Department of
Management

Chair of marketing at the bottom of the pyramid

Capturing the sense: a study of consumer sensory and emotional experiences in food

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INTRODUCTION

This thes is reflects a commitment to rethinking design from a fresh perspective. It is driven by the desire to explore human needs and ensure that everyone can fully experience and independently manage essential daily activities, including eating. What better starting point than one'sown home? The home becomes a hub of ideas guided by the principles of Design for All.

Our under standing of food will inevitably continue to evolve, along with our relationship with nutrition and each other. Therefore, we must work towards positive change through design, with the goal of creating a dining experience that is authentic, social, and ethical, and that reinforces these connections.

This work is structured into three chapters and the goal is to investigate the influence of plate design and food arrangement on taste perception and overall satisfaction of restaurant customers by administering a questionnaire to those who choose the "Rucoliana Scomposta," one of the most popular pizzas.

The first chapter aims to present the context from which the research work was developed, leading to a deeper understanding of the field. It will cover topics relevant to the focus of this study, starting with an overview of the end users, supported by literature and participant observation.

The second chapter will analyze the role of sensory analysis in product experience research. Specifically, the first section will delve into the challenges

associated with sensory research, while the second section will focus on identifying sensory variables and integrating consumer needs into food design.

Finally, the third section will address how color plays a crucial role in our perception of food, influencing our expectations, taste perceptions, and overall dining experience. Research indicates that color can significantly affect our sensory evaluation of food in various ways: taste perception, appetite and satisfaction, food quality and freshness, Cultural and Contextual Factors and Marketing and Branding.

Finally, the third and final chapter will explore, using statistical methodology, the role of sensory aspects at the dining table. The objectiveis to investigate the influence of plate design and food arrangement on taste perception and overall customer satisfaction at my restaurant. This chapter will present, in the first section, the methodology used; in the second section, the data collected; and, finally, in the third section, a detailed analysis of the results achieved.

CHAPTER 1

THE SENSES AND COOKING

1.1Emotions and food

Food not only nourishes the body but also influences emotions[1]**.** To explain this, think about how we feel when we are hungry: in such situations, we become alert and sometimes irritable. This happens to other animals as well, because the brain needs glucose from food, and when it doesn't receive enough, it perceives a dangerous situation that can only be resolved by eating[2].

The relationship between food and emotions is bidirectional, meaning that emotions can also influence food choices. Various studies show that many people change their eating habits when they are stressed: those who usually eat little tend to eat more under stress, while those who normally eat a lot tend to reduce their food intake in stressful situations[3].

Some foods can influence our emotional state. For example, cocoa directly affects the nervous system, stimulating feelings of pleasure and well-being. Honey, like chocolate, contains tryptophan, an amino acid that promotes the production of serotonin and melatonin, hormones that help improve sleep and manage stress.

[1]Bottura Massimo
[2]Raviola B.A., Cavallera M., Silvia A., Messina C., *The Pathways of Food*, Carocci Editore, 2019.
[3]Spence, C. (2017). *Gastrophysics: The New Science of Eating.* Viking.

The senses evoke our emotions and memories: “We remember 1% of what we touch, 2% of what we hear, 5% of what we see, 15% of what we taste, and 35% of what we smell”[4]. Among all the senses, the sense of smell is one of the first to develop; it typically begins to develop between the eighth and eleventh weeks of gestation[5].

This sense most intensely permeates memories and evokes emotions, thanks to the connections between the brain’s temporal lobe and the limbic system, which manages emotions[6].

In this regard, it is interesting to offer an example from a meeting held at the Italian Union of the Blind and Visually Impaired in Turin, where information was gathered from several visually impaired women. They shared how pleasant it is to share a meal, especially when the smells evoke childhood memories and their mothers kitchens. This experience is common among sighted people as well. The association between a good aroma and good food is as strong as the close link between smell and taste.

Both sighted and visually impaired people retain visual memories that they use to connect new foods to past experiences. Sight allows for the quick recognition of shapes and colors, even from a distance, while touch requires direct contact between the body and the object, such as to check if a fruit is ripe or if a liquid is hot. A loved one’s caresses feel good, while those from a stranger can cause discomfort. Similarly, some blind people avoid eating fish for fear of swallowing

[4]www.megustaprobarcosas.com/blog/2015/12/los-alimentos-a-traves-de-los-cinco-sentidos/, last accessed 02/03/2018.
[5]Saccà V., *Semantic Representations in Congenital Blindness: An Experimental Study on Stereotypies*, University of Messina, 2016, pp. 11, 109, 125, 178-181, 187-189.
[6]Ruiz Laza, R., Sabor/Flavour, in Application of Sensory Analysis of Food in the Culinary Industry, edited by G. Cordero Buezo, Seville, Pablo de Olavide University, 2013, pp. 19-24.

bones and feeling a loss of autonomy. They explore the table with their hands and, once familiarized, feel at ease. Rough wood can be unpleasant, while the porcelain of a tea or coffee set is light, delicate, and pleasant to the touch. For those born blind, touch is as essential and developed as sight is for the sighted.

Other factors that trigger emotions are music and sounds. Music can create a joyful, sad, calm, or other specific atmosphere, having the power to immerse people in a particular emotional state. For example, it can influence how long people stay in a restaurant or other place. The sound of a champagne bottle opening, evoking a festive atmosphere, does not produce the same feeling as the noise of a glass shattering on the floor. As will be discussed further, different sound frequencies affect the perception of food.

All memories and sensations depend on the active presence of the brain. During a meal, the brain processes all the information received from the senses and compares it with stored memories, looking for previous data that resemble the present moment, such as the situation, environment, ingredients, aromas, and more, to trigger emotions and connect us to reality[7].

[7] www.consumer.es/web/en/food/learn_to_eat_well/curiosities/2013/02/19/215811.php, last accessed 02/03/2018.

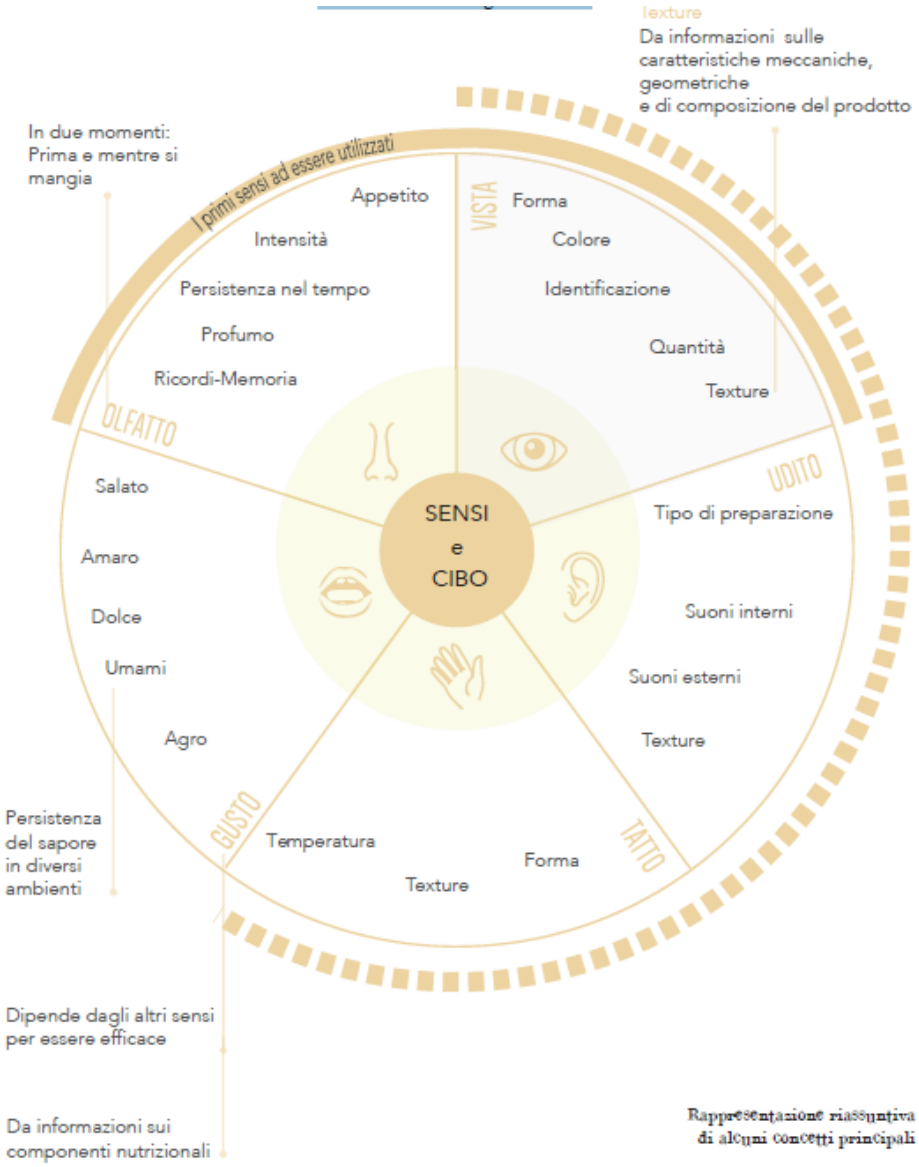


Figure 1.1 The Use of Senses in Food

Source: https://lamenteemeravigliosa.it/neurogastronomia-mangiare-con-i-sensi/

1.2 Analysis of the Five Senses and Food

Tasting food involves more than just one sense. Flavor is the result of a combination of sensations produced by food, primarily through taste and smell. However, the experience of eating engages all the senses. Therefore, it's important to be aware of the capabilities of each sense to understand how they work, what

information they can provide, and how they can be utilized, considering other factors like utensils, the dining environment, and the people with whom the meal is shared.

