week	0.004	0.967
Shots of liquor (40 ml) for week	**-0.244**	**0.007**
Glasses of cocktails for week	**-0.344**	**0.000**

4.8 Individual differences in sample complexity, liking and familiarity/surprisingness

Complexity. The first three dimensions on the Principal Component Analysis (PCA) computed on individual complexity scores explained 76% of the total complexity score variability. Two clusters were identified through K-means cluster analysis computed on consumer coordinates for the first three PCA components: Cluster 1 was composed by 90 consumers (56%), whereas Cluster 2 was composed by 69 consumers (44%). Figure 22 depicts the different perceived complexity between the two clusters. The more the complexity of a set of samples is similarly scored across consumers, the more the respondents are close each other in the correlation loading plot. From figure 22 it is possible to observe a higher agreement in complexity ratings within Cluster 1 compared to Cluster 2. Along the first dimension (from the right to the left), the opposition sample B/sample F, is represented. Sample F was perceived as the most complex by almost all respondents in Cluster 1 and part of those belonging to Cluster 2 located on the left of the first dimension. To the contrary, sample B was perceived as the least complex by all respondents in Cluster 1. The consumers in the top left of the plot, mainly composed of respondents belonging to Cluster 2 considered sample B as the most complex cocktail in the series.

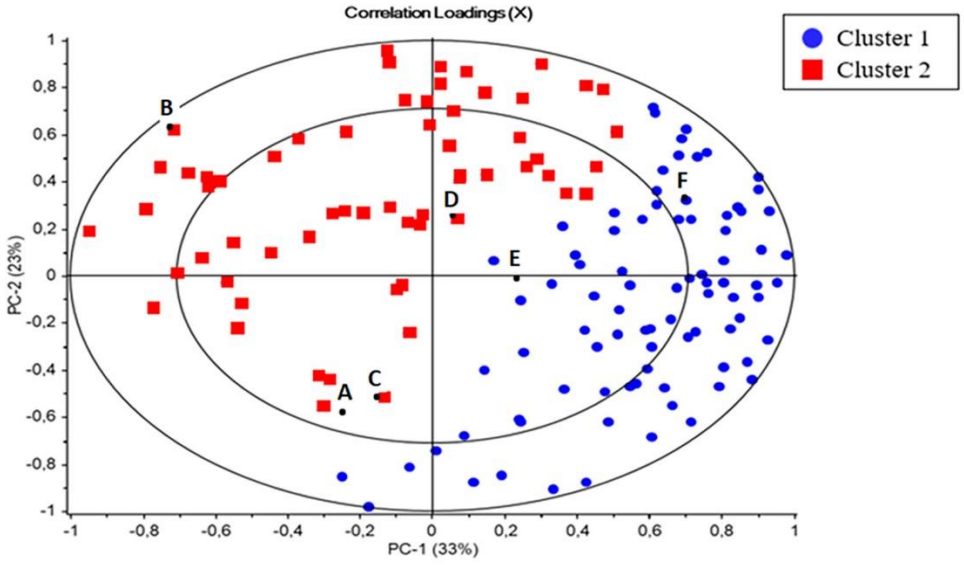

Fig.22. Correlation loadings for PCs 1 and 2 of a Principal Component Analysis on complexity scores expressed for the samples. Capital letters indicate the six different samples. Different shapes and colors indicate the clusters identified based on K-means clustering on the first three PCs.

A significant effect of sample ($F^{(5,1)} = 11.5$, $p < 0.0001$) and a significant interaction (cluster x sample; ($F_{(5,1)} = 23.0$, $p < 0.0001$) were found on complexity rating, while no significant effect of cluster was observed ($F_{(5,1)} = 3.09$, $p < 0.079$). Post-hoc tests revealed that the Cluster 1 rated samples E, C and F as more complex than did Cluster 2. Conversely, Cluster 2 rated sample B as more complex than did Cluster 1. In the ANOVA models for each cluster, a significant effect of sample was found for Cluster 1 ($F_{(5,89)} = 47.42$, $p < 0.001$). Post-hoc tests (Fisher's LSD) showed differences between samples (Figure 23a). Sample F was found to be the most complex sample, followed by E. Samples A, C and D were perceived as less complex than E and F, while B was perceived as the least complex sample. Significant effect of samples on complexity ($F_{(5,67)} = 10.82$, $p < 0.001$) was found also for Cluster 2 (Figure 23b). Sample B was found to be the most complex sample. Sample F was considered as less complex than B, but more complex than A and C. No differences in complexity between samples D, E, A and C were found.

Familiarity/surprisingness. Small differences in the ranking of the familiarity of the six sample cocktail names across the two clusters were found. In Cluster 1, a similar pattern of familiarity as in the aggregate data was found, but with no significant difference between samples B and D (Figure 23a). Cluster 2 showed a similar pattern, but no differences in familiarity between samples A and B or between samples

B and D (Figure 23b). Evidence for differences in cocktail familiarity between the two clusters for the other 37 evaluated cocktails were found. Cluster 1 consumers were least familiar with the following cocktails: *Caipirinha, Cosmopolitan, Gin fizz, Long island iced tea, Pina colada and Sex on the Beach*. The index of familiarity for the six cocktails included in the experimental plan showed marginally significant difference between the two clusters ($X^2 = 3{,}78$, $p = 0.052$). In Cluster 1, fewer consumers with lower familiarity with the samples were found, while, conversely, in Cluster 2 fewer consumers with higher familiarity with the six cocktails samples was found.

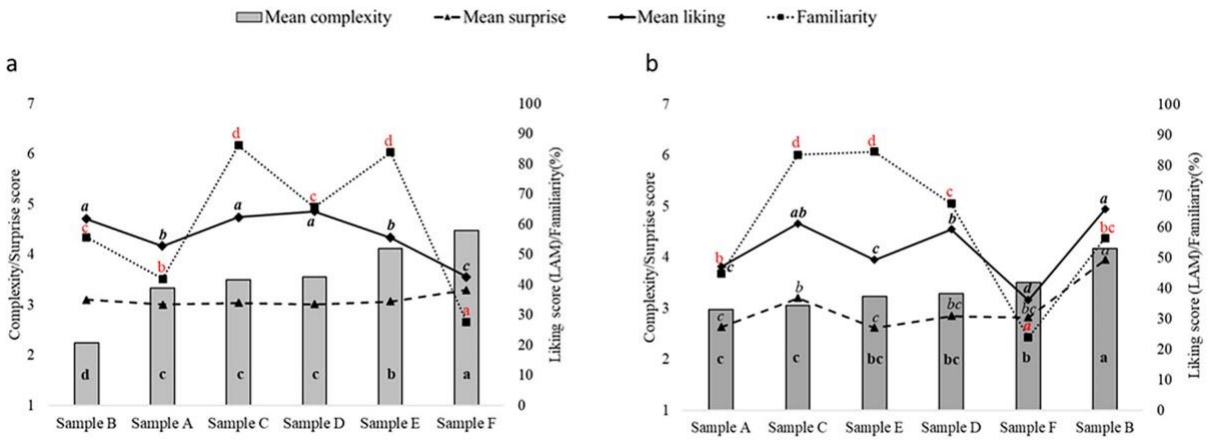

Fig. 23. Complexity, surprise and liking mean scores for the six samples for cluster 1 (a) and cluster 2 (b). Different letters (complexity = bold; surprise = italic; liking = bold/italic) indicate significance at 0.05 level by Fisher's LSD post hoc test. Sum of ranks for familiarity is expressed as proportion on theoretical maximum of each sample. Different letters (familiarity = regular in red) represent significant differences between samples as result of Dwass-Steel-Critchlow-Fligner post-hoc test ($p<0.05$).

Differences in *surprise* scores as a measure of perceived novelty were found: data from panel and from Cluster 2 showed that sample B was perceived as the most surprising ($p < 0.0001$) while no significant differences between samples were found in Cluster 1 (Figures 13 and 23).

4.8.1 Relationship between complexity, liking and novelty

Panel level (Figure 13). Sample B was perceived as the most surprising ($p < 0.0001$), and thus the most novel (Lévy, MacRae, & Köster, 2006). Sample A showed a low level of complexity and familiarity as well as lower liking score compared to B, C and D. Sample B, that was perceived as simple and novel, elicited as expected a medium level of arousal (optimum) that corresponded to a high liking score. Sample C was perceived as low in complexity and high in familiarity with similar liking to sample B.

