Shahid Bahonar University of Kerman

Journal of New Studies in Sport Management

Online ISSN: 2717 - 4069

Homepage: https://jnssm.uk.ac.ir

Iranian Scientific Association of Sport Management

# Investigating Types of Advertising Appeals and Cognitive and Emotional Processes of Sport Consumers in Neuromarketing: A Systematic Review

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## ARTICLE INFO

**Article type:** Original article

**Article history:**
Received: 26 May 2024
Received in revised form: 17 August 2024
Accepted: 22 August, 2024
Published online: 26 October 2024

***Keywords:***
Consumer Neuroscience
EEG
Eye tracking
Advertising appeals
Cognitive processes

## ABSTRACT

Advertising costs billions for many industries, including the sports industry, but many fail to accomplish their goals for various reasons. Poor advertising is caused by ignorance of the customer's needs. Neuromarketing made companies more aware of their clients and target market and examines unconscious responses to commercials and products, unlike traditional marketing. Knowing these factors helps companies build ads more accurately and cheaply. This research aims to conduct a systematic analysis of valid experimental tests in the field of neuromarketing. Specifically, we will focus on studies that utilize electroencephalogram and eye tracker to investigate advertising appeals and the cognitive and emotional processes of consumers. The objective is to analyze the data from these papers. To conduct an analysis, we will examine the number of publications per year, the publishers involved, the keywords employed, the methods utilized, the gender of participants, the issue of advertising stimulation, the style of advertising attractiveness, and the emotional and cognitive processes included. Our literature review was based on the Boland method (2017). A keyword search yielded 171 publications, which we refined using the Prisma standard guide (2009). This identified 43 English Scopus empirical studies from 2008 to 2023, which we categorized and sorted. Although the sports industry has smaller turnover than others, it can provoke powerful emotions and attract many people. Due to the specific nature of sports, emotive ads work better than others. According to the findings, the use of the eye tracking system is expanding. Among the cognitive and emotional processes, it was found that attention is used more than other processes.

## Introduction

Out of the five senses, vision is the most frequently utilized and exciting sensory source in the environment (Danesh Sani et al., 2017). In his book, Fugate (2007) asserts that the brain regions responsible for vision predate the areas associated with language. Consequently, when individuals' cognitive processes are predominantly visual, verbal persuasion becomes challenging. Hence, any discourse concerning the advantages or solutions offered by a product should be complemented by a powerful visual metaphor.

**How to Cite**: Shakeri, S., Norouzi Seyed Hosseini, R., & Farahani, H. (XXX). Investigating Types of Advertising Appeals and Cognitive and Emotional Processes of Sport Consumers in Neuromarketing: A Systematic Review. *Journal of New Studies in Sport Management*, *6*(2), 75-107. DOI: 10.22103/jnssm.2024.23500.1290

 Publisher: Shahid Bahonar University of Kerman DOI: 10.22103/jnssm.2024.23500.1290

Due to the complexity involved, any discussion regarding the advantages or remedies provided by a product should be supported with a compelling visual analogy (Fugate, 2007). In his book "The Buying Brain," Pradeep (2010) asserts that human evolution has prioritized the visual senses, placing them at the highest level in the sensory hierarchy. Additionally, he argues that around 70% of the receiver is influenced by visual stimuli. The sensory organs responsible for perceiving the external world are located in our eyes, and approximately 25% of the brain is dedicated to processing visual information. Given this matter, it can be inferred that firms employ advertisements (in the shape of movies or banners) with the awareness that they can activate our visual faculties to further their objectives. People are exposed to a significant number of advertisements on a daily basis, which can elicit annoyance or foster a negative attitude towards them. Conversely, sports, as a crucial platform in the realm of advertising, possesses attributes that can generate a positive attitude towards advertising and can be regarded as a mediator of attitudes towards it (Pyun DoYoung & James, 2009). Furthermore, sports project a formidable image, boast a vast international audience, and appeal to all social classes (Cheong et al., 2019). This social phenomenon possesses a flexible, widespread, and popular nature, thereby emerging as a pivotal advertising platform for numerous companies (Pegoraro et al., 2010). In today's world, there are few events that can amass a large number of individuals together to witness a specific topic like sports events. Moorman et al. (2012) discovered that watching a sporting event on television with others amplifies the level of attention given to displayed advertisements, and the authors propose that watching sporting events in groups enhances exposure to commercials as people are less inclined to switch channels during commercial breaks (Pozharliev et al., 2017). Based on the aforementioned instances, advertising and financial support in sports have garnered favorable attitudes from respondents, with one notable success story in this realm being the country of Singapore. This nation has skillfully employed sports in advertising during its development. For instance, Singapore has derived benefits from sports events in this regard. The country successfully hosted the inaugural Formula One Grand Prix night race in 2008, the first-ever Youth Olympic Games in 2010, and the Southeast Asian Games in 2015. Moreover, in 2016, it secured its first-ever gold medal in the Olympics in the men's 100m butterfly event. The act of hosting major sports events and achieving success in international competitions evokes a sense of pride among citizens. Hence, sports, as an advertising platform or a means of financial support, fosters excitement and emotional attachment among people, potentially overcoming any initial resistance consumers may have towards sports advertising or sponsorship (Cheong et al., 2019).