When faced with a new dish, our senses become more attentive, and the order in which we use them varies depending on whether a person is sighted or blind. A sighted person will first use their vision to recognize colors, shapes, and textures, associating them with known foods to determine if the new dish is appetizing. Then, they will bring the food closer to their nose to perceive the aromas (which can also happen earlier, during cooking, or through the steam of hot food). Next, they will use utensils and, through the touch of their hands and mouth, recognize the texture (involving hearing as well), while the taste will be perceived by the mouth[8].

In contrast, a blind person will first rely on their sense of smell, followed by touch, hearing, and taste. Those who primarily depend on sight often do not engage their other senses as fully, which can diminish part of the culinary experience. We can learn a great deal about sensory stimulation and development from those who lack sight.

To better understand the relationship between the various senses and food, it is useful to first explore how each sense behaves and the differences in their use among sighted, blind, and visually impaired individuals. Later, the interconnections and factors influencing food perception will be explained.

As mentioned earlier, sight is the sense that sighted people rely on the most (some researchers estimate that sight provides about 80% of all information). For those

[8]Baker, B., &Fong, M. (1998). The effects of service climate on customers' perceptions of food service quality: A study of university foodservice. *Journal of Hospitality & Tourism Research, 22*(3), 320-340.

with visual impairment, sight remains the primary means of gathering information about the environment, though the amount and quality of data will vary. This depends on the degree of visual impairment: some individuals may only see nearby objects through tunnel vision, while others perceive only fragments of what they observe; some may have lost peripheral vision or see poorly defined images, and others may have eye movements that make navigation difficult[9]. Visually impaired individuals might struggle with tasks such as pouring water, distinguishing the edges of objects, or reaching items in the center of the table. People who have lost their sight later in life will have more visual memories depending on the age at which they lost their vision; in contrast, those who were born blind have developed their other senses more acutely.

For sighted individuals, touch is essential for understanding food texture. Those with partial sight use touch to supplement the information that vision cannot provide. For the blind, touch becomes the primary sense for perceiving, processing, and storing information (such as contact, pressure, temperature, shape, texture, moisture, and flexibility). Touch is continuously utilized through the body's largest organ: the skin. Some areas, like the hands and mouth, are more sensitive than others. "This varying sensitivity is related to the different functions of each part. More sensitive areas have a greater number of receptors because they control finer movements. The greatest tactile sensitivity is found on the palm".

Touch can be exercised in two ways: by receiving stimuli on the skin (tactile) or by actively touching (haptic), which combines tactile and kinesthetic information

[9]AA. VV. Glossary of Ergonomics, edited by Marcolin F., Mian G., Ossicini A., Luisi F., Pischiottin S., Vechhi Brumatti. INAIL Editions: Milan, 2002, pp. 154-155.

(involving muscles and joints). Stimuli can be thermal, chemical, mechanical, or even electrical. The tactile perceptual process involves several stages[10]:

1. Attention: Readiness to receive tactile stimuli.

2. Localization: Contact with the object, which can be incidental or intentional, involving auditory, olfactory, and kinesthetic senses.

3. Exploration: Ability to recognize an object or surface.

4. Identification: Recognition of the explored object.

5. Discrimination: Recognition of differences between similar objects.

Concerning food, touch provides information about texture, shape, and temperature, as well as about dishes, utensils, and the arrangement of items on the table.

Hearing provides information about the environment but has limitations such as intermittency, variability, and temporariness, acquiring information more slowly than sight. Therefore, a person must remain more attentive. Hearing can also indicate cooking methods (such as the sounds produced in the mouth during chewing) and the texture of food. Both congenitally blind and those who have lost sight later in life develop this sense in their early years to understand distances (echolocation), space, and materials. While sighted people rely on vision to determine if a fruit is ripe, blind individuals may use echolocation to gather the same information. When cooking, blind individuals often prefer to avoid background music to hear the sounds of oil or boiling water. Hearing perceives both external noises and internal sounds (such as the crunchiness of food), both of

[10]Delwiche, J. (2004). The impact of perceptual interactions on perceived flavor. *Food Quality and Preference*, *15*(2), 137-146.

which are part of the eating experience. For example, the sound of a snack package evokes the crispiness of the contained food.

It is commonly believed that hearing and touch are the most important senses for the blind, but smell and taste also provide essential information for autonomy. Both sighted and blind individuals recognize scents, which evoke memories. The aroma of food can be perceived before it reaches the table or before eating begins (such as through the steam of hot foods). Once the food is in the mouth, smell contributes 80% to flavor perception (with the remaining 20% coming from taste)[11]. This is evident when a person has a cold and cannot taste food, or by blocking the nose while tasting, which alters perception. Additionally, the aroma can linger even after the source is gone. Therefore, time affects both the intensity and persistence of the aroma. Aroma perception occurs at different times, pleasuring anticipation and reward through retronasal olfaction, located within the oral cavity.

Molecules released by food diffuse into the air, with lighter molecules traveling farther. These molecules interact with the olfactory epithelium, a sensory organ composed of millions of neurons, each equipped with specific olfactory receptors that generate electrical impulses. These signals are carried by neurons to the limbic system[12].

Sighted individuals tend to pay attention to new aromas at first, but they quickly become accustomed to them. Their olfactory memory is less stimulated and developed compared to that of the visually impaired and blind. For the blind, the perceptual process of smell and taste involves these stages:

[11]Piqueras-Fiszman, B., & Spence, C. (2012). The influence of the color of the plate on the perception of the food in a restaurant setting. *Flavour, 1*(1), 24.
[12]Slow Food, The Origins of Taste, Bra, 2010, pp. 1-6.

1. Attention: Readiness to receive olfactory stimuli.

2. Identification: Ability to recognize a wide range of aromas and flavors.

3. Description: Assessment of qualities and characteristics (intense/weak, pleasant/unpleasant, sweet/bitter, dry/wet).

4. Association: Linking aromas with objects and characteristics.

5. Discrimination: Ability to distinguish between similar aromas.

A notable example of olfactory abilities is Helen Keller, a deaf-blind writer and activist who could recognize people by their scent, sense weather changes, and differentiate between various materials, thereby establishing a closer connection with both her environment and the people around her. In contrast, some people who have sight and hearing but lack the sense of smell (anosmia: loss of smell) face different challenges. Duncan Boak is one such individual who lost his sense of smell after an accident. He founded Fifth Sense, an organization that supports people with sensory issues, including olfactory and gustatory deficits, teaching them how to make the most of their remaining senses. Boak has developed techniques to enjoy food without smell, primarily through touch to perceive food textures and using basic flavors in cooking[13].

The receptors located on the tongue and palate detect the taste of the foods consumed. Chemical substances dissolve in saliva, which acts as a medium to deliver information to the receptors. Specific enzymes such as amylase, lipase, and protease bind to these receptors and transmit signals to the brain.

[13]Saccà V., *Semantic Representations in Congenitally Blind Individuals: An Experimental Study on Stereotypies,* University of Messina, 2016, pp. 11, 109, 125, 178-181, 187-189.

Throughout human evolution, taste receptors have undergone various developments. There are twenty-five receptors for bitter taste, which is often associated with toxic substances, while there is one receptor for sour taste and three combined receptors for sweet and umami flavors [14].