Sample D was at an intermediate level of complexity and familiarity but liked as B and C. Sample E was high in familiarity as well as the second most complex sample and was less liked compared to B, C and D. Sample F was unfamiliar as well as the most complex and also the least liked.

Cluster level (Figure 13). When looking at the relationships between complexity, liking and novelty within each cluster, we observed higher similarity with the model in the case of cluster 1. Cluster 1: same trend as aggregate data was present except for sample B. As not expected, sample B was not less liked compared to sample C and D despite it was perceived as the simplest sample. Cluster 2: A recognizable relationship between complexity and hedonic scores was not found. In particular, sample B, the most liked, was perceived as more complex and more surprising than all the other samples.

4.8.2 Cluster characterization and response to sample

No differences between the two clusters were found for age ($F_{(1,158)} = 0.07$; $p = 0.69$), gender ($X^2 = 0.035$, $p = 0.85$) and PROP status ($X^2 = 0.93$, $p = 0.62$). No difference was found in the choice of a specific complexity criteria between the two clusters ($X^2 = 7.49$, $p = 0.18$).

Table 18 reports sample and cluster effects on items from the Two-way ANOVA with interaction.
Significant effect of sample was found for all item scores of the three questionnaires (all p-values< 0.05) with the exception of *bored* (emotions), *alone*, *disco* and *cocktail bar* (contexts). A significant effect of cluster was observed for one item in the context (*fun*, higher in Cluster 1), nine items in the emotion (*merry*, *happy*, *calm*, *carefree* – higher in Cluster 1; *bored*, *disappointed*, *annoyed*, *disgusted* and *uncomfortable* – higher in Cluster 2) and six items in the sensory questionnaire (*light* and *sour* – higher in Cluster 1, and *bitter*, *alcoholic*, *herbs*, and *persistent* – higher in Cluster 2).

Table 18. Two-way ANOVA with interaction (Sample x Cluster): F and p value from for each item of the three questionnaires: emotions, contexts, sensory properties (appearance and taste, flavor and mouthfeel). Numbers in brackets indicate which cluster have significant higher scores (cluster 1 or 2), significant differences are in bold ($p<0.05$).

	Effect					
	Sample		**Cluster**		**Sample x Cluster**	
Emotions	F	p-value	F	p-value	F	p-value
Merry	11.803	**< 0.0001**	4.603	**0.032(1)**	3.355	**0.005**
Happy	8.983	**< 0.0001**	4.350	**0.037(1)**	2.373	**0.038**
Reassured	13.595	**< 0.0001**	2.686	0.102	2.685	**0.020**
Relaxed	11.188	**< 0.0001**	2.400	0.122	1.816	0.107
Calm	6.367	**< 0.0001**	4.957	**0.026(1)**	0.495	0.780
Relieved	10.718	**< 0.0001**	2.652	0.104	2.572	**0.025**
Carefree	8.074	**< 0.0001**	4.036	**0.045(1)**	2.648	**0.022**
Confident	4.661	**0.000**	0.746	0.388	2.760	**0.017**
Curious	8.442	**< 0.0001**	3.010	0.083	2.812	**0.016**
Surprised	3.577	**0.003**	0.366	0.545	3.401	**0.005**
Indifferent	3.232	**0.007**	1.407	0.236	1.374	0.232
Bored	0.628	0.678	9.574	**0.002(2)**	2.059	0.068
Disappointed	8.509	**< 0.0001**	4.102	**0.043(2)**	2.276	**0.045**
Annoyed	21.799	**< 0.0001**	7.477	**0.006(2)**	1.241	0.288
Disgusted	24.284	**< 0.0001**	4.315	**0.038(2)**	0.508	0.771
Uncomfortable	12.284	**< 0.0001**	5.158	**0.023(2)**	0.742	0.592
Sad	7.539	**< 0.0001**	2.053	0.152	1.201	0.307

	Factors					
	Sample		**Cluster**		**Sample x Cluster**	
Contexts	F	p-value	F	p-value	F	p-value
Alone	1,57	0,165	15,31	**< 0,0001**	7,81	**< 0,0001**
Couple	11,30	**< 0,0001**	5,61	**0,004**	8,50	**< 0,0001**
Friends	4,75	**0,000**	0,52	0,592	6,14	**< 0,0001**
Aperitif	38,81	**< 0,0001**	8,80	**0,000**	4,41	**< 0,0001**
After dinner	14,94	**< 0,0001**	2,47	0,085	3,36	**0,000**
Digestive	23,76	**< 0,0001**	10,38	**< 0,0001**	0,43	0,932
Disco	1,99	0,077	0,06	0,936	3,24	**0,000**
Party	2,64	**0,022**	0,86	0,421	2,94	**0,001**
Home	1,24	0,286	19,50	**< 0,0001**	3,91	**< 0,0001**
Holiday	11,05	**< 0,0001**	1,20	0,300	5,50	**< 0,0001**
Meeting	7,33	**< 0,0001**	10,91	**< 0,0001**	3,16	**0,001**
Cocktail bar	1,69	0,132	0,29	0,743	5,45	**< 0,0001**
Summer	29,25	**< 0,0001**	0,61	0,540	4,52	**< 0,0001**
Winter	28,31	**< 0,0001**	10,43	**< 0,0001**	1,97	**0,033**
Fun	1,70	0,131	4,75	**0,009**	5,97	**< 0,0001**
Relax	2,60	**0,024**	7,02	**0,001**	9,78	**< 0,0001**
Pub	4,51	**0,000**	0,55	0,576	1,92	**0,039**
Moment for me	129,24	**< 0,0001**	3,40	**0,034**	0,87	0,557

	Effect					
	Sample		**Cluster**		**Sample x Cluster**	
Appearance	F	p-value	F	p-value	F	p-value
Clear	137.043	< **0.0001**	0.204	0.652	0.385	0.859
Inviting	3.664	**0.003**	0.063	0.803	2.577	**0.025**
Intense color	12.396	< **0.0001**	1.756	0.185	1.958	0.083
Flavor, taste and mouthfeel						
Bitter	63.419	< **0.0001**	13.103	**0.000 (2)**	0.418	0.836
Sweet	59.669	< **0.0001**	2.522	0.113	0.709	0.617
Sour	3.726	**0.002**	4.665	**0.031(1)**	0.843	0.519
Alcoholic	123.698	< **0.0001**	9.564	**0.002(2)**	0.318	0.903
Herbs	48.194	< **0.0001**	9.432	**0.002(2)**	0.585	0.712
Chinotto	40.455	< **0.0001**	0.098	0.754	0.770	0.572
Rhubarb	12.368	< **0.0001**	1.818	0.178	0.300	0.913
Medicine	21.349	< **0.0001**	0.338	0.561	0.393	0.854
Peach	99.675	< **0.0001**	1.771	0.184	0.329	0.896
Citrus	81.114	< **0.0001**	3.689	0.055	0.532	0.752
Cherries	5.550	< **0.0001**	0.398	0.528	1.546	0.173
Aged	100.835	< **0.0001**	0.062	0.804	0.333	0.893
Spices	22.916	< **0.0001**	3.121	0.078	0.173	0.973
Sparkling	32.717	< **0.0001**	1.691	0.194	0.204	0.961
Clean mouth	13.369	< **0.0001**	0.006	0.937	0.635	0.673
Dense	26.596	< **0.0001**	0.017	0.897	0.810	0.542
Fresh	61.475	< **0.0001**	3.691	0.055	0.927	0.463
Tingles	30.522	< **0.0001**	1.895	0.169	0.866	0.504
Light	133.768	< **0.0001**	6.367	**0.012(1)**	0.467	0.801
Persistent	56.879	< **0.0001**	8.582	**0.003(2)**	0.120	0.988

Furthermore, significant interaction effects (sample x cluster) were found for eight items of context (*couple, friends, after dinner, disco, party, holiday, cocktail bar* and *fun*), nine items for emotions (*merry, happy, reassured, relieved, carefree, confident, curious*, *surprised* and *disappointed*) and one item (*inviting color*) for sensory properties. Interestingly, the interactions were always due to sample B. When significant differences in context appropriateness were observed, consumers belonging to Cluster 1 perceived samples as more appropriate compared to Cluster 2, with the only exception of sample B which was found more appropriate to specific contexts (*friends, after dinner, disco, party, holiday, cocktail bar,*

fun, moment for myself) by Cluster 2. When differences in emotions were found, samples elicited higher positive as well as lower negative emotions in Cluster 1 compared to Cluster 2, with the exception of sample B. For the item *inviting* (that had a hedonic positive connotation) a significant interaction (sample x cluster) was found for Cluster 2 that gave a higher score compared to Cluster 1.