Many companies in the contemporary business landscape strive to establish their brand by minimizing cultural disparities, thereby appealing to a broader audience (Ercan & Kabakçı, 2019). This endeavor is undertaken in order to expand their customer base, which is particularly pertinent for sports companies and sponsors. Given that sports are considered a universal language, it offers a greater platform for expression. In the current market, products across various industries are being manufactured with varying degrees of quality, design, and price. Simultaneously, customer preferences are in a constant state of flux, markets are becoming saturated, and technology continues to advance. These factors collectively indicate that companies are faced with fierce competition in their struggle for survival and growth. The allure of the sports industry outweighs that of competing sectors to such an extent that competitors are sometimes compelled to incorporate sports scenes in their advertisements, engage sports sponsors for their promotional campaigns, or even go beyond traditional advertising by participating as sponsors in sports events. This phenomenon is commonly referred to as sports advertising (Pyun & James, 2011). Due to excessive expenditure on advertising, numerous companies have failed to attain their objectives. Consequently, it appears that advertising appeal plays a pivotal role in this matter, exerting a significant influence on various dimensions of efficacy, including attention, awareness, attitude, and behavior. Thus, it becomes crucial to select an appropriate approach and method to enhance the advertising appeal within advertising campaigns. Nevertheless, despite extensive research endeavors, the quest to identify the most effective advertising appeal that captivates consumer attention and proves more efficacious for a specific product category remains unanswered

(Grigaliunaite & Pileliene, 2016). While neuromarketing has shown potential in enhancing advertising effectiveness, there is a lack of systematic reviews and analyses of experimental studies in this field. Specifically, research focusing on electroencephalogram (EEG) and eye-tracking technologies to investigate consumers' cognitive and emotional responses to advertising is limited. The sports industry, with its unique emotional engagement and audience dynamics, has not been extensively studied within neuromarketing. Addressing this gap will offer valuable insights for creating more effective sports advertisements and beyond. The study aims to answer: How do EEG and eye-tracking technologies help understand consumers' cognitive and emotional responses to advertising appeals in neuromarketing studies? This will be explored through a systematic analysis of existing empirical studies, examining publication trends, advertising appeal types, participant demographics, stimuli presented, and specific cognitive and emotional processes in advertising effectiveness. The research aims to identify key factors driving successful advertising and provide actionable insights for marketers and advertisers.

The Advertising appeals

In a study conducted by Jang et al. (2014), it was found that the selection of an advertising approach can significantly influence consumer perceptions of sports-related advertisements. From a business perspective, sports managers must strategically choose how to convey their advertising messages in a way that will impact consumers' perceptions of advertising and their likelihood to engage. Understanding the beliefs that shape consumer attitudes would result in more effective advertising campaigns, as it would enable the creation of visuals and text that align with positive beliefs and avoid triggering negative perceptions. It is expected that an individual's deeply held convictions will have the greatest impact on their attitude, which in turn influences their behavior. Gaining a deeper understanding of these beliefs empowers advertisers to develop more impactful advertising techniques, leading to higher revenue and improved brand perception for products or companies (Pyun & James, 2011). The impact of advertising appeal on various dimensions of advertising effectiveness, such as attention, awareness, attitude, and behavior, is widely acknowledged. Therefore, advertisers must carefully select appeals that are in line with the target market, as these appeals generate favorable reactions that meet consumers' psychological needs (Kunkel et al., 2019). A scientific literature review conducted by Albers Miller and Stafford (1999) provides a classification of advertising appeals, which can be summarized as follows: there are two main groups of appeals. The first group comprises emotional appeals, which are primarily used for hedonistic products. The second group consists of rational appeals, which are primarily used for utilitarian products. The effectiveness of advertising appeals greatly depends on the product category and the cultural context (customer group) targeted by the advertising (Grigaliunaite & Pileliene, 2016). When identifying the target audience for advertising, an advertisement can establish a connection with a specific group of people by appealing to shared values, such as supporting a particular team, race, language, religion, or geographical region. This can enhance the effectiveness of the advertisement (Franco et al., 2021). In addition to the appeal of advertising, the use of a validator is a component that can have a significant impact on its effectiveness. Endorsement typically involves the use of a well-known individual, often a celebrity, in advertising campaigns to promote products and researchers suggest that corporations whose sports products are promoted by sports sponsors enjoy a noticeable advantage over their competitors, and these commercials typically include idealistic appeals (Katirci, 2021). This section will present four primary advertising appeals: emotional, rational, ideal, and in-group values-based appeals. These appeals are considered the most significant in advertising.

*1- Emotional appeal*

The study conducted by Albers Miller and Stafford (1999) explores the category of emotional appeals, encompassing various components such as Distinctiveness, Tradition, Enjoyment, Youth, Modesty, Adventure, Ornamentation, Affection, Popularity, Magic, Relaxation, Morality, Security, Affiliation, Support, Community, and Family. In a study conducted by Wang (2008) on the impact of advertising appeals on prosocial behavior, two different styles of advertisements were presented to participants. The initial advertisement was a poignant one, highlighting the calamities that occurred in Cambodia and employing an emotional appeal. The second advertisement, categorized as a rational commercial, featured a female announcer urging individuals to contribute funds to an

