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ORIGINAL PAPERS

NEUROMARKETING AND FOOD DECISIONS: AN INTERDISCIPLINARY ANALYSIS OF THE INFLUENCE OF SENSORY AND EMOTIONAL STIMULI ON CONSUMER BEHAVIOR

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Abstract. *In a society where food preferences are affected by various aspects such as taste and nutritional value, advertising and packaging, perceiving the reasons that influence our choices becomes crucial. Neuromarketing is an innovative branch of marketing that combines knowledge from neuroscience with traditional marketing techniques to understand how our brain reacts to different stimuli. This connection between science and advertising has significant consequences for our eating habits, affecting not only our culinary choices, but also the way we look at and relate to food. Feelings, memory capacity and the reward center in the brain are essential factors in decision-making, leading us to often opt for products that meet nutritional and emotional needs.*

Keywords: neuromarketing, diet and health, emotional factors, brain health and nutrition, food marketing, sensory stimuli.

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Introduction

Neuromarketing is a modern interdisciplinary field, based on the study of brain mechanisms that support the understanding of consumer behavior in its interactions with various marketing methods [[45]].

It explores, through a rigorous approach, how feelings, desires, senses and memory contribute to consumers' decision-making [[15]]. Key tools used include functional magnetic resonance imaging (fMRI), electroencephalogram (EEG), galvanic skin response (GSR) and eye tracking, technologies that allow a detailed understanding of the stimuli that influence consumer receptivity and the responses generated by them [[28]].

A fundamental aspect influenced by marketing strategies is diet, which has a direct impact on overall health and optimal brain function. Dietary imbalances caused by an unhealthy diet, low in essential nutrients, are recognized as risk factors for numerous chronic diseases and mental disorders [[32]].

Advertisements, through their ability to generate emotions, significantly influence consumers' purchasing behavior, providing a direct link between sensory perception such as taste, smell or texture and consumption decisions[[11], [47]].

In this article, we'll look at the impact of neuromarketing on our food decisions, from packaging design to the advertising strategies that grab our attention. We will examine how our emotions and perceptions are controlled to determine our food preferences.

1.The concept of Neuromarketing

Dutch organizational theorist and marketing professor Ale Smidts introduced the term neuromarketing in 2002, defining it as the study of brain mechanisms to improve marketing strategies by understanding consumer behavior [[45]]. Neuromarketing involves using current knowledge about the brain to assess the influence that marketing and advertising have on consumers (https://www.researchgate.net/publication/272823068_Neuromarketing_Towards a_better_understanding_of_consumer_behavior).

Today, the field is thought to be the result of a synergy between behavioral psychology, economics, and consumer neuroscience [[33]]. It is a recent marketing discipline that uses medical techniques to study the reaction of the central nervous system to marketing stimuli [[28]].

Neuromarketing is the sector that can evaluate consumers' attention, feelings, desire, senses and memory, of which, feelings are the only ones that can arise without awareness. According to research, consumer desires and pleasures are significantly influenced by motivation [[15]].

Research indicates that there is a connection between food promotion and buyers' decisions. Obesity or malnutrition, which is a growing concern for the health of children and adolescents, is influenced by activities such as advertising, product placement, packaging and labelling [[31], [50]]. Packaging and labelling regulations must provide clear information on the nutritional value of food, in particular for products aimed at young and low-income consumers [[6]].

1.1 Neuromarketing and the techniques used

As for the physiological reactions of the consumer, the functioning of their brain is crucial for the emotional reaction to food and for food preferences [[46]]. Changes in the functioning of brain waves can generate various feelings and influence decision-making. Cognitive changes in the consumer can occur significantly when they are exposed to stimuli, name, appearance, smells and flavors of food [[23]]. Neuromarketing, the new science of marketing, is carried out using scientific techniques and tools such as functional magnetic resonance imaging (fMRI), electroencefalogy (EEG), the galvanic response of the skin (GSR) and eye tracking (Eye Tracking) [[28]].