The five basic tastes are now understood to be perceived across all areas of the tongue, contrary to the earlier belief that they were localized in specific regions. There is still debate about whether additional basic tastes such as fatty and metallic exist. For this study, the following five basic tastes are recognized:

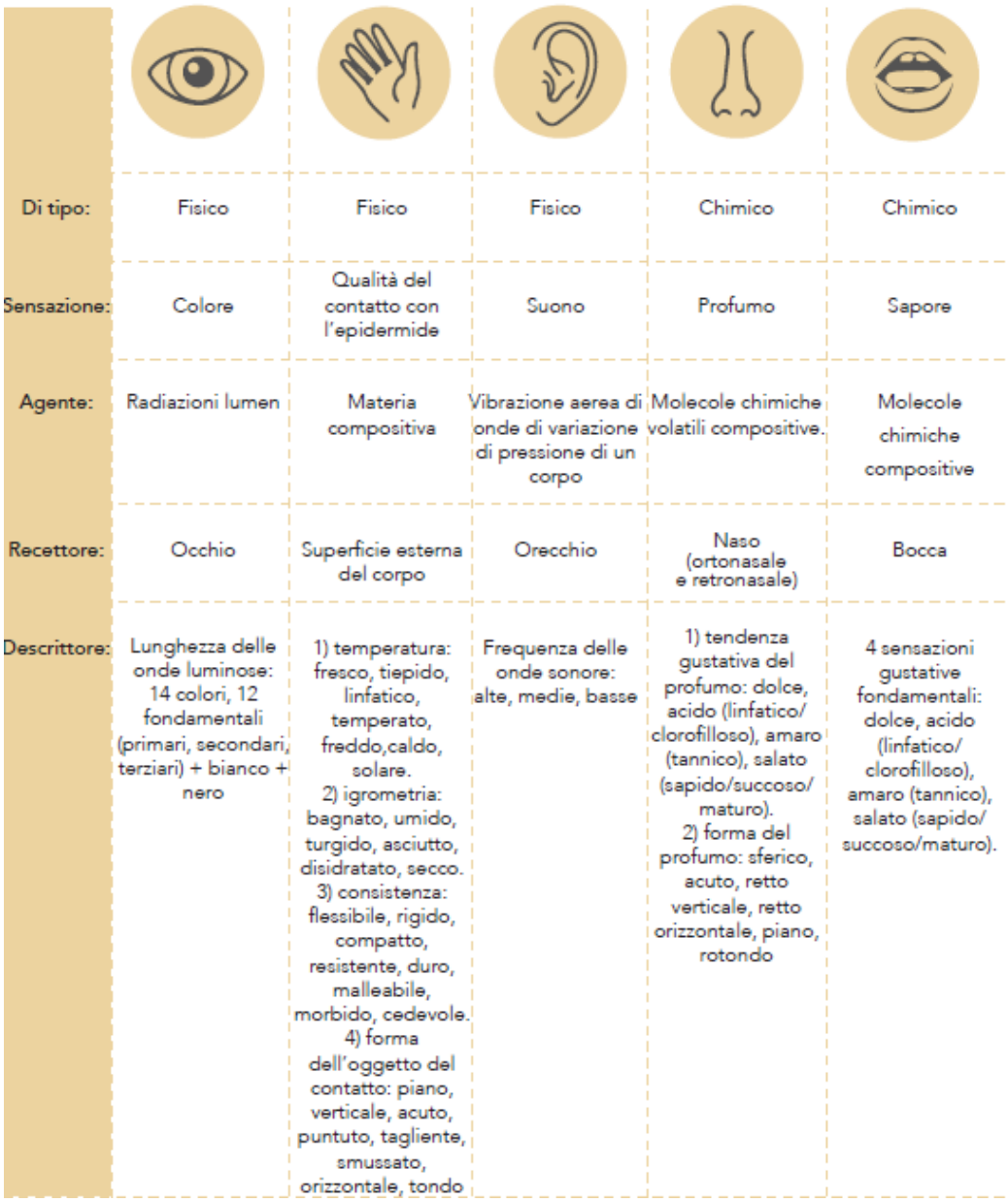
1. Sweet: Signals the presence of simple sugars, which serve as an energy reserve due to their high caloric content. These sugars create a pleasant sensation, especially favored by children. An example of this taste is lactose, a sugar found in breast milk. Sweetness is generated by various compounds, primarily of organic origin;
2. Bitter: Produced by different chemicals, especially alkaloids, found in foods like coffee, chocolate, beer, and more. Unlike sweet taste, which is naturally appealing to children, bitterness is acquired and typically enjoyed only after prolonged exposure. In many cases, a preference for certain foods is influenced by the cultural and culinary traditions of a community;
3. Sour: Linked to the presence of positive ions (H_3O^+), detected by TAS2R receptors, and associated with the taste of spoiled or fermented foods. While resistance to sour foods is often tied to their association with spoiled items, it has gradually been appreciated

[14]Feeney, E. *The impact of bitter perception and genotypic variation of TAS2R38 on food choice*. Nutrition Bulletin, vol 36, no1, 2011, pp. 20–33.

through culinary evolution, often with the addition of vinegar[15]. This taste can be found in foods such as oranges, lemons, apples, certain dairy products, and more;

4. Salty taste refers to the amount of minerals present in food. Taste buds are directly stimulated by inorganic salts, such as sodium chloride (NaCl), which are essential for maintaining the body's water balance. In low concentrations, salt can enhance the perception of sweetness, whereas it has the opposite effect with bitterness;
5. Umami, or the savory taste, is found in foods containing glutamate, such as high-protein items like meat, fish, cheese, and tomatoes. Initially detected by the mGluR4 and mGluR1 receptors, this taste is subsequently stimulated by the amino acid L-glutamate and certain ribonucleotides, such as monosodium glutamate, guanosine monophosphate, and inosine monophosphate[16].

[15]Chandrashekar, Hoon, Ryba e Zuker, *The receptors and cells for mammalian taste*, in Nature , vol. 444, n.o 7117, 2006, pp. 288–94.
[16]Chandrashekar, Hoon, Ryba e Zuker, *The receptors and cells for mammalian taste*, in Nature, vol. 444, n.o 7117, 2006, pp. 288–94.



Di tipo:	Fisico	Fisico	Fisico	Chimico	Chimico
Sensazione:	Colore	Qualità del contatto con l'epidermide	Suono	Profumo	Sapore
Agente:	Radiazioni lumen	Materia compositiva	Vibrazione aerea di onde di variazione di pressione di un corpo	Molecole chimiche volatili compositive.	Molecole chimiche compositive
Recettore:	Occhio	Superficie esterna del corpo	Orecchio	Naso (ortonasale e retronasale)	Bocca
Descrittore:	Lunghezza delle onde luminose: 14 colori, 12 fondamentali (primari, secondari, terziari) + bianco + nero	1) temperatura: fresco, tiepido, linfatico, temperato, freddo,caldo, solare. 2) igrometria: bagnato, umido, turgido, asciutto, disidratato, secco. 3) consistenza: flessibile, rigido, compatto, resistente, duro, malleabile, morbido, cedevole. 4) forma dell'oggetto del contatto: piano, verticale, acuto, puntuto, tagliente, smussato, orizzontale, tondo	Frequenza delle onde sonore: alte, medie, basse	1) tendenza gustativa del profumo: dolce, acido (linfatico/ clorofilloso), amaro (tannico), salato (sapido/succoso/ maturo). 2) forma del profumo: sferico, acuto, retto verticale, retto orizzontale, piano, rotondo	4 sensazioni gustative fondamentali: dolce, acido (linfatico/ clorofilloso), amaro (tannico), salato (sapido/ succoso/maturo).

Figure 1.2 The Five Senses

Source: ruotasensorialesinestetica.com

1.3 The simultaneous use of the senses in food presentation

Eating, closely linked to desire and oral experience, deeply engages the emotional and sensory aspects of being human. All the senses are involved, starting with the sense of smell. Even before we see the food on the table, we detect its aromas

wafting from the kitchen; those skilled in the culinary arts can identify dishes by their scent alone.

Aromas are crucial in initiating gastronomic pleasure; cuisines from different cultures are distinguished by their distinctive smells: the curry of the East, the pepper of the Middle East, the cabbage from Northern Europe or monastic kitchens, and so forth. It is a mistake to overlook this fundamental aspect by diving into the food without first smelling it. Aromas introduce the food to us, awakening our discernment and preparing us to judge whether it is good, less good, or not good.