insurance firm aimed at assisting the population of Cambodia. It was hypothesized that women would exhibit a more positive helping attitude when presented with a tragic emotional plea compared to a rational explanation. However, when men were subjected to the same two advertising situations, there was no disparity in their contribution. Strick et al. (2009) conducted a study using eye-tracking to investigate the impact of humor on memory. The participants were exposed to humorous texts, non-humorous but positive texts, and non-humorous texts related to new consumer brands. The analysis of eye-tracking data revealed that comedy captured attention for a more prolonged duration in comparison to other types of information. Consequently, the researchers deduced that humor not only hinders the retrieval of background information but also influences the cognitive processes associated with the recognition and recollection of symbols (Strick et al., 2009). Panda et al. (2013) argued that emotional advertising appeals are primarily used for product categories that are difficult to provide rational evidence for regarding the product's benefits. Furthermore, they posit that the use of emotional appeal in advertising leads to increased recognition, although this effect is closely linked to the specific product category being marketed. Keshari and Jain (2014) provide a definition of emotional appeal as the act of trying to evoke either negative or positive emotions in order to stimulate the motivation to make a purchase. Additionally, Grigaliunaite and Pileliene (2016) discuss emotional appeals in relation to this definition. This type of appeal is particularly relevant for brands that have little differentiation from their competitors. Moreover, scientific literature suggests that emotional appeals hold greater importance than rational appeals, as they are more attractive, enjoyable, and aesthetically pleasing to respondents. Therefore, they appear to be more effective and superior. The study conducted by Jang et al. (2014) investigated the influence of emotional appeals on consumers' perceptions of commercials in high-involvement situations, specifically pleasant sporting events. The results indicated that consumers' initial responses were positively affected. Emotional commercials are designed to elicit consumers' emotions, particularly positive emotions such as excitement, pleasure, and entertainment. Similarly, participating in and watching sporting activities also serves the purpose of obtaining pleasure. Therefore, commercials that focus on emotions and evoke positive experiences related to sporting events are appropriate and effective in fostering a favorable attitude. Ultimately, the study emphasizes the necessity of emotional advertising to persuade individuals with low involvement to use the advertised products, whereas rational advertising is needed for those with high involvement. Behnam et al. (2015) conducted a study examining the influence of advertising appeal on consumers' future intentions and attitudes towards advertising in sports services. The findings revealed that the type of sports service had a substantial impact on individuals' future intentions and attitudes towards advertising. Specifically, participants exposed to the advertisement of the Blue Center, which emphasized pleasurable services with emotional appeal, demonstrated a stronger positive attitude and intention towards the advertising compared to those who viewed the fitness center advertisement, which emphasized utilitarian services with rational appeal. Akbari (2015) conducted a comprehensive analysis of the effectiveness of rational and emotional appeals in advertisements for high and low involvement products. The findings demonstrate that both types of appeals have a positive impact on individuals' attitudes towards advertisements and their purchase intentions. Emotional appeals significantly influence advertising attitudes for low-involvement products, whereas rational appeals have a stronger influence for high-involvement products.

The study by Jovanović et al. (2016) investigated the influence of emotional and rational arguments in commercials on purchase intention among students. The results showed that emotional appeals had a stronger impact on women, while rational appeals significantly influenced men. The participants in the study highlighted the importance of obtaining information about a new product through commercials, which is known as rational appeal. However, if the advertised product was already familiar to consumers or they had previously used it, the positive emotions evoked by the advertising message could serve as a reminder of the product's existence, particularly if they had forgotten about it. Furthermore, these positive emotions could reinforce their previous satisfaction with the product and influence their decision to make a purchase. In a study conducted by Lee and Heere (2018), the effectiveness of emotional advertising, rational advertising, and mixed advertising on sports consumer behavior in a US college football environment was experimentally examined.

The study also considered the insights of Damasio (1994) and Damasio (1999), who suggested that when there is a conflict between emotion and cognition, emotion tends to prevail. The study demonstrated that emotional advertising elicited a more favorable response in terms of attitude towards advertising, brand attitude, purchase intention, and product consumption compared to rational and mixed advertisements. Additionally, the study found that mixed advertisements received more positive opinions compared to rational advertisements. Ghasemi Siani et al. (2021) conducted a study to compare how adults respond to rational and emotional advertisements for sports products, while considering the moderating factors of product type and gender. The findings revealed that emotional advertisements had a stronger impact on individuals' attitudes towards the advertisements and their intention to purchase sports products. The results also indicated that rational advertising appeals were more effective for utilitarian sports products (such as sports shoes), whereas emotional advertising appeals had more influence on hedonic sports products (such as badminton rackets). However, the gender variable did not have a significant moderating effect. Furthermore, the research findings contradicted the background information of the study, as they asserted that emotional advertising appeals held greater significance than other advertising appeals for both genders. This discrepancy may be attributed to the age group of the participants (18 to 22) and the emotional aspects of sports.

*2- Rational appeal*

Albers Miller and Stafford (1999) categorized subjects exhibiting characteristics such as effectiveness, convenience, affordability, naturalness, intelligence, productivity, independence, healthiness, durability, modernity, technology, and safety as rational appeals. This classification employs rational reasoning to produce persuasive arguments. Rational appeals primarily focus on highlighting the features and utility of a product. Rational advertising operates by establishing connections that possess practical appeal and delivering information to consumers. By emphasizing the characteristics or advantages of a product, rational appeals prove to be advantageous in situations where consumers make purchases out of necessity or when persuasive arguments are presented to influence their buying behavior by emphasizing the uniqueness and differentiation of the product (Kunkel et al., 2019). Lin (2011) conducted an experiment with the objectives of investigating the impact of advertising appeals on attitude and purchase intention, as well as comparing the effectiveness of different types of advertising appeals. The findings indicate that the reception of rational advertisements carries greater significance compared to emotional appeals, especially in the context of advertising mobile phones as expensive products. The purchase of such items necessitates rational decision-making. Therefore, customers are more inclined to dedicate time to gather, analyze, and make informed judgments based on information about the phone before commencing the purchase process. Behe et al. (2014) identified three distinct groups of plant consumers using eye tracking technology: 1) individuals who paid attention to the type of plant, 2) those who were attentive to the production method, and 3) price-oriented individuals. The study revealed that subjects allocated visual attention to cues in products that held relatively greater importance to them. For instance, price-oriented individuals spent the longest amount of time scrutinizing the price tag. Furthermore, the researchers stated that price can serve as an indicator of quality, and a price of $1.99 is one of the lowest in the market, potentially negatively impacting preferences. This may explain why individuals opt to purchase the $2.49 plant instead, as they preferred the cheaper option (although this preference also existed for plants priced higher than $2.49).