Over the past twenty years, functional magnetic resonance imaging (fMRI) has become a well-known method for studying how the brain reacts to food [[41]]. A larger number of studies have investigated how the neuron reacts to images of high calorie versus low-calorie foods [[7]]. High-calorie foods have been shown to provide greater satisfaction than low-calorie foods. However, this research had its limitations, examining the difference in the consumption of high calorie versus low-calorie foods in the absence of a choice between them. However, no correlation was observed between food stimuli and taste, which could explain the discrepancy in reward. Also, participants were usually in a state of hunger, which increases the food reward [[49]]. The increase in food pleasure is influenced by hunger, and the areas of the brain responsible for processing reward are more active when individuals view images of food when they are hungry [[49]].

EEG monitoring of brain activity is a fascinating method used in sensory research and consumer behavior towards food, providing detailed information to understand their reactions [[42]]. Currently, the most commonly used method for measuring brainwaves with a high temporal resolution is the EEG technique. It is capable of monitoring brain activity in real-time and provides a lot of valuable information. EEG information from brainwave measurements can be investigated in relation to mood, acceptance level, and brain activity [[1]]. The use of the EEG technique is promoted in sensory research and assessment of consumer behavior [[39]]. Food properties, environmental factors, and internal consumer factors stimulate consumers, causing them to respond to food in two ways: through a physiological response, such as changes in facial expression and autonomic nervous activity, and through an emotional response, such as pleasure, dislike,

happiness, and neutral reactions, following changes in brain activity. Both answers define whether a food is acceptable to consumers [[42]].

GSR is a measure of the body's autonomic (involuntary) reaction. When subjected to external or internal factors, such as sound, light, temperature, feelings, vocabulary, and facial expressions, the body reacts involuntarily. With the change in the level of physiological arousal, the autonomic reactions also change [[27]].

Visual attention is an important factor in the food decision-making process, providing a key contribution to subsequent decision-making [[29]]. Eye monitoring technology has become increasingly popular as a direct method of assessing visual concentration. This technology monitors people's reactions live, the gaze pattern [[8]], It assesses the point of focus or gaze (the place where the person looks), the duration in which the person has fixed that point, the movement of the eyes together with the head, the frequency of blinks and the dilation of the pupil as they complete an attention task [[52]]. This technology transforms eye movements into a range of information, including the position of the pupil, the direction of gaze for each eye, and the focal point. Therefore, technology is responsible for decoding eye movements and transforming them into insights [[15]].

2. Neuromarketing and Eating Behavior

2.1 The role of diet in brain function

The combination of the individual genotype and various environmental factors, such as nutrition, parental care, social interactions, stress and disease, determines the evolution and functions of the brain [[14], [3]]. Interest in the link between diet and mental health is growing [[44]]. Despite the fact that food was traditionally seen as a way to provide energy and building substances to the body, now its ability to prevent and protect against disease is beginning to be appreciated. In particular, studies in recent years have brought to light compelling evidence about the impact of dietary factors on specific molecular systems and mechanisms that support mental functioning [[16]].

Many micronutrients, including vitamins and trace elements, are crucial during the period of early brain development [[25]]. A lack of vitamin B has been associated with various mental health problems, and vitamins B6, folate (B_9) and B12 have been the most researched in terms of their impact on the brain [[18]].

Referred to as the "neglected neurosteroid", vitamin D has specific receptors in the brain and influences its development [[13]]. It plays an important role in the absorption of calcium in the intestine and is also a crucial factor in synaptic transmission [[2]]. Nutritional components, as well as diet as a composite, affect the maintenance and functioning of the brain. Healthy diets may protect against dementia and mild cognitive impairment [[32]]. Inadequate nutrition during

pregnancy and in the early stages after childbirth can cause long-term changes in various aspects of metabolic and brain functions, including cognitive problems and premature brain aging [[9]].