In the ANOVA models separated for each cluster, a significant sample effect (all p-values < 0.05) was found for all questionnaire items, with the exception of *surprised, bored* (emotions), *alone, party, relax, moment for myself* (context) and *inviting* (sensory) in Cluster1, and *indifferent* and *bored* (emotions) in Cluster 2.

In the Three MFAs computed to study differences between clusters as a function of descriptor domains. the two clusters did not differ overall in their sensory responses to samples, some differences were found on the second dimension in the emotional responses (for all samples with the exception of E and, to a lower extent, in context appropriateness (for samples B, D and E) along the second dimension (Fig.24).

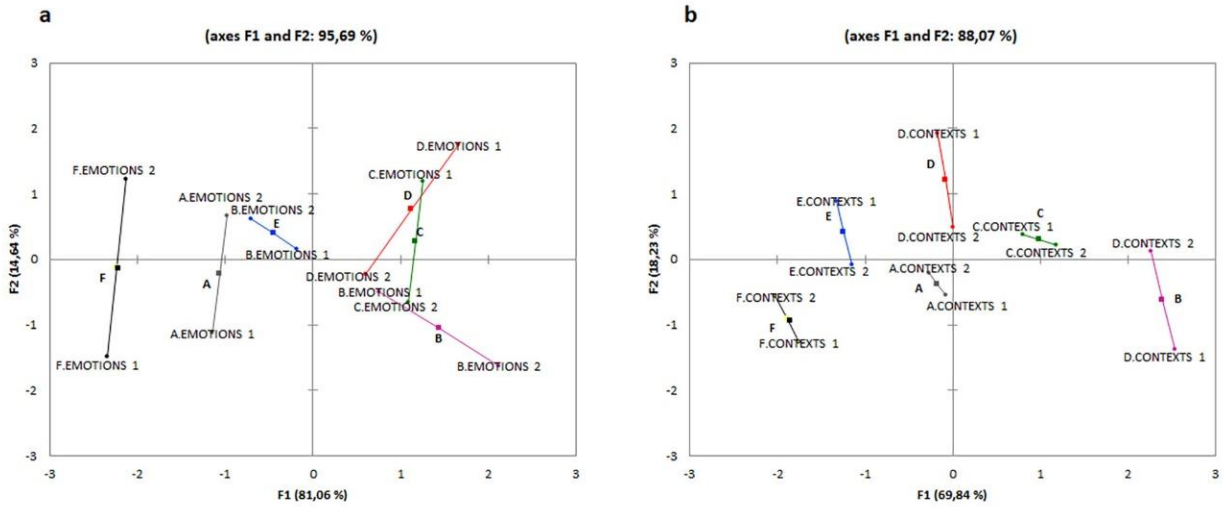

Fig.24. Superimposed representation of the first two dimensions of the MFA space showing the six products as mean points and their partial individuals representing descriptors scores in the two consumers clusters (1,2) for emotions (a) and contexts (b).

Figure 25a and 25b show the correlation circles and score plots of the MFA for each cluster. In Cluster 1, the first three dimension accounted for the 93.04% of the variance of experimental data representing 59.04%, 26%, and 8% of the variance, respectively. The first dimension was negatively correlated with descriptors related to negative emotions (*disgusted, sad*), contexts (such as *after dinner* and *digestive*)

and specific flavors (*herbs, spices*), while it was positively correlated to descriptors related to positive emotions (*relaxed, curious*), context (such as *summer* and *holiday*) and sensory (*light, fresh*). The second dimension was positively correlated with the descriptor related to *sparkling mouthfeel* and negatively with *dense*. Complexity and liking were negatively correlated to each other: the first dimension was negatively correlated with complexity and positively correlated to liking.

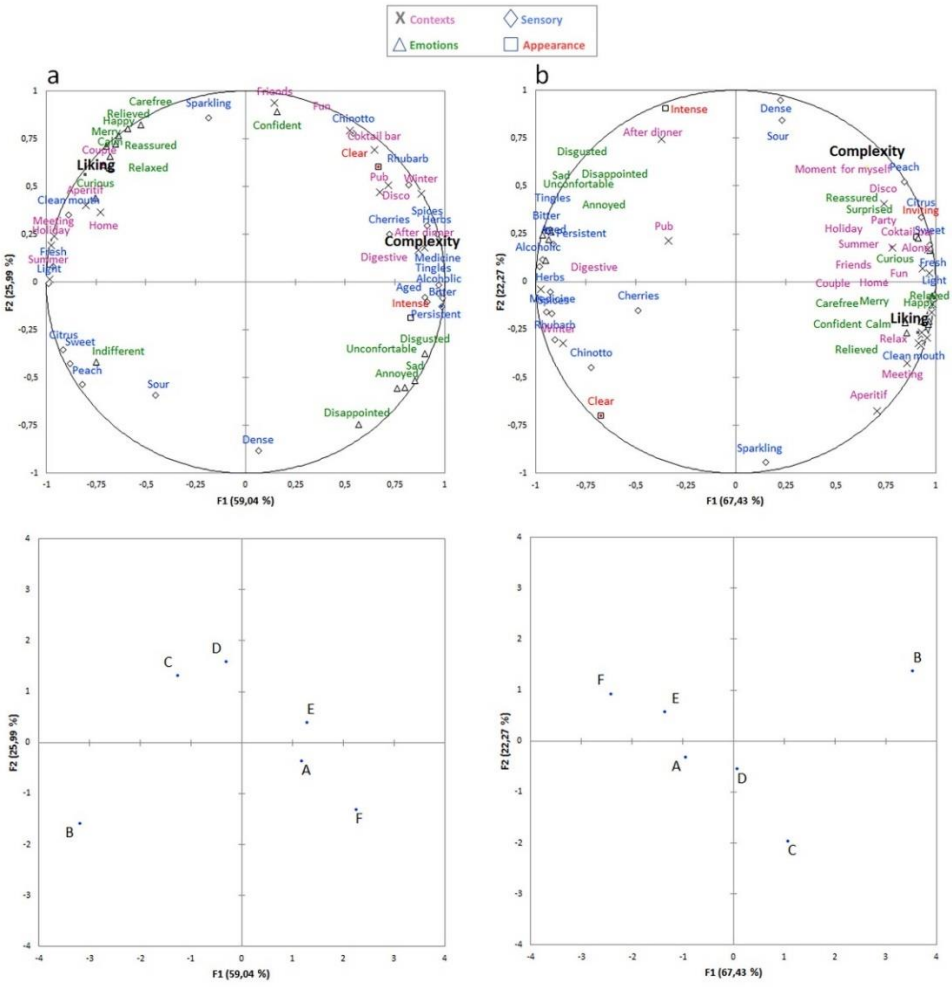

Fig.25. Correlation circle and score plots on the first and second dimension of the MFA for cluster 1 (a) and cluster 2 (b), with complexity and liking (in bold) plotted as supplementary variables.

In Cluster 2, the first three dimensions accounted for the 96.2% of the variance of experimental data representing 67.4%, 22.3%, and 6.5% of the variance, respectively. The first dimension was positively correlated with positive emotions (such as *curious, surprised, merry, relaxed*), contexts (*cocktail bar,*

party) and sensory properties (*light, fresh, sweet, citrus*). The first dimension showed instead a negative correlation with negative emotions (*uncomfortable, sad*), contexts (*winter, digestive*), flavors (*herbs, spices*), *alcoholic* and *medicine*. The second dimension was also positively correlated with the items related to *sparkling mouthfeel* and negatively with *dense, sour taste, intensity of the sample color* and *after dinner* context. Complexity and liking were positively correlated to each other and to the first dimension.