The experiment conducted by Gong et al. (2018) sought to examine the neuronal processes involved in consumers' purchasing choices. Specifically, they aimed to investigate how information ambiguity in different sales promotion methods affects consumers' decision-making. To gain insights into consumer behavior and purchasing decisions, the researchers created two advertisements offering gifts and discounts, and utilized EEG/ERP technology. The findings revealed that discount commercials had a more pronounced impact on purchasing decisions compared to gift sale advertisements, despite the equivalent value of the discount and gift. This suggests that individuals experience reduced uncertainty when presented with a discount, leading to more positive evaluations, decreased risk perception, and heightened trust. In a similar vein, Boccia

et al. (2019) delved into the intriguing relationship between corporate social responsibility and customer behavior. The study aimed to determine the extent to which consumers are willing to pay a premium for products from socially or environmentally responsible companies. The researchers found that consumers generally prefer conventional enterprises over socially responsible ones due to the more affordable costs offered by the former. Although customers acknowledged the ethical aspect of environmentally friendly products, the majority of respondents (83% of the sample) were unwilling to pay a higher price for them. This suggests a misalignment between customers' attitudes towards ethically-oriented products and their actual purchasing behavior. Furthermore, Kaheh et al. (2021) conducted an experiment in which participants were presented with photographs of two comparable products while their brain activity was recorded using EEG, and their eye movements were tracked. Subsequently, the participants were shown the associated brand and price of each product. One product belonged to a high-end premium brand, while the other represented a more affordable alternative brand. Participants were asked to express their preference for a specific product both before and after being exposed to the brands and pricing information. The results indicated that participants tended to prefer purchasing the product with a lower price tag, even if they initially favored the luxury brand version. This suggests that buyer preferences are influenced by exposure to brand names and the perceived value of the product's pricing. According to Belch and Belch (2004), rational appeals are recognized as informative and are utilized by advertisers to persuade consumers that their product or service possesses specific characteristics or provides a particular advantage that meets their needs. The objective is to convince the target audience to purchase the brand based on its superior quality or unique advantage in satisfying consumer demands. Furthermore, it is argued that rational and information-based appeals are commonly perceived as uninteresting, whereas emotional appeals fail to capture attention. Given that advertising cannot be effective if it goes unnoticed, the use of rational appeals is considered ineffective. In contrast to Sadeghi et al. (2015), who asserted that emotional appeals are more captivating, it is contended that rational arguments are more relevant and provide explicit information about the product, thus attracting greater consumer attention. Grigaliunaite and Pileliene (2016) also observed that respondents found rational commercials to be more appealing, useful, and instructive. The researchers further found that rational appeals are particularly suitable for certain businesses due to their straightforward differentiation based on rational characteristics.

3- *Ideal appeal*

When it comes to advertising in sports, advertisers commonly utilize athlete endorsers to promote their products and gain a competitive advantage over rival companies (Pyun & James, 2011). This marketing tactic effectively enhances the visibility of companies seeking to increase their market presence (Kunkel et al., 2019). Many individuals aspire to emulate or associate themselves with famous figures, leading them to purchase products used by celebrity athletes in order to adopt their appealing qualities. Referred to as ideal appeal, this phenomenon is closely related to advertising strategies employed by companies through sports endorsers to capture attention. Zhou and Belk (2004) argued that sportsmen and coaches are seen as trustworthy endorsers due to their association with qualities such as commitment, expertise, and superiority, distinguishing them from movie stars and pop musicians. Examining the presence of female athletes as endorsers in magazine advertisements, Grau et al. (2007) found that only 12% of ads featuring well-known athletes were specifically targeted toward female endorsers. The study also revealed that the portrayal of athletes in these advertisements differed based on gender, with women's attire being more attention-grabbing and their gender being emphasized more prominently than their athletic abilities. In a study by Lin (2011) the aim was to investigate the impact of advertising spokespersons on attitudes and purchase intention. The study also sought to compare the effectiveness of various advertising appeals and spokesperson types on purchase intention. The results demonstrated that well-known spokespersons had a significantly positive influence on advertising attitudes. Furthermore, famous spokespersons were seen as more important experts in the eyes of consumers. The study also found that the combination of rational advertising appeals and expert spokespersons had a greater impact on advertising attitudes compared to emotional appeals and expert spokespersons. This finding can be attributed to the nature of the product being promoted, as mobile phones are expensive and

require rational decision-making. Therefore, consumers tend to invest more time in gathering information, evaluating options, and forming assessments before purchasing.