Scents have the power to embed themselves in our memory, evoking childhood memories or the aroma of a mother's cooking. Fleeting moments during a meal, when particular smells evoke strong emotions, seem imbued with a sense of timelessness.

Following the sense of smell, vision comes into play, sometimes transforming into contemplation. We may marvel at the simplicity of a pepper, or be captivated by the beauty of not only elaborately prepared but also exquisitely decorated dishes. When presented this way, food celebrates itself and the skill of the chef. It is important to address the contemporary tendency to neglect the act of looking at and contemplating the food on the table, overshadowed as it is by the media's portrayal of culinary arts. Media often presents dishes in a way that does not teach us to appreciate the elegance of a simple loaf of bread or the essentiality of a head of garlic for a bruschetta.

Touch is another significant aspect, though many today use utensils like forks and spoons. However, before tasting food with the tongue and palate, we experience it

through touch. Holding an apple or a peach offers very different tactile experiences.

Touch transitions to taste when we finally savor the food. Taste is the most significant sense for those eating or drinking, influenced by our cultures, families, and local roots. The flavors of foods shape our palates, and personal experiences add deep meanings. The impact of sharing food with certain people versus others should not be underestimated: the food can be perceived as good or bad depending on who we share it with, influencing our emotional connections.

Finally, there is hearing, which at first glance might seem unrelated to eating. An experienced cook must listen to the sounds of the kitchen to know when to intervene during cooking: the simmering of a stew, the frying of potatoes, and the searing of a roast beef are like different melodies. Even while eating, the sounds of food in the mouth reach the ears, such as the crunch of a breadstick between the teeth or the sucking of mozzarella.

In essence, eating and drinking engage all the senses. It is not just about satisfying the taste but experiencing the true meaning of nourishment.

After discussing the senses and how they influence the culinary experience in the previous paragraph, it is important to highlight that the upcoming chapters will focus on investigating the impact of plate design and food arrangement on taste perception and overall customer satisfaction in my restaurant. However, this analysis will specifically examine visually impaired consumers only.

CHAPTER 2

THE ROLE OF SENSORY ANALYSIS IN PRODUCT EXPERIENCE RESEARCH

2.1 The challenges promoted in sensoryresearch

To monitor and improve the quality of their products, food companies need expertise in the sensory field. Initially, this need was met by hiring and training a limited number of sensory experts, suchas master brewers, winetasters, or dairy judges. However, with the advancement of sensory evaluation techniques and statistical methodologies throughout the 20th century, the role of the sensory expert has gradually been replaced by laboratory panels composed of trained employees or groups of untrained consumers[17].

Many standard sensory techniques have been derived from psychophysics or are heavily influenced by it[18], a discipline that typically utilizes experiments conducted under highly controller laboratori conditions. However, this method has limitations when it comes to understanding food perception, as in everyday life, the perception of food isinfluenced by environmental conditions and the way itisconsumed. Therefore, thereis a need to broaden sensory research beyond the intrinsic characteristics of food alone.

[17]Lawless, H. T., & Heymann, H. (1998). Sensory evaluation of food: Principles and practices. New York: Chapman & Hall.

[18]Moskowitz, H. R. (2002). The intertwining of psychophysics and sensory analysisHistorical perspectives and future opportunities - a personal view. Food Qualityand Preference, 14, 87–98.

For instance, with the increasing demand for convenience from consumers, a growing number of foods are available in single-serving packages that can be consumed directly (suchas desserts, cookies, and salads). Consequently, over time, the influence that packaging characteristics have on the perception of the contents has increased. Additionally, food products may be consumed in a wide variety of settings, suchas at home, in a restaurant, or on an airplane. Consumers are influenced by contextual features, suchas lighting, the utensils used, and the atmosphere, as well as by pre-existing knowledge about the product, derived from advertising or consumer education. As a result, it is important to integrate the study of the sensory properties of food with research that analyzes different modes of consumption, also taking into account physical, social, and cultural aspects of the context[19].

Unlike the food sector, the development processes of many durable goods have focused little, if at all, on different sensory impressions. The creation of new consumer durables has traditionally centered on the main utilitarian function of the product. Even with the introduction of competing products leading to market saturation, competitive advantage has often been achieved by introducing design variations in terms of size, color, shape, packaging, features, and accessories[20]. These changes have primarily involved creating a distinctive visual appearance, with some improvements in product functionality. This emphasis on visual differentiation is understandable, giventhat visual information helps capture consumers' attentionat points of sale, facilitates product identification and

[19]Meiselman, H. L. (2008). Experiencing food products within a physical and socialcontext. In H. N. J. Schifferstein & P. Hekkert (Eds.), Product experience(pp. 559–580). Amsterdam: Elsevier.
[20]Berkowitz, M. (1987). Product shape as a design innovation strategy. Journal of Product Innovation Management, 4, 274–283.

categorization, and provides a rich source of data that communicates functional, ergonomic, symbolic, and aesthetic aspects[21]. Indeed, visual information oftenseems to influence purchasing decisions more significantly for many industrial products[22].

However, the focus on visual aspects suggests that the involvement of non-visual sensory modalities in industrial design isoften limited to functional improvements. Nevertheless, manufacturers have begunenhancing the quality of industrial products beyond their primary functionality, by emphasizing user-friendliness[23] and the pleasure experienced during use[24], or by going evenfurther and aiming to design the entire experience people have when they purchase and use the product[25]. Since sensory perception provid esessential components for product experience, therehasbeen a growing interest in the full range of sensory properties of consumer products. Consequently, sensory evaluation methods are increasingly being applied to research on non-food products. For instance, several studies have assessed the sensory properties of different types of materials, including packaging materials and clothing fabrics. Other studies have explored sensory properties in specific product categories, suchas personal care products, cigarette lighters, coffee makers, parabolicskis, air conditioning systems, and elements of car interiors. More and more studies are also investigating subtle sensory manipulations that might seem of minor importance, suchas the role of smell in

[21]Creusen, M. E. H., & Schoormans, J. P. L. (2005). The different roles of product appearance in consumer choice. Journal of Product Innovation Management, 22,63–81.
[22]Fenko, A., Schifferstein, H. N. J., & Hekkert, P. (2010). Shifts in sensory dominancebetween various stages of user–product interactions. Applied Ergonomics, 41,34–40.
[23]Norman, D. A. (1988). The psychology of everyday things. New York: Basic books.
[24]Jordan, P. W. (1998). An introduction to usability. London: Taylor and Francis
[25]Pine, B. J., & Gilmore, J. H. (1998). Welcome to the experience economy. Harvard Business Review, 76(July/August), 97–105.

evaluatingclothing or the sounds produced by fabrics. Some of these sensory studies have linked their theoretical framework to Kansei engineering, an approach that seeks to connect consumer preferences to detailed analyses of subjective responses to products and physical design characteristics. Recently, sensorymethodshaveevenbeenapplied in archaeologicalresearch.

Similar to industrial products, food products in highlysaturated markets should not only offer good quality and be visually appealing but also provide interesting and engaging experiences to entice consumers into purchasing them. Therefore, food development is likely to shift towards food design. In concepts developed by food designers, the physical food itselfis no longer the main focus butrather one of severalelements shaping the intended consumer experience. Food designs typicallyconsiderhow the food ispresented (e.g., through packaging or tableware) and the context in which it is consumed (e.g., on the street, during a particular event, or in a themed restaurant). As a result, sensory evaluation faces new challenges because we now need methods that study the entire food experienceas a cohesive whole. This requires a paradigm shift and presents challenges for improving research methods. To facilitate this change, we can learn from the findings of product experience research conducted with durable, industrial products.

2.2 Identifying sensory variables and integrating consumer needs into food design

Whendesigning store environments, retailers frequently incorporate appealing product displays, beautiful artwork, and specific lighting levels[26]. In other words, visual elements are a major focus. However, retailers also ad just other sensory aspects. For example, they migh tenhanceol factory experiences with signature scents, auditory experiences with particolar types of music, and haptic experiences with factors like store temperature or the texture of materials customers touch[27]. Retailers may also add a gustatory dimension by offering product samples and influence vestibular sensations related to balance and posture by providing seating options. These examples illustrate that it has become standard practice for retailers to manipolate atmospheric elements to enhance the sensory experiences of in-store customers and create enjoyable shopping experiences. Looking a head, we anticipate that retailers will invest more in these and other sensory elements to craft unique and pleasurable experiences. We will now explore how retailers are increasing their focus on each of the five traditional senses (i.e., visual, olfactory, auditory, haptic, and gustatory) and the potential for future focus on other sensory modalities.