5. Discussion

Some differences were present in the alcoholic cocktail consumer population as compared to the general one. Deviations from expected values were observed for both PROP status distribution and personality traits. In our sample there was a higher percentage of non-tasters (33.8%) and a lower of supertasters (19.9%) as compared to the distribution of PROP in the Italian population (Monteleone et al., 2017). We may hypothesize that the reason of this characterization is due to the recruitment of consumers that were frequent consumers of cocktails (Duffy, Peterson, et al., 2004; Guinard et al., 1996; Intranuovo & Powers, 1998). The recruitment of alcoholic cocktail consumers could also explain the presence of higher sensation seeking scores as compared to other studies. In fact, it is possible that cocktail consumers are more likely to seek novel and intense sensations partly by drinking alcohol (that is a stimulant) and engaging in social activities linked to alcohol consumption like going to parties or in the disco (Rossier et al., 2016). The lower level of food neophobia among cocktail consumers as compared to the general population could be explained by the tendency of high neophobic individual to avoid food and beverages that are connoted by warning sensations such as bitterness, sourness, astringency and alcohol (Laureati et al., 2018). Then, it is possible that is less likely to find high-neophobic individuals among cocktail consumers due to the sensory properties of alcoholic cocktails that could be perceived as unpleasant by these individuals that could also tend to a lower consumption of these products. Sensitivity to reward was higher in cocktail consumers, this result is in line with previous studies highlighting that high scores in reward sensitivity scales are associated with current alcohol-taking habits (Pardo et al., 2007).

Implicit methodologies were found to be useful both to characterize the consumer panel and in the case of the procedure used to study the effect of *Campari* brand to characterize consumer segments based on liking patterns for cocktails. From the individual differences point of view, Global Profile methodology allowed us to investigate the relationships between sensory characteristics, emotions, and context appropriateness in different consumer segments. The investigation of preferred contexts of cocktail consumption using open-ended questions was found to be effective to further study the effect of individual differences in the choice of preferred aspects of cocktail experience. Finally, the study showed that individual differences also affect the perception of cocktail complexity and provided further advances in the definition of product innovation models.

5.1 Consumers implicit reactions to picture of alcoholic and non-alcoholic beverages and brand

At the panel level, reaction times to alcoholic beverages were consistently faster, suggesting increased salience of alcoholic to non-alcoholic beverages images. This result highlights that the panel of

individuals was composed of consumers who considered alcoholic beverages (here represented by beer, wine, and champagne) more activating stimuli than non-alcoholic ones (here represented by orange juice and milk). This result accounts for a tendency to deploy more attentional resources in the presence of alcoholic beverages than non-alcoholic ones. This observation could be useful to further characterize consumers and to gain further insights into consumer behavior. Interestingly, further differences in reaction times were present among different beverages. Among non-alcoholic beverages, faster reaction times were recorded for *orange juice_b* than orange *juice_a* and *milk*. A possible explanation of this effect comes from the beverage container represented in the pictures. Even if we tried to exclude possible interferences in the salience of the image by removing colors and brands, an effect due to the shape of the beverage container could be present. As *juice_a* and *milk* were presented in a drink carton whereas *orange juice_b* was presented in a round bottle, it is possible that in the latter case reaction times are shorter due to the more pleasant aesthetic of the bottle, as previously observed for aesthetically pleasant objects (Righi, Gronchi, Pierguidi, Messina, & Viggiano, 2017). Among alcoholic beverages, slower reaction times were observed for the *champagne* image than for *red wine* and *beer*. A possible explanation of this effect could be derived by a difference in familiarity between the images. Champagne is less familiar to Italian consumers than red wine or beer, as it is typically from France (Guy, 2007), and in Italy products of the same category are produced (e.g., Italian Spumante and Prosecco). Thus, we may hypothesize that reaction times for the champagne image were slower due to less familiarity with the product (Egeth & Blecker, 1971). All in all, this procedure allowed us to further characterize consumers by means of an implicit test based on reaction times. It could be of interest if further studies explored more systematically the effect of product category and familiarity and the effect of individual differences by the means of a Go/NoGo task using foods and/or beverages as stimuli.

5.2 Global Profile methodology and consumer clustering

The results of the present research supported and expanded the validity and efficacy of the Global Profile approach to the multidimensional study of alcoholic beverages by investigating the relationship between sensory-emotions-context appropriateness in consumers differing for liking patterns. Integrating the Global Profile approach beyond product differentiation to consumer differentiation allowed the observation of the effect of consumers' individual differences in the modulation of liking patterns. This was done taking into account consumer differences in oral responsiveness, personality traits, familiarity, explicit responses to products and implicit attitudes towards brand. Supplementing hedonic measures with emotional and context appropriateness variables allowed a better and more detailed differentiation

of products. Each response type provided different insights, which, combined, resulted in an in-depth sample characterization and discrimination. Coupling IPM with cluster analysis allowed the characterization of three groups of consumers with noticeably different patterns of sample liking and disliking: Fruit-bitter lovers, New-bitter lovers and Classic-bitter lovers.

Our findings showed that the consumer clusters did not differ greatly in their sensory responses to products - only limited differences in the intensity of sensory descriptors among clusters were found - while they differed much more in emotions and, to a lower extent, in context appropriateness. This result highlights that clusters did not differ in their product perception; instead, clusters differed in the meaning that they attribute to the different cocktails, which is reflected mostly by emotional response and context appropriateness. The small differences between clusters that were found in the perceived intensity of sensory properties could be explained by inter-individual variability in sensory responses to foods. These results are in line with recent findings on different food product categories (cashew nuts, chocolates, canned tomatoes, potato crisps) pointing out that consumers with different liking patterns for products do not necessarily differ greatly in how they describe the sensory characteristics of those products, but rather they differ mostly in their emotional associations to these products (Spinelli et al., 2019). Hence, the present results confirm previous studies which have shown that emotion measures may provide additional information to liking ratings that help to better understand product performance (King, Meiselman, & Thomas Carr, 2013; Mojet et al., 2015; Ng et al., 2013a; Porcherot et al., 2010; Spinelli et al., 2019; Spinelli et al., 2014, 2015). Our results show that the variability between consumer clusters differing in liking patterns was much higher in their emotional responses than in their identification of context appropriateness. In addition, despite some similarities, we mostly found very different emotions-sensory linkages between the clusters of consumers. Thus, sour was in fact associated with bored for New-bitter lovers and with indifference for the Classic-bitter lovers, denoting some communality (low arousal, neutral to negative valence). In contrast, *sweet, citrus* and *peach* were associated with *surprise* and *curiosity* for the Fruit-bitter lovers, with *indifference* for the Classic-bitter lovers, while clear associations with emotions were not found for the New-bitter lovers. Instead, for this cluster, stronger associations were found between sensory properties and context appropriateness, with *citrus, sweet* and *peach* associated with *summer* and *aperitif*. It is interesting to note that despite the Fruit-bitter lovers associated with the liked cocktails sweetness and *citrus* flavor, both descriptors were perceived at a lower intensity as compared to other clusters. This may suggest that they were perceived as to high by the other cluster (e.g. too sweet, too citrus) to be appreciated, as in this group of consumers.

As a whole these results reinforce the idea of the existence of sensory drivers of product-elicited emotions moderated by liking (Jaeger et al., 2018; Spinelli et al., 2019) but also introduce the idea of the existence of different relationships between sensory properties and context appropriateness that are moderated by liking. Thus, mouthfeel descriptors also differed between clusters in their association with emotions and contexts. *Sparkling*, which represents an important sensory property in many alcoholic cocktails, was associated with *indifferent* and related to an *aperitif* context for the Fruit-bitter lovers, while it was associated with many positive emotions and in particular with *merry*, for the Classic-bitter lovers. For this cluster this sensory property was associated again with *aperitif* but also with *a situation at home* and *in couple*.