2.2 Influence of diet on consumption decisions

Today, unhealthy eating habits are closely linked to chronic diseases such as heart disease, hypertension, diabetes, and increased death rates [[12]].

The preference for healthy foods is increasingly present in today's society, reflecting people's desire to have a healthy and lasting life. It is essential to maintain a healthy lifestyle [[24], [19]]. In this context, the demand for healthy food continues to grow, leading to significant changes in consumer purchasing behavior [[11]]. Choosing and purchasing healthy foods daily are the choices people make to ensure the amount of nutrients they need, promote health, and prevent disease. The main purpose of eating healthy foods is to meet the body's nutrient needs through a balanced and varied diet [[19], [22]]. Promoting the consumption of healthy foods also involves limiting processed foods that contain high amounts of sugar, salt, fat, and artificial additives, in order to mitigate the risks of obesity and other conditions related to overconsumption [[51]].

2.3 Psychological Factors in Food Decisions

Feelings are important in purchasing behavior, influencing the decision to purchase a product [[38]]. Feelings can have an impact on how we consume food and our decisions about how much and when we eat it [[26]]. Every advertisement we observe, every nuance we notice has an emotional impact that influences the decision to buy or not to buy a product [[38]]. Emotional marketing focuses on using emotions in marketing and advertising efforts to attract attention, generate recognition, drive sharing, and drive product purchase. It usually focuses on a single emotional state, such as joy, sadness, anger or fear, to determine the reaction of consumers.

3. The Impact of Neuromarketing on Food Decisions

Eating behavior and appetite are certainly influenced by food-related signals. A constant excitement of the appetite is encountered throughout the day. Advertisements, the plethora of products in attractive packaging in stores, and the visual or olfactory sensations of food, people eating or discussing food, as well as emotional reactions, feelings, and actions can provide clues [[37], [21]].

The sensory attributes of food are essential in setting preferences and avoiding them [[47]]. Color is one of the most important visual indicators of the likely sensory qualities (such as taste or aroma) of food [[43]].

In the sales environment, both on the internet and in physical stores, most of the information that customers consider to make decisions is mainly visual in nature. When we go to a physical (food) store or browse an online (food) store, we notice various visual aspects or external physical characteristics of products, packaging, or the environment that influence the appearance of the product [[35]]. Visual signs include graphic elements, such as advertising colors or the font of writing, but also structural elements, such as the size and shape of the package and the type of material [[5]]. The first impression is given by the visual appearance [[36]]: Individuals set their expectations for food based on how it looks [[4], [30]]. In most decision-making situations, people rely mainly on the visual aspect to make choices, especially when these aspects are handy and relevant [[34], [48]].

Presentations that use the sense of smell are important because of their varied use in fields, including neuromarketing. It is important to note that its use in food advertisements can stimulate appetite. Odors are known to have a strong impact on human taste and appetite [[40]]. A growing number of scientific studies now indicate that our perception of taste and smell is mainly influenced by the expectations we have before tasting [[10], [17]]. These expectations can be the result of branding, labeling, packaging, and other contextual effects, as well as various intrinsic characteristics of the product.

Conclusions

Neuromarketing is a modern and valuable approach in elucidating the relationship between consumers and marketing strategies, highlighting the interaction between brain mechanisms and consumption decisions. Through advanced techniques such as fMRI, EEG, GSR or Eye Tracking, it becomes possible to analyze in depth how external stimuli influence people's perceptions or choices. The results of these analyses can contribute not only to the optimization of marketing campaigns but also to the promotion of messages that support public health.

In terms of diet, this research highlights the close link between food advertisements, consumer choices, and the impact of these choices on overall health. Essential to this process are emotional, sensory and contextual factors, understanding them bringing major benefits in developing strategies to encourage healthy eating habits.

Integrating the principles of neuromarketing in a responsible way can transform the relationship between consumers and marketing into a balanced environment, based not only on commercial objectives but also on the well-being of consumers.

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