Falsarella et al. (2017) conducted a study employing eye tracking technology to assess the impact of celebrity endorsers on visual attention in print advertisements. The primary objective of this research was to examine whether consumers allocate greater visual focus towards celebrities in print advertisements compared to other stimuli, including logos, names or symbols, products, and non-celebrities. Overall, the findings indicated that participants showed a significant level of attentiveness towards the famous individuals featured in the study and the products they endorsed. When comparing celebrities to non-famous individuals, the majority of cases demonstrated that the presence of a famous person in the advertising was impactful. Marketing managers are primarily concerned that the presence of a celebrity in advertising may divert attention away from the brand and the featured items. Sung et al. (2020) examined an ERP (Event-Related Potential) study conducted by (Zhang et al., 2018). This study focused on consumers' attention levels towards social media content displayed on the Facebook platform. The research demonstrated differences in brain reactions to Facebook posts featuring famous individuals versus ordinary individuals. Upon analysis, the researchers discovered higher levels of frontal brain activity in response to celebrity faces compared to non-celebrity faces. Furthermore, subjects exposed to celebrity Facebook posts exhibited a greater inclination towards positive attitudes and a heightened curiosity to learn about the content of these posts, in comparison to exposure to non-celebrity posts. In a study conducted by Katirci (2021), two different advertisements featuring endorsers Cristiano Ronaldo and Serena Williams were shown to participants. Using an eye tracking system, the researchers found that when the advertisement was presented by a female author, male viewers paid more attention to the female athlete, while female viewers focused more on the beverage product. However, when the advertisement was presented by a male author, male viewers directed their attention more towards the food and text. The individuals surrounding Ronaldo directed their attention towards him, while female participants placed greater emphasis on Ronaldo's facial features and physique. In another study conducted by Frank and Mitsumoto (2023), the aim was to examine the impact of athlete endorsers' attractiveness on consumers and how these effects vary based on the compatibility between the athlete endorser and the endorsed product, as well as the gender of the consumer. The findings revealed that factors such as success appeal, the attractiveness of the athlete's personality, and the similarity between the athlete and the product have a positive influence on the drivers of customer value. Gender roles dictate that the impact of achievement and personality on attractiveness is more pronounced for male athletes, while the influence of product similarity with the athlete is less significant. Contrary to common misconceptions, the level of sexual attractiveness does not exert a stronger influence on female athletes. The sexual preferences of individuals are evident in their judgments of athletes of the opposite sex. Specifically, male consumers are more positively influenced by the sexual attractiveness of female athletes, while female consumers are more positively influenced by the success and attractiveness of male athletes. Studies indicate that attempting to attract athletes by emphasizing their gender appeal is not only unsuccessful but also harmful to establishing brand trustworthiness among female consumers.

*4- Appeal to in-group values*

Contemporary corporations are employing branding strategies aimed at eliminating cultural distinctions between countries and appealing to a broad range of consumers (Ercan & Kabakçı, 2019). However, despite these efforts, there are still individuals who harbor biases based on factors such as ethnicity and language. Leveraging appeals based on shared group values, especially when targeting a specific audience with common characteristics (such as supporting a specific team, race, language, religion, or geographical region), can be highly advantageous. Grounded in the concept of social identification, individuals who identify themselves with a particular group are motivated to uphold their membership by conforming to the perceived norms and expectations of other group members (Kim et al., 2013). Limited research has been conducted on the subject of attractiveness that focuses on intra-group values. In this text, we will provide a description of these investigations. A study conducted by Han and Shavitt (1994) on persuasive appeals discovered that magazine advertisements in the United States, an individualistic culture, contain more appeals compared to

advertisements in Korea, a collectivistic culture focused on individual interests, preferences, personal success. Korean advertisements employed appeals that placed a higher emphasis on in-group benefits, harmony, and family unity compared to U.S. advertisements. A controlled experiment conducted in both countries revealed that in the U.S., advertisements that highlighted individual benefits were more effective in persuading viewers, while ads that emphasized family or in-group benefits were less persuasive than in Korea.

Zhou and Belk (2004) found that both global and local advertisements are attractive in China, but it depends on the advertising context. For example, products related to fashion and beauty are perceived as more stylish and beautiful when they are associated with Western models. They concluded that if foreign models, brands, and attractiveness are used for luxury goods, they will be well-received. They also explain that sometimes there is no need to universalize the advertising message, and they gave the example of Coca-Cola's success in competing with Sprite when they used the image of the Chinese Olympic champion and achieved success in the competition. In a study conducted by Chang (2006), the objective was to examine the impact of cultural-level masculinity/femininity on individuals' responses to advertising that utilizes utilitarian images and appeals. The investigation demonstrated that participants from the United States, a largely "masculine" culture, preferred the utilitarian (rational) appeal advertisement and perceived it as more credible compared to the visual appeal advertisement. Conversely, individuals from Taiwan had similar levels of positive response towards both categories of advertisement appeals. Laeng et al. (2007) published an article entitled "Why do blue-eyed men prefer blue-eyed women (the same eye color)?" The results were interesting. They did not show attractiveness ratings for male models of both eye colors. Similarly, brown-eyed men showed no preference for blue- or brown-eyed female models. However, blue-eyed men rated blue-eyed women more attractive than brown-eyed women, possibly due to the assurance based on matching the father's and offspring's phenotypes. Although this study was not about advertisements or consumer behavior, it can be assumed that, for example, the incorporation of such elements in advertisements can be effective for the target audience. Vecchiato et al. (2011) conducted an EEG experiment aimed at investigating cultural differences and evaluating the effectiveness of carbonated beverage marketing campaigns in Western and Eastern countries. The researchers carried out two identical trials in China and Italy, using the same advertisement featuring popular beverages like Pepsi and Coca-Cola. The results yielded intriguing findings. Among Chinese participants, the highest level of attention was observed when a significant crowd was present, while the lowest level of interest was recorded during solo singing performances. In contrast, Italian participants showed the strongest response to advertising when two individuals engaged in humorous banter and when the brand name was explicitly mentioned. These cultural disparities can be attributed to the distinctly different orientations of Eastern societies, characterized by collectivism, and Western societies, characterized by individualism.