Attractive visual elements have long been known to positively impact consumers' perceptions of stores and merchandise. Recently, creative and appealing product

[26]Biswas, D. (2019), "Sensory aspects of retailing: Theoretical and practical implications," *Journal of Retailing* , 95 (4), 111–15.

[27]Meyers-Levy, J., Zhu R. and Jiang L. (2010), "Context effects from bod- ily sensations: Examining bodily sensations induced by flooring and the moderating role of product viewing distance," *Journal of Consumer Re- search* , 37 (1), 1–14.

displays have been shown to boost sales[28]. Consequently, retailers employ architects and designers to create engaging retail spaces and frequently refresh these displays to offer customers new experiences. For example, the New York-based retailer Story changes its theme and merchandise every 4–6 weeks, H&M's Brooklyn Boutique rotates visual displays and music every twelve weeks[29], and Gymshark'sflagship store in London features a versatile floorthat can be transformed in fifteen minutes to provide different experiences for shoppers. The trend towards visually appealing environments is likely to continue, with future stores needing to be not only functional but also aesthetically pleasing. Some retailers are already dedicating space to photogenic features, supporting the trend toward visually captivating retail environments. For instance, l'Occitane's 5th Avenue store includes stationary bikes for customers to photograph thems elves "cycling" through Provence, Bikini Mall in Berlinhas a plantwall with a swing, and many independently-owned stores feature selfie walls. These features not only attractattention but also aim to enhance customer engagement and potentially reduce product returns. Future stores might leverage technology to create engaging and novel displays. Recent surveys show that consumers expect interactive and non-interactive screens in stores, and the presence of screens can influence store selection. Digital screens can showcase products, engaging images, or brand-related information and positively impact sales. For example, Apple nowuses video walls in allits stores, Modivo in Warsaw features screens coveringwalls with merchandise and promotions (Retail Customer Experience

[28]Keywan, C. (2022). *Me places"in retail: The fitting rooms* . Bergmeyer https: // www.bergmeyer.com/ trending/ me- places- in- retail- the- fitting- rooms.
[29]Ryan, T. (2022). *H&M brings rotating experiences to its new Brooklyn boutique* . Retail Wire https:// retailwire.com/ discussion/ hm- brings- rotating- experiences- to- new- its- brooklyn-boutique/.

2021), and Walgreens and Kroger use screens on refrigerated coolers to keep products attractively displayed. In the future, stores may continue to integrate screens and mighteven include motion-sensing technology to activate screens when customers enters pecific areas. Motion-activated screens could create the illusion of personalized video content, aligning with the personalized environments we discuss later. Additionally, screens could help retailers easily update photogenic store backdrops. Digital technology also enables the display of images and information without traditional screens. Technologies like holograms and projectors are popular for displaying visuals. For instance, H&M hasused holograms in window displays to entice customers (Retail Customer Experience 2023), and DSW, Fossil, and Levi Strauss & Co. Have employed projectors to display clothing designs on mannequins and other backgrounds. Projected scenes can provide an immersive shopping experience[30] and increase sales throughvivid product displays[31]. Retailers can also use augmented reality and virtual reality to offernovel visual experiences. For example, Harrod's use daugmented reality in window displays to let passers by scan a QR code and see a dance performance by a Harrod's robot. Some Nike stores have used virtual reality to show various locations in Nike's supply chain, and The North Face has used virtual reality to transport shoppers to Yosemite National Park. Future stores could use holograms, projectors, and virtual reality to create captivating visual displays. Retailers might evenallow customers to project digital images of thems elves into different settings. For instance, instead of changing lighting in fitting rooms to see how

[30]Lumen and Forge. (2022). *How to create unique dining experience with immersive technology?* . Lumen and Forge https://lumenandforge.com/ how- to- create- a- unique- dining- experience- with- immersive- technology/.

[31]Schweiger, E.B. , Ahlbom C.-P. , Nordfält J. , Roggeveen A.L. and Gre- wal D. (2023), "In-store endcap projections and their effect on sales,"*Journal of Retailing* , 99 (1), 5–16.

cloche will look, customers might project digital images of themselves into differentscenes. Retailers could also use technology to outfit employees, as demonstrated by Burberry's use of holograms of models in a fashion show. Future stores might use virtual reality to guide customers through virtual settings related to their products or brands, using technology to create novel visual experiences that were previously expensive or labor-intensive.

Retailers often use scents in their stores. The commercial scent market isvaluedat $800 million and isexpected to growfurther .Scents can positively impact product evaluations, memory, and sales. Given these benefits, some retailers have developed signature scents. For example, Hugo Boss uses fruit and cocoascents, while Hamley's Toy Store has a pina colada aroma[32]. The distinctivescent of Abercrombie and Fitch stores has become part of their brand identity. Some retailers use scents to evoke product us age environments, suchas The North Face Soho store, which features a scentreminiscent of Yosemite National Park. Using scents associated with product usage can create an immersive shopping experience and potentially boost sales of complementary products. Technological avances may soon enable retailers to incorporate scents in new ways. For example, emerging technology can translate fragrances into visual displays by predicting the emotions theyevoke and representing these emotions with colors. This technology could be used in future stores to complement product displays. Additionally, Byredo has partnered with RTFKT to create customized fragrances using NFTs, and Samsung show casedscent-producing kiosksat the 2023 National Retail Federation Conference. Future retailers should use scentsat the display or

[32]Biswas, D. , Szocs C. and Abell A. (2019), "Extending the boundaries of sensory marketing and examining the sixth sensory system: Effects of vestibular sensations for sitting versus standing postures on food taste perception,"*Journal of Consumer Research* , 46 (4), 708–24.

department level (ratherthan store-wide) to optimize product sales and the in-store experience. Technology trends suggestthat by 2030, consumers may experiencescents digitally[33], so physical stores should strategically use scents to create memorable experiences.

Studies on store sounds haveshownthat ambient music can affect consumer behavior, such as increasing shopping time, reducingdining time, and enhancing mood. Retailers have begun experimenting with different types of ambient music and sound. For instance, Nespresso uses music to reinforceits luxury brand identity[34], and Pangaia stores use ambient sounds to create an immersive forest experience that aligns with their sustainable mission. Some retailers use sound to attractattention or directmovement, like Heel's Department Store with a window display mimicking a child'sbedroom and playing cartoons, and AT&T with music nearescalators to encouragemovement to the second floor[35]. Sound can also enhance the product experience, asseen with Porsche's pop-up exhibition in New York featuring the sound of driving a 911 and Mastercard'sauditory logo. Augmented reality labels on Ensophia Wine bottles and QR codes on Campbell's so up can sallow customers to experience music paired with the product. Scanning these products in-store offers a preview of the product experience and mayincrease sales, as consumers are more likely to buy products when music or relevant sounds are included. Additionally, robot sequipped with facial recognition technology can greet customers by name. Future stores should use

[33]Fourtané, S. (2020). *The F of senses: Digital aroma*. Interesting Engi- neering https:// interest ingengineering.com/ culture/ the- internet- of- senses- digital-aroma.
[34]Gadson, C. (2022). *Why retailers can't ignore the power of sound: Building a sonic strategy for your store* . Shopify https://www.shopify.com/retail/ sonic- strategy- for- retail.
[35]Lueck, K. (2021). *The power of sound for retail* . Retail Touch- Points https:// www.retailtouchpoints.com/ topics/ customer-experience/ the- power- of- sound- for- retail.

thistechnology to tailorauditoryexperiencesbased on customer data or emotions. Given the impact of sound on consumer behavior and branding, auditory elements should be a key focus in store design.

Physical interaction with products is a unique feature of brick-and-mortar stores, thoughit may be less appealing to those concerned about germs or contamination. Whilemany stores encourage touch, some use technology to facilitate hapticexperiences. For example, Apple stores are known for interactive product displays[36], and both Ulta and Sephora offer testers for product sampling. Some retailers use different strategies to provide variedtactile sensations. Boutique stores may incorporate various textures into their designs, and some retailers have reintroduced hot food bars for direct selection (Friend 2022). Technology also enhances haptic experiences; Saatva stores use smart displays thatreveal product information when items are lifted, and Kate Spade employ saugmented reality to show customization options when a bagis removed from a shelf. Future stores are likely to combine tactile experiences with advanced technologies to enhance product interaction.