Consumer characterization of the type conducted here may assist in uncovering the basis of our experience of alcoholic cocktails. In the present study, we found a higher number of female consumers among Fruit-bitter lovers, as well as a higher number of males among Classic-bitter lovers. Such gender differences may be a contributing variable in explaining variations in linkages between sensory properties, emotions and contexts, just as it partially accounts for differences in food liking and preferences (Wardle et al., 2004). Fruit-bitter lovers showed lower alcoholic beverages consumption in general and specifically for weekly consumption of shots of liquors and beer as compared to Classic-bitter lovers. This result is in line with studies that suggest a lower consumption of alcoholic beverages in females as compared to males (Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000; Wilsnack, Wilsnack, Kristjanson, Vogeltanz- Holm, & Gmel, 2009). Fruit-bitter lovers were less familiar with a number of cocktails (about 30%) connoted by bitter taste and higher alcohol content as compared to other clusters. This observation could help explain the lower liking of these consumers and the subsequent linkage with negative emotions for Sample E and F in which the bitterness of the common bitter ingredient was enhanced by the presence of other bitter compounds. It is interesting to note that no difference was found between clusters as a function of PROP status. As in Fruit-bitter lovers a higher number of females was found, we might have expected a higher FPD as well higher PROP bitterness ratings in females participants (Dinnella et al., 2018; Tepper et al., 2017). Greater PROP bitterness and number of fungiform papillae was found to be also associated with alcohol liking in a previous study that used a 50% ethanol probe applied to the left tip of the tongue with a cotton-tipped applicator (Duffy, Peterson, et al., 2004). However, the distribution of PROP intensity showed a lower proportion, even if not significantly different, of highly bitter-sensitive PROP supertasters in aggregate data and in the Classic-bitter lovers as compared with the Italian population (Dinnella et al., 2018; Monteleone et al., 2017). It

is possible, therefore, that the subgroup of the population comprising cocktails consumers might show less variation in PROP responsiveness, particularly in terms of high sensitivity. FPD was also found to be not associated with different patterns of cocktail liking. We could hypothesize that this measure was not enough sensitive to differentiate among liking clusters for complex products such as cocktails in which liking was not only modulated by the irritant sensation of alcohol but also by sample appearance, tastes and flavors. Personality traits scores were investigated to gain further evidence for explaining differences in product perception between clusters. Fruit-bitter lovers that in general tended to consume fewer alcoholic beverages was composed of a higher number of individuals connoted by a higher Behavioral Inhibition System (BIS) sensitivity. This result is in line with studies reporting a lower consumption of alcoholic beverages for high BIS individuals (Pardo et al., 2007; Tapper et al., 2015).The BIS sensitivity is said to regulate aversive motives, in which the goal is to move away from something unpleasant (Carver & White, 1994). In terms of individual differences in personality, greater BIS sensitivity could account for a higher sensitivity to punishment in general, and novelty and to the tendency to not accept a reward (Gray, 1970). It is possible to hypothesize that those with a higher sensitivity to BIS are more concerned about the immediate consequences of alcohol consumption and then they tend to avoid highly alcoholic beverages. This observation could provide a further explanation for the product/variable configuration of Fruit-bitter lovers as we can hypothesize that consumers with a high BIS activation could like less cocktails that are more bitter and more alcoholic that are considered as negative and unpleasant. The Behavioral Activation System (BAS) is believed to regulate appetitive motives, in which the goal is to move toward something desired. A higher BAS was associated with a higher intake of alcohol; this finding was not confirmed here as we did not find any significant association. This result could be due to different reasons; first, we reported a relative lower Cronbach alpha value compared to the literature, both in studies with Italians (α= 0.96 Balconi & Vanutelli, 2016) or other culture (α= 0.79; Tapper et al., 2015).

Second, a possible explanation could be linked to the particular population taken into account in the consumer test that was composed by frequent cocktail consumers only, whereas other studies that studied the link between BAS and alcohol intake have relied on general population samples. This observation could account for a lack of differentiation in the alcoholic cocktail consumers population. This aspect did not affected the reliability of the BIS scale as BIS and BAS scales are psychological questionnaires that measure orthogonal and unrelated systems (Carver & White, 1994; Pickering, 1997).

The level of impulsiveness as measured with the BIS-11 was not different among consumer segments. In a previous study, an effect of this personality trait was found for sweet taste in white wine, showing that participants with a sweet taste preference were significantly higher in impulsiveness than their dry preference counterparts (Saliba et al., 2009). However, this study used a different measure (Adult Impulsiveness, Venturesomeness and Empathy Scale; Eysenck & Eysenck, 1991) and also a different criterion to segment participants ("sweet" or "dry" preference). Then, it is possible to hypothesize that impulsivity as measured with BIS-11 scale did not provide a sufficiently fine-grained measure to distinguish consumers that differs for liking patterns among the bitter-based alcoholic cocktail product category. Further research is required to assess if impulsivity could be related to the choice of cocktails belonging to different product typologies (e.g. sweet-based vs bitter-based).

Sensation Seeking Scale did not highlight significant differences between consumer segments. In a previous study a correlation between Sensation Seeking and alcoholic beverage preference was reported (Terasaki & Imada, 1988). This correlation was found using a questionnaire in which participants were asked to rate their preference for a list of different food and beverages in a general population. In the present study it is possible to hypothesize that as alcoholic cocktail consumer clusters with different liking patterns were analyzed, less variation as compared to the preference for alcoholic beverages in a general population was present. Another observation is that the preference for alcoholic beverages is also linked to the context of alcohol consumption. As the item list of the SSS is related mostly on activities and contexts where people seek varied, novel, complex, and intense sensations and experiences it is possible that a correspondence between alcohol consumption and more engaging contexts where alcohol is consumed (e.g. a party or a disco) could exist, promoting the correlation between SSS and the consumption of alcoholic beverage. Further research is needed to test the hypothesis accounting for differences in Sensation Seeking among alcoholic cocktails consumer segments that are composed by people that consume cocktails in different contexts and situations.

Also, Food Neophobia Scale was found to do not differentiate among the three examined liking segments. Lower liking ratings for different alcoholic beverages in high neophobic as compared to medium and/or low neophobic individuals were reported in a previous study (Laureati et al., 2018). Interestingly a reported lower liking for *Alcoholic aperitif* in low neophobic as compared to high neophobic individuals was found. In our sample all the consumers independently from the cluster liked the products in the set, thus we may explain this result as due to the criteria for consumer recruitment. In fact, in our sample, neophobia was lower (mean= 22.41, range= 10-56) than in the general population (mean= 27.40, range=

10-69, Monteleone et al., 2017). This observation could account for less variability among cocktail consumers as compared to the general Italian population.

Finally, no significant difference was found between clusters as a function of Sensitivity to Reward and Punishment Questionnaire. To the best of our knowledge, no previous study has investigated the influence of Sensitivity to Reward (SR) and Sensitivity to punishment (SP) in the preference or liking for alcoholic beverages. Previous studies have focused instead on drinking behavior (alcohol intake) finding that high SR was related to higher alcohol consumption whereas SP was found related to lower alcohol consumption (Morris et al., 2016; Pardo et al., 2007). We selected only frequent cocktail consumers thus the range in alcohol intake in our sample was smaller than in these studies. However, in the present study, a higher rate of alcohol consumption was found between Classic-bitter lovers and Fruit-bitter lovers, so a difference also in SR and SP could be expected. Differences in sensitivity to punishment among clusters were captured by BIS scale but were not observed using SP questionnaire. This result is coherent with the item structure of the two tests as the BIS/BAS scales and the SPSRQ are developed to measure different constructs (Carver & White, 1994; Torrubia et al., 2001). In fact, the SPSRQ differs from the BIS/BAS scales in the sense that the items of the BIS/BAS scales measure reactions to general cues of punishment and reward, whereas the items of the SPSRQ are related to specific cues of punishment and reward (Matthews & Gilliland, 1999; Torrubia et al., 2001).

In Classic-bitter lovers a higher number of consumers with a high positive implicit brand effect was found. As expected, consumers that had a more positive emotional association with the brand of the bitter ingredient showed a broader appreciation for the evaluated cocktails included in the sample set, all sharing this ingredient. This result is in line also with a positive emotional response to samples as well as with a wider range of contexts perceived as appropriate for different cocktails by these consumers. In the case of Sample B, that was less liked by Classic-bitter lovers, it is possible that liking was not promoted by the positive brand effect. In fact, it is possible to hypothesize that in blind conditions consumers belonging to Classic-bitter lovers that are positively engaged with the brand could have not identified the bitter ingredient in this cocktail due to the presence of orange juice that could have masked the bitter ingredient (due to flavor and color masking), making less straightforward the matching with the brand.