The study conducted by Kim et al. (2013) aimed to establish the correlation between consumers' patriotism and their reactions to patriotic commercials and the associated brand. The researchers also sought to determine if the research model exhibited consistent patterns across various sporting events. The findings demonstrated that consumers' patriotism has a positive impact in certain social contexts, such as the soccer World Cup and Olympic Games. Moreover, the study revealed that patriotism generates positive sentiments towards patriotic advertisements and the promoted brand. It also highlighted that the effects of consumer patriotism vary across different sports domains. Patriotic advertising, as a marketing communication strategy, is particularly suited for domestic firms targeting sports fans who share the same national and ethnic backgrounds. This approach emphasizes the importance of belonging to a collective and highlights its unique significance within a specific social context. These findings suggest that promoting loyalty to a particular group can yield positive outcomes for brands associated with that group. Therefore, marketers and advertisers are advised to effectively communicate the value of being part of a collective and underscore its distinctiveness in order to differentiate their brand from competitors. Multiple studies have indicated the effectiveness of patriotic advertising for domestic brands. However, multinational corporations can overcome resistance in local markets by endorsing the national team that the target

consumers support and establishing connections between the brand and the team. This strategic approach ultimately fosters impartiality among consumers towards information about foreign brand products. The researchers also discovered that ethnocentrism tends to diminish when customers possess knowledge about or are consciously aware of foreign companies. In their study, Berčík et al. (2016) utilized EEG and eye tracking techniques to investigate the effects of three different stimuli on creating a positive ambiance in a store. These stimuli consisted of Slovak and French music, as well as a control condition without any music. The study revealed that women exhibited greater engagement than men while listening to Slovak music, potentially due to the higher emotional responsiveness typically observed in women. The use of Slovak background music can have a dual effect, enhancing customers' perception of stimuli in the store and stimulating their interest in purchasing products from Slovakia. On the other hand, playing French music resulted in increased attention and concentration, which may be attributed to the slow pace of the music allowing individuals to remain more aware of their surroundings. When customers feel at ease and content, they are more likely to spend longer durations in the store and may even opt to purchase additional items. Therefore, it is essential for managers to prioritize client comfort in order to encourage increased purchasing. The absence of music led to diminished interest in the stimuli, suggesting that background music cultivates a convivial ambiance in the store. This knowledge is advantageous for retailers, as music not only establishes a pleasant atmosphere for clients but also has a beneficial impact on personnel. In terms of excitement, stimuli with Slovak music elicited the highest average values, possibly due to its quick beat. Conversely, the lowest sensitivity was observed during the testing of stimuli without music. In another study conducted by Garczarek-Bąk and Disterheft (2018) various neuromarketing devices - including electroencephalogram, eye tracking, galvanic skin response, and facial electromyography - were employed. The research findings indicate that the frontal asymmetry index, measured through electroencephalogram, is a significant predictor of buying decisions. Participants were presented with two instances of each product (national brand or private label) from various categories such as hand cream, liquid soap, shaving foam, shampoo, facial scrub, soap, and toothpaste. The study assessed the frontal asymmetry scores for each product. It was found that individuals displayed a greater preference for national brand products compared to private label ones. This phenomenon can be attributed to the higher levels of recognition typically associated with national brands, which in turn elicit a greater number of associations in the brain compared to private label companies.The inadequate understanding of the cognitive mechanisms exhibited by sports consumers has presented considerable difficulties for researchers and marketers. The implementation of neuromarketing, a discipline currently being utilized across numerous sectors such as food, tourism, finance, pharmaceuticals, fashion, education, and technology, has proven to be a valuable tool in discerning cognitive and emotional patterns in consumers. Considering the substantial potential and allure of the sports industry, coupled with the well-documented achievements of neuromarketing in other domains, it follows logically that its application within the sports industry is justified.

Sports and Advertising Appeals to Consumers

As previously discussed, Albers Miller and Stafford (1999) identified two types of advertising appeals: emotional and rational. However, this model did not address sports-related appeals. Fahim et al. (2021) introduced the rhetorical triangle model specifically for the sports category, highlighting the need for a balanced use of different appeals in marketing campaigns. This triangle consists of three equally important elements: emotion, logic, and credibility. Unlike the Albers Miller model, which does not include credibility, the new model recognizes the significant role of sports endorsers. Athletes, as trusted and reputable figures, possess advertising appeal and can be effectively utilized. Previous research primarily focused on identifying advertisement themes, with less attention given to individuals' social identity and intra-group values. Joaddan (2024) argues that cultural nuances and socio-economic factors should be considered when developing international advertising appeals. While certain sentiments may resonate universally, their effectiveness can vary based on cultural values and preferences. Thus, successful international campaigns require a balance of appeals that align with local cultural norms and evoke relevant emotions. This approach, outlined in Franco et al. (2021), is particularly evident in sports advertising. Franco and colleagues' research demonstrated that an individual's group identity significantly influences their intention to

purchase a sponsored product. Participants who consumed an in-group beverage showed higher purchase intention than those who consumed an out-group beverage or a control group. Advertising appeals in sports can be categorized into four types, each illustrated by a neuromarketing study. Oboudi et al. (2023) investigated emotional appeals using eye-tracking technology, presenting charitable ads with subtitles during a football match. Their findings suggested that advertisements should use contrasting colors to enhance visibility and impact, such as avoiding green in a football stadium to prevent blending with the field. Unfortunately, specific studies on neuromarketing and rational advertising appeals in sports are scarce due to limited sources. Katirci (2021) examined the use of sports endorsers through eye-tracking studies featuring Cristiano Ronaldo and Serena Williams. The results showed gender-specific attention patterns: male participants focused more on female athletes, while female participants directed their attention towards the endorsed product. Conversely, in ads featuring male sports endorsers, men focused on the product and text, while women paid more attention to Ronaldo's face and body. Franco et al. (2021) explored the impact of in-group values using EEG. Fans of a particular team were given three drinks: one sponsored by their favorite team, another unrelated to their favorite team, and a control drink. The results indicated that participants who tasted the in-group beverage were more likely to purchase it compared to those who tasted the out-group beverage or the control drink. This finding underscores the influence of group identity on purchase intentions.