Attractive visual elements have long been recognized for positively affecting consumers' perceptions of stores and merchandise. Recently, creative and engaging product displays havebeenshown to boost sales. As a result, retailers collaborate with architects and designers to create captivating retail environments and frequently update these displays to offer fresh experiences to customers. For instance, the New York-based retailer Story changes its theme and merchandise every 4–6 weeks, H&M's Brooklyn Boutique updates its visual displays and

[36]Briggs, F. (2022). *Interactive retail stores create stand-out cus- tomer experiences* . Samsung https:// insights.samsung.com/ 2022/ 01/ 25/ interactive- retail- stores- create- stand- out- customer- experiences/.

music every twelve weeks, and Gymshark's flagship store in London features a versatile floorthat can be transformed in fifteen minutes to providevarious experiences for shoppers. The trend toward visually appealing environments is likely to continue, with future stores needing to be both functional and aesthetically pleasing. Some retailers are already incorporating photogenic features, supporting the trend towards visually striking retail spaces. For example, l'Occitane's 5th Avenue store includes stationary bikes for customers to photograph themselves "cycling" through Provence, Bikini Mall in Berlinhas a plantwall with a swing, and many independently-owned stores have selfie walls. These features notonly draw attention but also aim to enhance customer engagement and potentially reduce product returns[37]. Future stores might leverage technology to create innovative and engaging displays. Recent surveys indicate that consumers expectboth interactive and non-interactive screens in stores, and the presence of screens can influence store choice. Digital screens can display products, engaging images, or brand-related information and positively impact sales. For instance, Apple nowuses video walls in allits stores, Modivo in Warsaw features screens coveringwalls with merchandise and promotions (Retail Customer Experience 2021), and Walgreens and Kroger use screens on refrigerated coolers to keep products attractively displayed. In the future, stores may continue to integrate screens and mighteven include motion-sensing technology to activate screens when customers enter specific areas. Motion-activated screens could create the illusion of personalized video content, aligning with the personalized environments we will discuss later. Additionally, screens

[37]Abdullah, H. (2022). *Encouraging customer selfies could drive down return rates* . JustStyle https:// www.just-style.com/ news/ encouraging- customer- selfies- could- drive- down- return-rates/.

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[38]Argo, J.J. and Dahl D.W. (2020), "Social influence in the retail context: A contemporary review of the literature,"*Journal of Retailing* , 96 (1), 25–39 .

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2.3 The influence of color on food perception

Color plays a crucialrole in how we perceive food, impact ingour expectations, taste perceptions, and overall dining experience. Research shows that color can significantly affectour sensory evaluation of food in several ways:

1) Taste Perception: Color can alter ourperception of taste. For example, red foods are often associated with sweetness, while green foods may be perceivedas more bitter or savory. Studies have demonstrated that people might perceive a beverage colored red as sweeter compared to the same beverage in a different color. This is because color can influence the psychological expectations we have about the taste of food;
2) Appetite and Satisfaction: The color of food can affect appetite and satisfaction. Warm colors like red and yellow are known to stimulate appetite and increase the desire to eat, whichis why many fast-food chains use these colors in their branding and decor. Conversely, cooler colors like blue and green may suppress appetite and create a sense of

calmness, which can be used in dining environments to create a relaxedatmosphere;

3) Food Quality and Freshness: Color can alsosignal food quality and freshness. Bright, vibrant colors are often associated with freshness and high quality, whiledull or off-colors can indicate spoilage or poorquality. For instance, a brightly colored salad or fruit might be perceivedasfresher and more appetizingthan a discolored or wilted version of the same food (Olsson et al. 2006);
4) Cultural and ContextualFactors: Cultural and contextual factors play a significantrole in how color influences food perception. Different cultures have varying associations with colors and their meanings. For example, in some cultures, white might signify purity and freshness, while in others, it might be associated with blandness or lack of flavor. Context, suchas the setting in which food isserved, alsoaffectshow color isperceived. A dish that appears appealing in a restaurant might look less appetizing when served in a different context;
5) Marketing and Branding: The use of color in food marketing and packaging is a deliberate strategy to influence consumer behavior. Packaging colors can attract attention, convey brand identity, and influence purchasing decisions. For instance, green packaging is often used to suggest healt hiness and natural ingredients, while bright colors can create a sense of fun and excitementa round the product.

Overall, color is a powerfulfactor in food perception that affects not only our immediate sensory experience butal soour emotional and cognitive responses to

food. Understanding these influences can help food producers, marketers, and chefs create more appealing and satisfying food experiences.

Here’s a tablesummarizing the senses, their impact on customers in the culinarycontext, and associated academic studies:

Sense	Impact on Customers	Study and References
Sight	Visual presentation of food (color, shape, plating) influences customers' perception of taste, quality, and value. Attractive presentation can enhance the dining experience and increase satisfaction.	Spence, C. (2015). *Multisensory flavor perception*. Cell, 161(1), 24-35.
Smell	Aroma significantly impacts flavor perception and appetite. A pleasant smell can elevate the perceived taste, while unpleasant odors reduce it.	Herz, R. S. (2004). *The effect of verbal context on olfactory perception*. Journal of Experimental Psychology.
Taste	Taste is the most direct sense in food evaluation, but it is highly influenced by other senses such as smell and sight. Presentation and aroma can enhance or diminish the perception of taste.	Auvray, M., & Spence, C. (2008). *The multisensory perception of flavor*. Consciousness and Cognition.
Touch	The texture of food plays a key role in enjoyment. It affects mouthfeel and the perception of freshness or quality. Customers may prefer foods with certain tactile properties.	Chen, J., & Stokes, J. R. (2012). *Rheology and tribology: Two distinctive regimes of food texture sensation*. Trends in Food Science & Technology.
Hearing	Sounds (such as crunchiness or sizzling) contribute to the perception of freshness or cooking methods. The auditory experience can influence customer enjoyment and expectations.	Zampini, M., & Spence, C. (2004). *The role of auditory cues in modulating the perceived crispness and staleness of potato chips*. Journal of Sensory Studies.

This table highlights key aspects of sensory impact and offers academic references to support further exploration.

After discussing the senses and how they influence the culinary experience in the previous paragraph, it is important to highlight that the up coming chapters will focus on investigating the impact of plate design and food arrangement on taste perception and overall customer satisfaction in my restaurant. However, this analysis will specifically examine visually impaired consumers only.

CHAPTER 3

CASE ANALYSIS SENSORIALITY AT THE TABLE

3.1 Questionnaire Administration Methodology

The objectiveis to investigate the influence of plate design and food arrangement on taste perception and overall customer satisfactionatmyrestaurant.

The researchwill be conductedatmyrestaurant and will involve twodistinct groups of participants:

- Group 1: Regular Experience: this group willreceivedishes with a traditionalpresentation, without special attention to design or food arrangement. The goal is to gather data on how customers evaluate the visual aspect, taste, and overall satisfactionin a standard context (Fig. 3.1);

Figure 3.1: Group 1 presentation

- Group 2: DesignedPlates Experience: this group will be serveddishes with more attention to design and food arrangement. The focus will be on aesthetic elements suchas the shape, size, and color of the plate, aswellas a more elaborate presentation of the food. The objectiveis to determine if these factors affect taste perception and overall satisfaction (Fig. 3.2);

Figure 3.2: Group 2 presentation

- Group Assignment: participants will be randomly assigned to the two groups to ensure representativeness and minimize bias. The randomizationwill be simple: the first customer to arrivewill be assigned to Group 1, the second to Group 2, and so on;
- Questionnaire Administration: After the meal, participants will complete a structured questionnaire, administeredei ther in paper format or digitally (via tablet or QR code). The

samequestionnairewill be used for both groups, allowing for directcomparison of responses;

- Questionnaire Structure: The questionnaire is divided into five sections to collect detailed information:
- Demographic Information: age, gender, frequency of restaurant visits, and dining companions;
- Evaluation of Visual Experience: Questions exploring the visual aspect of the dish, the influence of plate design and colors on food perception, and the importance of food arrangement on the plate;
- Taste Perception Evaluation: Questions related to satisfaction with the food's taste, the consistency between visual appearance and taste, and the influence of plate design on taste perception;
- Overall Sensory Experience: Questions regarding aroma, texture of the food, and the influence of visual presentation on mealenjoyment;
- Overall Satisfaction and Feedback: Final questions on overall satisfaction and suggestions for improving the presentation of dishes and the dining experience.