New-bitter lovers showed a lower level of involvement with cocktails as compared to other clusters indicating that the amount of arousal and interest evoked by cocktails was less relevant, or the drive to consume a cocktail was lower for these consumers. The lower involvement with the product category

could also explain the absence of a broad appreciation of the evaluated cocktails and the weak relationship between sensory properties and emotions for these consumers. For these consumers liking seems more driven by context appropriateness, with the two products most liked characterized by very different sensory profile: the most and the least alcoholic cocktails; the most bitter and the sweetest one.

Taken together, these observations could allow to match the different configurations obtained in product characterization with individual differences in consumer segments. This could support the increasing need in product differentiation within marketing and research & development (Cardello et al., 2016; Jaeger & Porcherot, 2017; Smith, 1956) that aims to create personalized products and advertisements.

5.3 Individual differences in preferred context to drink an alcoholic cocktail

Text analysis of the open-ended question on consumers' preferred context for having a cocktail allowed us to identify a variety of situations and factors that characterize the cocktail experience. These results extend the applicability of the methodology developed by Spinelli et al., (2017) to the study of preferred contexts of alcoholic cocktails consumption. Three clusters with different preferred contexts of alcoholic cocktail consumption were identified. The first cluster of consumers focused on the relaxing features of cocktail consumption (theme 1, RELAX); the second described a social context linked to the research of new experiences during parties or in the disco (theme 2, SOCIABILITY); the third was linked to a before-dinner context in which they can recover from work and drink alcoholic beverages with friends (theme 3, APERITIF). One way on interpreting these different preferred contexts is that they reflect different aspects of the physiological and rewarding effects of alcoholic cocktails (Loke, 1992), namely the relaxing properties of alcohol (RELAX), the stimulating effect of alcohol (SOCIABILITY), and the capacity of alcohol to stimulate appetite (APERITIF). Linkages between preferred contexts and psychological and attitudinal variables were found. Individuals who described a preferred context focusing on the social dimension and new experiences (SOCIABILITY) were found to be higher in sensation seeking, reflecting a desire for varied, novel, complex, and intense sensations and experiences. These individuals were specifically higher in the sensation-seeking disinhibition subscale, indicating a desire to engage in disinhibited social behaviors. Interestingly, these consumers were *less* involved with cocktails compared to the other clusters, suggesting that they perceive cocktails as less relevant for their broader values and goals. Instead, they were perhaps more focused on the effects/outcome of alcohol consumption than on the product itself, reflected too in their higher consumption of spirits.

Conversely, consumers that preferred either a relaxing or an aperitif context showed lower scores in sensation seeking, and particularly on the subscale disinhibition, pointing out a lower preference in these

individuals for engaging in novel activities as well as seeking intense sensations (cluster 1, RELAX); furthermore, they showed a lower interest in making new acquaintances, preferring to consume cocktails with friends that they already know (cluster 3, APERITIF). Consumers belonging to these latter two groups tended to be less impulsive and to seek less thrill and adventure (that is a tendency to engage in sports or activities involving speed and danger) as compared to cluster 2 (SOCIABILITY). These observations are in line with previous findings that account for a positive correlation between higher level of engagement in novel activities, the seeking of intense sensations and impulsivity (Mobini, Pearce, Grant, Mills, & Yeomans, 2006). In addition, these consumers (relax and aperitif lovers) showed higher scores in the involvement scale for cocktails. We interpret this to mean that the physiological effects of alcohol were perhaps less important for these individuals than the fact that the consumption of cocktails is compatible with their broader needs and interests. It may be that these individuals rely more on the different sensory properties to choose a cocktail rather than they do on the alcohol content.

The impact of preferred contexts was also evident in hedonic evaluations of the cocktails. Consumers preferring an aperitif context liked the set of six cocktails more than those preferring a relaxing context. This is perhaps not very surprising, since the samples were selected from recognized aperitifs, but it does reinforce the idea of a correspondence between liking and preferred context of consumption. No difference between liking scores of cluster SOCIABILITY as compared to the other two clusters was found. It is possible to hypothesize that liking of these consumers was promoted by the alcoholic content of cocktails that was in line with their preference. In fact, aperitif cocktails are meant to stimulate appetite and have in general a higher alcohol content (from 6% to 33% in selected samples) as compared to other typologies of cocktails. However, the evaluated cocktails were less capable of gaining liking when they were coupled with a preferred context of relaxation and more intimate/discreet. It is possible to assume that consumers belonging to cluster 1 (RELAX) sought a lighter effect of alcohol stimulation that is in line with the preference for an intimate context with light music and suffuse light in which they can nicely chat with friends.

In this study, PROP status was not significantly associated with specific preferred contexts. This result is in line with Spinelli et al. (2017) who also did not find an effect of PROP taster status on the choice of the preferred context of coffee consumption. No significant difference was found for FPD among the three clusters. A previous study on coffee reported that individuals with higher FPD focussed more on the psychoactive and alertness effect after sleeping of coffee in describing their preferred context of consumption whereas individuals with lower FPD find coffee more rewarding for its sensory and

emotional enjoyment and less rewarding for its stimulating function (Spinelli et al., 2017). In the present study, a clear differentiation between the function (stimulating effect of alcohol) and the product (sensory properties of alcoholic cocktails) was not present. The three clusters reported a description of their preferred context that was linked to different aspects of the stimulating effect of alcohol. Then, it is possible to hypothesize that in the case of bitter-based cocktail consumers the effect of FPD was less evident because a clear differentiation between cluster as a function of a shift in the focus between the function and the sensory properties - emotional enjoyment of cocktails was not present. Further studies relying on a wider range of consumers, integrating also the occasional user of cocktails, are then needed to verify the hypothesis of an effect of PROP bitterness perception and FPD on the choice of preferred contexts of cocktail consumption.

A different preferred context is associated with a different liking for alcoholic cocktails. This means that the aspects valued of a situation from an individual may provide relevant information about the preferences of this individual. These findings suggest that the preferred context for a product is not separated from it and contributes to the experience of the product itself, it. Differences in personality traits and attitudes are associated with different preferred contexts for cocktails. Thus, investigating this aspect provides relevant information to profile consumers that exhibit different liking patterns. These findings also recommend caution when contexts are presented to the respondents through a description or a name, as it is clear that the same situation may activate different features in different individuals.

5.4 Perceived complexity and its relationships with liking and novelty at panel level

When data at panel level were considered, the perceived complexity was found to be aligned with the hypothesized rank of complexity, based on both the number of ingredients and sensory properties. The relationship between perceived complexity and alcohol content is not clear. While we observed that for cluster 1 complexity tended to be related to alcohol content in line with previous findings (Meillon et al, 2010), the same trend was not observed for cluster 2.This difference in the relationship between alcohol content and complexity in the two clusters could reflect the use of different scales to evaluate complexity and may be also linked to the inter-sample variability: the sensory differences between cocktails are larger than between wines, so it is the number of ingredients.

Looking at the relationships between complexity, liking and novelty, we observed a trend similar to Berlyne's collative-motivational model. The pattern liking-complexity was in line with the theoretical model, with the most complex sample as the lowest in liking ratings. When familiarity was included in the model as the frequency of having perceived the actual stimulus on earlier occasions (Tuorila et al.,

2001) we observed a pattern in line with Berlyne's model only for the most complex samples. Sample E was perceived as one of the most complex but also one of the most familiar ones and thus more liked than F that was unfamiliar. According to the theoretical model we should have expected sample C as the least liked, based on its low complexity and high familiarity, while it is among the ones more appreciated. When novelty is included in the model as degree of surprisingness (Berlyne, 1970), we observed only partial overlap with the model of Berlyne for what concern the least complex samples. Sample B was perceived as simple and also the most surprising associated with a high liking score (Fig. 23). However, variations in liking were not always explained by differences in novelty or surprise.

5.5 Individual differences in perceived complexity and their relationships with affective responses and novelty

a. Complexity, liking and novelty

When looking at the relationships between complexity, liking and novelty within each cluster, higher similarity with Berlyne's model in the case of Cluster 1 was observed. For Cluster 1 the same trend observed at panel level was present except for sample B. In Cluster 1 no significant differences in surprisingness between samples were found.