Neuromarketing

The weight of the human brain is only 1.5 kg, while it accounts for approximately 20% of the body's energy consumption (Herculano-Houzel, 2012). Consequently, the brain must use its energy resources efficiently in order to function. To ensure minimal disruption to individuals, one approach to conserve energy is to make decisions through the subconscious mind. For instance, when we learn to drive, many of our decisions are made unconsciously. Research has demonstrated that as much as 95% of our decisions are subconscious in nature (Nyoni & Bonga, 2017). Neuromarketing also supports this perspective. According to this discipline, a significant portion of consumer purchases is not consciously made, but rather influenced by the subconscious mind. As a result, individuals may not have a rational and logical explanation for their purchases, as they are driven primarily by emotions. Indeed, many of our motivations operate at levels below conscious awareness. The threshold of human consciousness is estimated to be around 300 to 400 milliseconds, meaning that stimuli presented for durations shorter than this threshold are unlikely to be verbally reported as conscious experiences(Ohme et al., 2011; Pozharliev et al., 2017).

Conventional marketing techniques are limited by various constraints and biases, as they mainly rely on customers' expressed opinions, which represent only a fraction of the overall picture. Additionally, there are several factors that can distort participants' emotional responses in research settings, such as the presence of incentives, time limitations, or peer influence (Morin, 2011). The terms "neuromarketing" and "consumer neuroscience" are often used interchangeably, as both fields encompass the realms of neuroscience, psychology, and marketing (Alsharif et al., 2022; Khurana et al., 2021; Plassmann et al., 2012). Consumer neuroscience places greater emphasis on academic research, while neuromarketing primarily employs neurophysiological methods for commercial market research purposes (Khurana et al., 2021). Neuromarketing refers to the study of how the human brain responds to marketing stimuli and enables us to tap into the subconscious mind of consumers. It applies principles from neurology to understand consumer behavior and the decision-making processes involved. By leveraging these principles, it becomes possible to identify the emotional and cognitive triggers that influence consumers in their purchasing choices, and to uncover underlying data that informs customer preferences, thereby enabling organizations to adjust their marketing strategies accordingly (Ercan & Kabakçı, 2019). Furthermore, through the application of neuromarketing, we can identify aspects that may elicit negative responses from buyers (Hubert & Kenning, 2008).

Neuromarketing tools

*1- EEG*

It is the oldest neurophysiological tool, dating back to approximately a century ago, with the purpose of measuring the electrical activity of nerve cells in the cerebral cortex. This measurement is achieved by employing electrodes that are fitted into a hat worn on the head. The participant is positioned (Alvino et al., 2020; Casado-Aranda & Sanchez-Fernandez, 2022; Sung et al., 2020). This device is capable of identifying the intensity of brain waves generated by neurons, which record cognitive processes such as perception, emotions, and memory (Pagan et al., 2020). Among the advantages of this tool are its cost-effectiveness, portable size, and non-invasive nature (Alsharif et al., 2021; Alvino et al., 2020; Ercan & Kabakçı, 2019; Plassmann et al., 2007; Rawnaque et al., 2020; Sung et al., 2020). Unlike brain metabolic tools, this method provides excellent temporal resolution, measuring events in milliseconds, and can detect brief neural events (Agarwal & Xavier, 2015; Harris et al., 2018). However, its spatial resolution is limited (approximately one cubic centimeter), and it does not grant access to deeper brain structures (Alsharif et al., 2022; Alvino et al., 2020; Fortunato et al., 2014; Morin, 2011). The brain produces various neural activities, of which the most significant ones can be measured by EEG. These include: 1) Rhythms: neural oscillations or brain waves, which represent repetitive patterns of neural activity. Rhythms are categorized into frequency bands, such as delta, theta, alpha, beta, gamma, and Mu rhythms, and measure the synaptic, neuronal, and axonal activities of nerve complexes. 2) Transient activities: these can be recognized by their position, frequency, amplitude, shape, and operational characteristics. Common types of transient activity include event-related potentials (ERPs) and event-related spectral spikes (ERSPs). ERPs have very small amplitudes, thus EEG samples must be averaged over multiple repetitions to reveal ERPs and eliminate noise fluctuations. The N200, P300, and N400 are among the most well-known ERP components (Aldayel et al., 2020).

*2- Eye tracking*

Nixon (1924) and Karslake (1940) were the first to document eye movement patterns in response to viewing printed advertisements (Harris et al., 2018). The eye tracking system is a device that utilizes infrared light emitting diodes to measure eye position, eye movement, and pupil dilation, enabling researchers to assess people's attention towards presented stimuli, such as audio-visual content (Alvino et al., 2020; Casado-Aranda & Sanchez-Fernandez, 2022; Hafez, 2019; Sung et al., 2020). The measurements obtained from the eye tracking system include fixation (focused gaze on a specific location), fixation length (duration of gaze at a specific location), saccade (rapid eye movement between fixations), and pupillary dilation response (changes in pupil size). This method offers several advantages, including portability, non-invasiveness, good temporal resolution, and relatively low cost. However, it is worth noting that some devices may be less efficient when dealing with samples that wear glasses or contact lenses (Alvino et al., 2020). Additionally, the method does not provide insight into which aspect of attention triggers emotional responses in the consumer's mind (Hafez, 2019).