Section	Question	Answer Options
Section 1: Demographic Information		
1. Age	18-24, 25-34, 35-44, 45-54, 55-64, 65+	
2. Gender	Male, Female, Other, Prefer not to answer	
3. Visits in the last 6 months	This is my first visit, 1-2 times, 3-5 times, 6+ times	
4. Dining companions	Alone, With friends, With family, With a partner, With work colleagues	
Section 2: Visual Experience		
5. Visual appearance rating	Likert scale from 1 to 5 (1 = Very unsatisfactory, 5 = Excellent)	1, 2, 3, 4, 5
6. Influence of plate design	Likert scale from 1 to 5 (1 = Did not influence at all, 5 = Influenced a lot)	1, 2, 3, 4, 5
7. Influence of plate colors	Likert scale from 1 to 5 (1 = Did not influence at all, 5 = Influenced a lot)	1, 2, 3, 4, 5
8. Importance of food arrangement	Likert scale from 1 to 5 (1 = Not important, 5 = Very important)	1, 2, 3, 4, 5
Section 3: Taste Perception		
9. Satisfaction with taste	Likert scale from 1 to 5 (1 = Very unsatisfied, 5 = Very satisfied)	1, 2, 3, 4, 5
10. Consistency of appearance & taste	Likert scale from 1 to 5 (1 = No consistency, 5 = Very consistent)	1, 2, 3, 4, 5
11. Plate design influence on taste	Yes, No	Yes, No
Section 4: Overall Sensory Experience		
12. Satisfaction with aroma	Likert scale from 1 to 5 (1 = Very unsatisfied, 5 = Very satisfied)	1, 2, 3, 4, 5
13. Satisfaction with texture	Likert scale from 1 to 5 (1 = Very unsatisfied, 5 = Very satisfied)	1, 2, 3, 4, 5
14. Influence of visual presentation	Likert scale from 1 to 5 (1 = Did not influence at all, 5 = Influenced a lot)	1, 2, 3, 4, 5
Section 5: Overall Satisfaction		
15. Overall satisfaction	Likert scale from 1 to 5 (1 = Very unsatisfied, 5 = Very satisfied)	1, 2, 3, 4, 5
16. Recommend the restaurant	Yes, No	Yes, No

3.2 Data collection

The data collection focused on exploring the influence of plate design and food arrangement on customers' sensory perception and overall satisfaction. The studied population consisted of customers of the pizzeria Gusto. Gusto is a pizzeria located in the heart of Castellammare del Golfo, distinguished by the excellence of its raw materials and its innovative approach to pizza preparation. The goal is to create a unique culinary experience, where the tradition of pizza merges with particular attention to the quality of the ingredients and the presentation. The customers involved in the study ordered the "Rucoliana Scomposta" pizza, one of the most representative and appreciated dishes on the menu. The sample was divided into two distinct groups: • Group 1 - Traditional presentation: Participants in this group received the pizza in a conventional manner, without particular aesthetic attention to the presentation of the dish or the arrangement of the food. The pizza was served whole, in line with the restaurant's standard practice. • Group 2 - Elaborate presentation: In this group, the pizza was served in a more elaborate manner, with a pre-cut arrangement, and the ham served separately on a cutting board. The aim was to visually stimulate the participants and provoke a more intense sensory perception. The questionnaire was administered on alternate days to balance the experience between the groups. Group 1 participated on Tuesday, Thursday, and Saturday, while Group 2 participated on Wednesday, Friday, and Sunday. This procedure allowed for an even distribution of participants and avoided potential biases caused by external factors. The questionnaire, administered digitally via QR code, was structured into several sections to collect data on: 1. Demographic data: age, gender, frequency of

visits to the restaurant, and type of company during dinner. 2. Visual perception of the dish: evaluations of the visual appearance of the dish, design, colors, and food arrangement. 3. Taste satisfaction: judgments regarding the taste and coherence between the visual appearance and the flavor of the dish. 4. Overall sensory experience: questions related to the aroma and texture of the food. 5. Overall satisfaction: final evaluation of the experience and willingness to recommend the restaurant to friends and family. A total of 101 questionnaires were collected, equally distributed between the two groups (51 for each group). In the restaurant context, the customer's sensory perception is not based solely on the taste of the food but is also influenced by visual and environmental factors. The presentation of the dish, which includes the design and arrangement of the food, plays a crucial role in shaping the overall sensory experience. As mentioned in the previous chapter of this thesis, various studies demonstrate that visually appealing presentations can positively influence taste perception, even when aesthetic appearance and actual taste are not directly correlated. This concept is particularly relevant to our research, where the comparison between an elaborate design and a traditional presentation allowed us to examine how aesthetics can affect customer satisfaction.

3.3 Results achieved

After the data collection, the responses were loaded into SPSS for a comprehensive statistical analysis. The analysis was conducted using both descriptive statistics and a One-Way ANOVA to compare the responses from the two groups and determine the statistical significance of the observed differences.

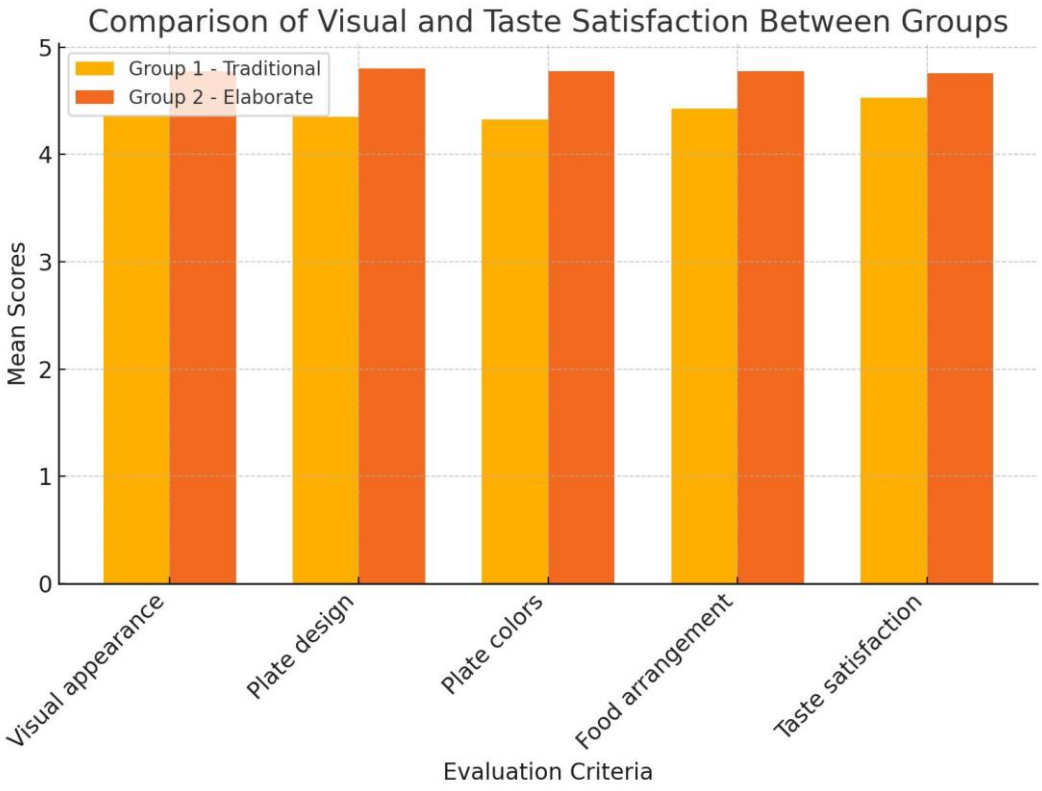
Descriptive analysis represents a fundamental preliminary phase in any statistical study, as it provides a summary of the main characteristics of the collected data. Through descriptive analysis, it is possible to obtain an overview of the distributions, means, and standard deviations for key variables. This method allows for a general understanding of trends in the data and the identification of any anomalies or outliers. In our case, the descriptive analysis enabled us to explore the evaluations related to the visual appearance of the dish, design, taste satisfaction, and overall experience, providing a solid foundation for the subsequent inferential analysis. The One-Way ANOVA was chosen as the main statistical test to compare the group means. This test allows for determining whether the differences between the group means are statistically significant or due to random variation. The One-Way ANOVA is particularly suitable when comparing a single independent variable (in this case, the presentation of the dish) across multiple dependent variables (visual perception, taste satisfaction, etc.). By using ANOVA, we rigorously verified whether the aesthetics of the dish had a significant impact on participants' evaluations.