More differentiation among samples was observed when the familiarity ratings were considered. The sample A that was perceived as simple but novel was liked less, differently from what expected according to the model. In addition, we should have expected sample C as the least liked, based on its lower complexity and higher familiarity, while it is among the ones most appreciated. Also, a clear relationship between complexity, hedonic ratings and novelty was not found in Cluster 2. In particular, sample B was perceived as the most complex and surprising. But it was also the most liked. So, this effect may be due to the lack of agreement in the evaluation of complexity within this group of consumers, as suggested in the correlation loading plot. A competing hypothesis could be that cluster 2 preferred the sensory properties characterizing sample B, but this could be ruled out when considering that the two clusters dis not differ strongly in their sensory drivers of liking.

There are a number of possible explanations for the observed mismatch between Berlyne's model (1960, 1970) and the observed results. First, Berlyne's model (1960) that was based on the evaluation of visual stimuli and novelty was defined as "inversely related to (1) how *often* patterns that are similar enough to be relevant have been encountered before, (2) how *recently* they have been experienced, and (3) how *similar* they have been". In the case of food/beverage stimuli, the concept of novelty (=unfamiliar) has

been operationalized through the familiarity scale (Tuorila et al., 2001) which integrate aspects related to recognition and aspects related to the frequency of consumption (occasional or regular), implying that recognition is only the first step to qualify a product as familiar. In addition, recognition was distinguished in recognition as a name (I have heard about it) and recognition as a tasting experience (I have tried once). This specificity of food stimuli might explain why a perfect overlap with the model, built on visual stimuli, has never been found.

Secondly, as cocktails samples were evaluated by regular cocktail consumers a clear differentiation in terms of novelty across samples was limited in our study. Finally, as optimal level of complexity has to be considered at individual level (Berlyne, 1970) it is possible that other extrinsic factors such as expertise or product knowledge influence product complexity perception as reported in previous studies (Meillon et al., 2010; Mielby et al., 2012; Parr, Mouret, Blackmore, Pelquest-Hunt, & Urdapilleta, 2011; Schlich et al., 2015). In addition, the reported mismatch between our findings and the prediction of Berlyne's collative-motivational model could be derived by the variation of other dimensions such as the number of perceived aromas, the ability to identify sensations and the strength and persistence of flavor perception in the six selected cocktail samples.

A variety of previous studies (Giacalone et al., 2014; Lévy et al., 2006; Meillon et al., 2010; Reverdy et al., 2010; Stolzenbach et al., 2016; Sulmont-Rossé et al., 2008) have also failed to find a reverse U-shape relationship between liking and complexity. Instead, they have reported either a positive or a negative relationship, and hypothesized as possible reasons of this finding, either 1) the selection of products that were highly accepted by consumers that caused a failure in spanning the spectrum sufficiently enough to activate the minimum rejection threshold, or 2) the use of experimental products instead of commercial ones may contribute to a context effect (analytical mindset in the task) that might have been responsible for a shift in complexity tolerance.

In the present study the six samples were selected among market available cocktails to span the range of perceived complexity. In addition, a preferred context of consumption evoked by each consumer by the use of a written response to an open-ended question was used to provide consumers with a frame of reference closer to the natural consumption conditions (Hein et al., 2010, 2012). The samples set successfully activated the rejection threshold, with mean ratings below the neutral point of the scale for some samples. Let consumers providing a written description of the occasion that they were imagining (preferred context) may have increased the degree of consumer involvement and promoted a more

realistic hedonic evaluation. The present study used an open-ended question in a controlled laboratory setting to evoke a context; further research is natural settings may contribute to a better understanding of the relationship between complexity and contexts.

Furthermore, it was not possible to obtain a wide variation in complexity in cocktail samples due to fact that they were all bitter-based cocktails. Bitterness in such drinks is due to herbs and other aromatic plants that are popular ingredients in strongly flavored alcoholic beverages (A. J. Johnson, Hopfer, Heymann, & Ebeler, 2017; Tonutti & Liddle, 2010). One of the primary uses of bitters is their addition to mixed drinks to accent flavors and increase aromatic complexity (Parsons, 2011). The presence of a common bitter based ingredient could have influenced the observed relationship between complexity and liking due to the presence of an innately rejected sensation (bitter) that could be enhanced by the addition of some ingredients. Then, results could not be generalized to all cocktails categories. It is possible that the use of a different common ingredient could led to a different perception of the samples modifying the complexity-liking pattern. This aspect could also have affected the ability to reproduce the full spectrum of complexity.

Novelty/familiarity is another collative property that could exert a crucial effect in complexity perception. Familiarity refers to whether the stimulus has been encountered before by an individual and relies on the sensory memories that everyone has stored in his/her memory. As found by Parr et al. (2001) in wines, domain-specific expertise could influence how consumers represent the concept of complex and also could influence the types of information considered important. So, the differences in perceived complexity between the two clusters may be due to this different degree of familiarity reported by consumers. This is suggested by the fact that, even though all participants were regular consumers of alcoholic cocktails, individuals in Cluster 1 tended to be more familiar with the six sampled cocktails, compared to individuals in Cluster 2. Cluster 2, which was slightly less familiar with this bitter based cocktails, showed different and unshared conceptualizations of complexity.

b. Complexity and sensory properties

Perceived complexity was not related to a different sensory responsiveness of the clusters. In fact the two clusters gave quite similar ratings in terms of sensory properties when describing the products. In addition, no difference in PROP status between cluster was reported. However, the two clusters associated different sensory properties to the concept of “complex”.

Cocktail is a very broad product category, including a variety of exemplars which may strongly differ in factors such as alcohol content and dominant flavor (e.g. sweet, sour, bitter…). It is possible to hypothesize that Cluster 2 had in mind a concept of cocktail that was not based on the prototype of one based on a prominent bitter flavor. This hypothesis is supported by the fact that this cluster was found to be more familiar with cocktails that are classified as "long drinks" (*Caipirinha, Gin fizz, Long island iced tea, Pina colada and Sex on the Beach*) or "all day cocktails" (*Cosmopolitan*) by International Bartenders Association (IBA). These cocktails are refreshing and can be drunk at any time and therefore are connoted by lighter flavors. Conversely, the evaluated cocktails samples are considered as "before dinner cocktails" (aperitifs), that are meant to stimulate appetite and that have in general a higher alcohol content (https://www.campari.com/it; http://iba-world.com/).

The different configurations found for sensory/emotion and context domains obtained through the MFAs in the two clusters may also suggest a difference in cocktail conceptualization. While a higher homogeneity of complexity scores was found in Cluster 1, Cluster 2 showed a lack of such agreement.

Notwithstanding that there were no differences in declared complexity criteria between the two clusters, differences in association between complexity and several dimensions of product perception were found. Cluster 1 associated complexity with the intensity of spices and herb flavor as well as with bitter taste and negative emotions. In addition, they evaluated complex cocktails as more appropriate to an after-dinner context.

We observed that only limited differences were found between the two clusters in their sensory description of products. Consumers that belong to Cluster 2 tended to perceive samples taste as more bitter and more persistent. Also, they perceived the samples as more alcoholic with a higher intensity of herbs flavor.

c. Complexity emotions and contexts

On the other hand, large differences between the two clusters were present in their association between complexity, liking, emotions, and contexts. When differences in emotions were found, Cluster 1 reported higher positive emotions as well as lower negative emotions for all samples, with Sample B being the only exception. Also, in line with this positive emotional activation, when differences in context appropriateness were found, Cluster 1 reported a significantly higher rating, for all samples with exception of sample B.

These data suggest that individuals clustered for complexity ratings differed in their experiences with the cocktails included in the study. Only a small difference in familiarity between the groups was reported, suggesting that conceptualization is mainly linked to the individual experience of the product category and the frequency with which the item in the category have been previously encountered.

6. Conclusions

This study provides evidence for the application of the Global Profile methodology not only to foods but also extended to beverages, in this case alcoholic cocktails. The method allowed us to investigate the relationships between sensory characteristics, emotions, and context appropriateness in consumers differing in liking patterns. Emotions elicited by products as well as context appropriateness were found to be much more informative than sensory properties in sample differentiation among consumer clusters. This study provides further evidence that the linkage between sensory properties and emotions are strongly related to different liking patterns among different groups of consumers. In addition, evidence of the effect of linkages between sensory properties and consumption contexts were provided, extending the approach beyond product differentiation to consumer differentiation, and improving insights into differences among consumers. A more detailed profiling of consumers was gained thanks to the investigation of variables ranging from implicit brand responses to psychological traits and taste responsiveness, that help to understand better the characteristics of consumers differing in liking patterns.