3.3.1 Descriptive Analysis

The descriptive analysis showed that Group 2 (elaborate presentation) achieved higher average scores than Group 1 (traditional presentation) regarding visual dimensions: • Visual appearance of the dish: Group 2 had a mean of 4.78, compared to 4.37 for Group 1. • Dish design: Group 2 reported a mean of 4.80, compared to 4.35 for Group 1. • Dish colors: Group 2 achieved a mean of 4.78,

compared to 4.33 for Group 1. • Food arrangement: Here too, Group 2 had a mean of 4.78, compared to 4.43 for Group 1. In terms of taste satisfaction, the differences were less pronounced but still present: • Taste satisfaction: Group 2 had a mean of 4.76, compared to 4.53 for Group 1. • Taste expectations, aroma, and texture: Both groups reported similar ratings for these dimensions (Fig. 3.3).

Figure 3.3. Bar Chart (Comparison of Visual and Taste Satisfaction)

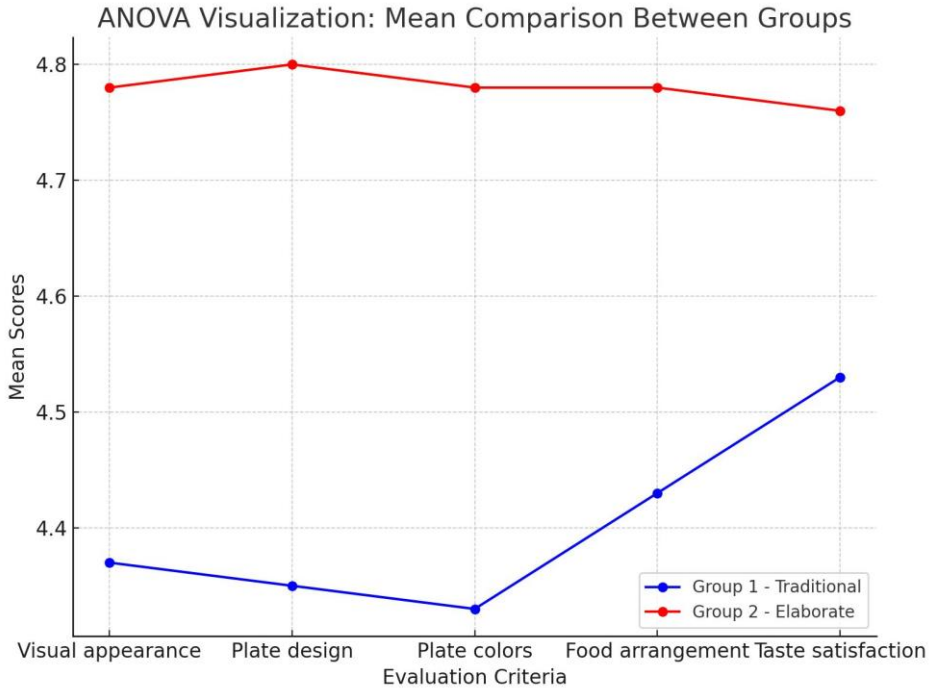


3.3.2 Analysis of Variance (ANOVA)

The ANOVA test was performed to determine whether the observed differences between the two groups were statistically significant. The results indicated that: • Visual appearance of the dish: Significant difference between the groups (p =

5.87e-05), with Group 2 receiving significantly higher scores. • Dish design: Highly significant difference (p = 1.41e-06). • Dish colors: Significant difference between the groups (p = 1.00e-05). • Food arrangement: This variable also showed a significant difference (p = 0.00035). • Taste satisfaction: A significant difference was also observed here, although less pronounced than the visual variables (p = 0.0168). Taste expectations, aroma, and texture did not show significant differences between the groups: • Taste expectations: p = 0.82 (no significant difference). • Aroma: p = 0.19 (no significant difference). • Texture: p = 1.0 (no significant difference). Finally, overall experience did not show significant differences between the groups (p = 0.35), suggesting that other factors, such as the quality of the food and atmosphere, played a predominant role in the final evaluation of the experience (Fig. 3.4)

Figure 3: ANOVA analysis comparing the mean scores of Group 1 (Traditional) and Group 2 (Elaborate) across different evaluation criteria to determine statistical significance.



Conclusions and Limitations of the Study

The analysis clearly shows that the visual design and food arrangement significantly influence customers' visual perception and overall satisfaction. In particular, Group 2, which received a more elaborate aesthetic presentation, reported significantly higher ratings regarding visual appearance, design, and food arrangement. However, sensory dimensions related to taste, aroma, and texture did not show significant differences between the groups, indicating that taste perception is less influenced by the plate's aesthetics. Despite the statistically significant results between the two groups, it is essential to recognize some limitations that may affect the interpretation of the data and their generalizability. One significant limitation of the study concerns participant selection. The sample consisted exclusively of customers who chose to order the "Rucoliana Scomposta" pizza, one of the most representative dishes on the menu. This may have introduced a selection bias, as not all restaurant customers may share the same preferences or expectations. The choice of the dish may reflect a specific type of consumer, with inclinations that are not necessarily generalizable to the entire restaurant clientele. Consequently, while the results provide relevant insights, they may not be representative of the perceptions and experiences of a broader customer population. Moreover, the possible response bias should be considered. Participants were aware that they were part of a study and had to provide immediate feedback on their culinary experience through a digital

questionnaire. This awareness may have influenced their behavior and responses. It is possible that participants expressed more favorable ratings, particularly regarding the aesthetic component of the dish, to align with the perceived expectations of the researchers or the restaurant itself. This phenomenon, known as the Hawthorne effect, occurs when subjects modify their behavior in response to being observed. In this study's context, participants may have paid more attention to the visual aspects of the dish's presentation precisely because they were aware that these aspects were being evaluated. This may have led to an overestimation of the plate's design's influence on overall satisfaction. Another limitation concerns the non-random sampling methodology. Participants were selected from those who voluntarily chose to order a specific dish, rather than through a random selection, which may have limited the sample's heterogeneity. Although this approach facilitated the questionnaire administration, it may have introduced a distortion in the data, as the sample may not fully represent the restaurant's clientele. Additionally, the data collection was carried out over a limited period of six consecutive days, which may not reflect the variability of customer preferences at other times of the year or under different circumstances. Finally, while the visual appearance of the dish significantly influenced overall perception, sensory variables such as taste, aroma, and texture did not show statistically significant differences between the two groups. This suggests that pure sensory perception is not necessarily influenced by the plate's aesthetics but may be determined primarily by the food's intrinsic quality. Furthermore, external factors, such as the restaurant's environment, interaction with the staff, and the overall atmosphere, may have played a predominant role in the overall experience

evaluation, thus attenuating the direct impact of the plate's design. The study conducted has confirmed that plate design and food arrangement significantly influence customers' visual perception and overall satisfaction. The analysis of the questionnaires administered to the two participant groups made it clear that a more curated and visually elaborate presentation of the dish results in a more positive evaluation of its visual aspects and design. Group 2, which received the pizza in a more aesthetically sophisticated manner, reported higher scores in terms of visual impact, food arrangement, and design compared to Group 1, which received a more traditional presentation. However, variables related to taste, aroma, and texture showed no statistically significant differences between the two groups. This result suggests that while aesthetics may enhance the overall dining experience, it does not directly influence sensory perception of food quality. In other words, although visual design plays a crucial role in creating a pleasant and memorable experience, the intrinsic quality of the food remains the key element in pure sensory evaluation. Methodologically, the decision to adopt a quantitative approach through a digital questionnaire allowed for efficient and precise data collection. Nonetheless, as discussed in the limitations section, it is important to consider some potential distortions that could have influenced the results. First, the selection bias related to the sample, consisting exclusively of customers who ordered the "Rucoliana Scomposta" pizza, may not fully represent the heterogeneity of the restaurant's clientele, meaning the conclusions may not be generalizable to the entire customer population. Moreover, response bias and the Hawthorne effect may have influenced participants' evaluations, leading them to provide more favorable feedback knowing they were part of a study. Despite these

limitations, the findings provide valuable insights for the restaurant industry. It is clear that attention to the aesthetic presentation of dishes can improve visual perception and contribute to a more satisfying overall experience for customers. This emphasizes the importance of plate design as a strategic element in offering a culinary experience that goes beyond mere taste, engaging other senses and creating a more complete and fulfilling experience. In light of the findings, future studies should expand on this topic by involving a wider variety of dishes and a more diverse sample. Additionally, further research could investigate the relationship between visual appearance and sensory variables in greater depth, exploring how other factors, such as the restaurant's atmosphere and staff interactions, may influence the overall dining experience. In conclusion, this research has confirmed the importance of plate design in creating a positive sensory experience, providing concrete indications for enhancing customer satisfaction and perceived meal value through attention to aesthetic details.

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