This study extends the original methodology proposed by Spinelli et al. (2017) to the investigation of preferred contexts of cocktail consumption using open-ended questions and provide further evidence of the effect of individual differences. Experimental results point out that including personality traits and attitudes in consumer characterization allows a deeper understanding of consumer behavior. Results also highlight the impact of the preference for specific contexts of product consumption on liking. These data could be considered a further advance in the recognition of variables that could impact the appreciation of alcoholic cocktails. Moreover, this study shows that open-ended questions coupled with semiotic and thematic analysis allow a more thoroughly understanding of consumer food behavior.

The findings of this study represent also a starting point for a deeper understanding of the role of individual differences in perceived complexity and their relationships with product acceptability and experience (liking, emotions, situational appropriateness). Since this study also shows that perceived complexity is a multi-dimensional construct that differs as a function of familiarity with product category, further studies are needed to better understand the role of familiarity/novelty in this model, starting from a clarification of its definition when applied to the study of consumer responses to products. These data have important implications for future studies suggesting the importance of examining measures of knowledge of the category based both on novelty/familiarity, defined as the frequency with which this particular stimulus has been encountered, and as the extent to which the stimulus resembles other known stimuli (Lévy, MacRae, & Köster, 2006), but also with surprisingness as recommended by Berlyne

(1960). Other measures of knowledge of and expectations generated by the product category might be useful as well. Also, relying on consumers that are familiar with a product category could allow better understanding of the applicability of Berlyne's model.

7. General conclusions and future prospects

This research constitutes a step forward in the search for factors that can differentiate people in the perception and appreciation of alcoholic cocktails. For this purpose, methodologies based on recent advancements in product characterization and different measures of consumers' individual differences were considered.

Consumer segmentation was confirmed as a valuable strategy in the alcoholic cocktail product category as well, as it explicitly acknowledges heterogeneity among individuals. Furthermore, the use of a multivariate approach allowed a more in-depth investigation of products and consumers' characteristics.

The simultaneous collection and representation of different groups of variables in the hedonic, sensory, emotional and context appropriateness domains allowed more refined profiling of the performance of the products, compared to the analysis of each dimension separately. The proposed approach has proven its usefulness even if applied to products in which the differences in liking are relatively small, and also for consumers that are already users of the examined product.

Consumers were clustered not only based on their liking patterns, but also on their complexity patterns and on their preferred context to drink a cocktail.

Consumer clusterization based on Internal Preference Map coupled with the Global Profile approach allowed to discover how bitter-based cocktails are perceived in different consumer segments, in terms of emotions, sensory properties and context appropriateness. Segmentation on complexity ratings highlighted the multidimensionality of complexity construct and allowed to provide a step forward in the study of the applicability of product innovation models. Clustering consumers as a function of the aspects that characterize the context in which a cocktail is preferably consumed allowed to study the connections between different aspects of cocktail experience, individual differences and liking.

Several measures of consumer individual differences were identified, adding to demographic data also psychological and attitudinal factors that could be useful to explain differences in consumer behavior linked to product perception. In particular, measuring Behavioral Inhibition System (BIS) has proven to be useful to achieve insights that determines different liking patterns for bitter-based cocktails. Furthermore, the study of sensation seeking and impulsivity could be a starting point to uncover motives that drive the choice for different contexts of cocktail consumption.

However, the identification of psychological traits useful for explaining differences in liking for alcoholic cocktails is still at an early stage and more research is needed to explain which personality factors could be used for more effective consumer targeting. In this vein, this research provided both the uncovering of psychological aspects linked to alcoholic cocktail experience and avenues for future research. This study confirmed that attitudes could play a significative role in uncovering motives of cocktail appreciation. However, the study of product involvement highlights the need for more research on the definition of the constructs and tools to measure this important aspect of consumer behavior, as in our case different measures of the same construct were needed to differentiate the consumer segments obtained with different segmentation techniques. Furthermore, multidisciplinary approaches derived from semiotics and cognitive psychology such as text analysis and implicit methods showed themselves to be useful tools to cluster consumers as well as to study unconscious motives linked to cocktail perceptions. The present study also confirms that product familiarity could be a very important dimension to be taken into consideration, as it could account for differences in preferences as well as determine the ability to describe product complexity.

Differences among consumers in oral responsiveness indices such as PROP status and fungiform papillae density turned out not to be directly linked to the perception and appreciation of alcoholic cocktails. The observation of several differences among the alcoholic cocktail consumer population than the general population in the distribution of PROP bitterness ratings and fungiform papillae density suggest that for alcoholic cocktails connoted by a bitter taste and a medium-to-high alcohol content, more fine-grained measures of oral responsiveness might be necessary to observe stable differences among consumer segments as a function of the appreciation of different products.

As the study was based on a specific product matrix (bitter-based cocktails), results could not be generalized to all cocktails categories and other product categories as well. It is possible to hypothesize that different results could be achieved in terms of variables effect using different cocktail typologies (e.g. sweet-based) as samples. Other than this, it could be also of interest to study the effect of different product variables such as texture in products in which this attribute could play a more incisive role (e.g. solid/semi-solid foods) in highlighting the effect of consumers' individual differences.

In this vein, the proposed approach may be considered a general framework for investigating the effect of individual differences on the perception and appreciation of products. This research could be a starting point for a deeper investigation of the variables that might allow further advances in product and

consumer characterization that would allow companies to gain a competitive advantage in the market by means of greater product innovation and marketing actions driven by consumer targeting.

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Appendix A. Scientific dissemination

List of original research papers

- Pierguidi, L., Spinelli, S., Dinnella, C., Prescott, J., & Monteleone, E. (2019). Individual differences in perceived complexity are associated with different affective responses to alcoholic cocktails. *Food Quality and Preference*, *76*, 47-59.
- Pierguidi, L., Spinelli, S., Dinnella, C., Prescott, J., & Monteleone, E. Liking patterns moderate the relationship between sensory, emotional and context appropriateness profiles: evidences from a *Global Profile* study on alcoholic cocktails. Under review, *Food quality and Preference*.
- Pierguidi, L., Spinelli, S., Dinnella, C., Prescott, J., & Monteleone, E. Sensory acceptability and personality traits both determine which contexts are preferred for consumption of alcoholic cocktails**.** Under review, *Food quality and Preference*.

Oral and poster communications

- Pierguidi, L. (2017) September. *Exploring Individual Differences in Affective Responses to Alcoholic Beverages: Focus on Cocktails*. XXII Workshop on the *Developments in the Italian PhD Research on Food Science, Technology and Biotechnology,* Bolzano (Italy). (Poster presentation)
- Pierguidi, L (2018) September. *Exploring product complexity dimension: contribution of sensory properties, emotions and individual differences*. XXIII Workshop on the Developments in the Italian PhD Research on Food Science, Technology and Biotechnology, Oristano (Italy). (Poster presentation)
- Pierguidi, L., Spinelli, S., Dinnella, C., Nardello, F., Fusi, R., Tatti S., Gregori, M. and Monteleone E. (2018) September. *Exploring product complexity dimension: contributions of sensory properties, emotions and individual differences*. Eurosense 2018, Verona (Italy). (Oral presentation)
- Pierguidi, L., Spinelli, S., Dinnella, C., Tatti S., Gregori, M. and Monteleone E. (2019), May. *Preferred context for cocktails. 8th E3S Symposium and General Assembly 2019***.** (Oral presentation).

- Pierguidi, L., Spinelli, S., Dinnella, C., Tatti S., Gregori, M. and Monteleone E. (2019) July. *Individual differences in preferred context to have a cocktail: a multidimensional approach*. 13th Sensory Science Symposium, Pangborn. (Poster presentation)
- Pierguidi, L. (2019) September. *Individual differences in cocktails perception and appreciation*. XXIV Workshop on the *Developments in the Italian PhD Research on Food Science, Technology and Biotechnology*, Firenze (Italy). (Oral presentation)
- Pierguidi, L. (2019) October. *Studio della relazione tra complessità e gradimento nei cocktail alcolici*. MiMo Workshop, Rovereto (Italy). (Oral presentation).

Awards

E3s Eurosense Student Award 2018 for the work presented at the Eurosense 2018 conference.