The provision of marketing stimuli can activate a person's cognitive and emotional processes, influencing their behavior and mental state, including memory, preferences, and attitudes (Pagan et al., 2020). Neuroimaging tools can be employed to measure these responses (Alsharif et al., 2022). Stimuli that elicit significant and measurable changes in specific brain regions suggest successful engagement, although the actual impact on purchasing behavior remains unanswered (Fugate, 2007). Extensive research has been conducted to determine the most effective advertising appeals; however, there is no consensus among researchers regarding which appeals attract the most attention from consumers and which appeals are most effective for specific product categories (Grigaliunaite & Pileliene, 2016). Numerous studies have focused on detecting neural and physiological responses, including emotions, feelings, attention, memory, reward processing, motivation, and perception, towards advertisements, particularly those featuring presenter attributes, such as celebrities, as these processes play a crucial role in consumer decision-making, specifically in making purchase choices (Alsharif et al., 2022). The following section aims to review articles that have explored the cognitive and emotional processes of consumers.

Cognitive and emotional processes of consumers

*1- Attention*

Attention is a cognitive process that involves the selection of relevant information over other available stimuli (Plassmann et al., 2012). When we allocate our consciousness to a specific subject, we engage in the process of attention, often resulting in the exclusion of other input information. Attention can be categorized into two main types: top-down attention and bottom-up attention. Top-down attention is intentional and conscious, such as when we enter a store with the intention of purchasing a specific drink and focus solely on finding that particular product. On the other hand, bottom-up attention is automatic and unconscious. It occurs when certain stimuli in the environment capture our attention, even if we did not originally intend to pay attention to them (Alsharif et al., 2022). Factors such as contrast, density, brightness, and movement play a significant role in attracting bottom-up attention, making them important considerations in neuromarketing (Figure 1).

Numerous studies have demonstrated a correlation between reduced alpha brain waves (8 to 13 Hz) and increased attention and visual interest (Simons et al., 2003). Moon et al. (2019) further suggest that alpha and beta brain waves are associated with sustained attention. During rest, alpha band power values increase while beta band power values decrease. In contrast, during periods of attention, alpha band power values decrease and beta band power values increase. Given the various functions of different brain lobes, it is advisable to focus on analyzing these waves in the frontal and prefrontal lobes, as they are more likely to exhibit attention-related wave patterns. Additionally, eye-tracking studies have found a positive relationship between visual attention to advertisements and fixation duration, which refers to the length of time a person gazes at a specific point without making eye movements (Tangmanee, 2013). However, it is important to note that prolonged fixation does not always indicate greater attention, as it can also be influenced by the complexity of the stimulus being presented. Recent research has integrated emotional and cognitive reactions of consumers to stimuli in order to provide a more comprehensive understanding of attention (Alsharif et al., 2021; Pagan et al., 2020).

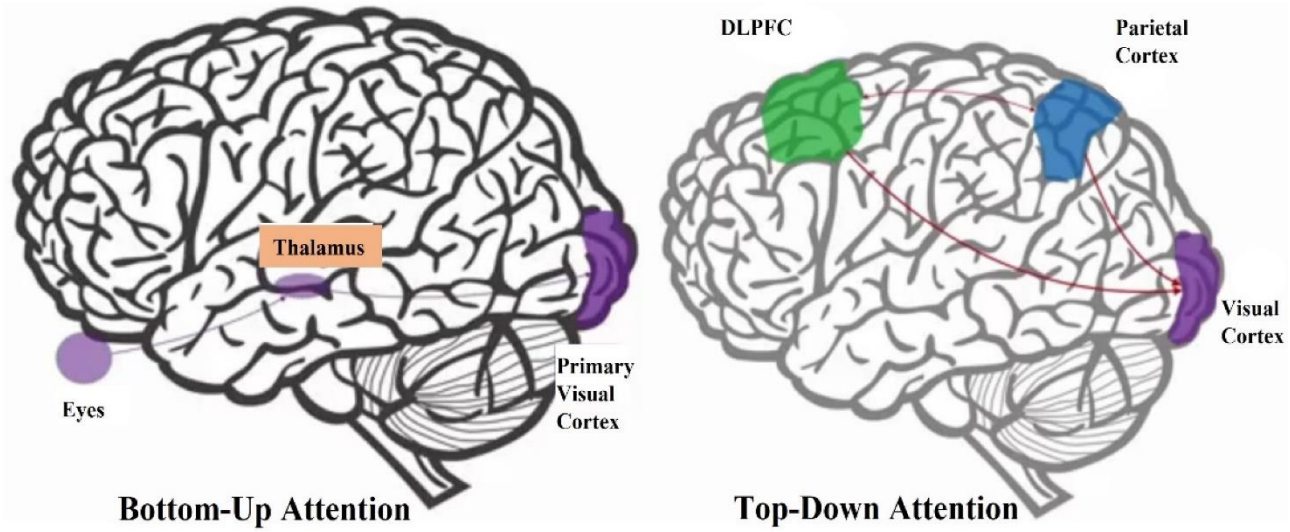


**Figure 1.** Pathways of bottom-up and top-down attentional processes in the brain (In bottom-up attention, the stimuli first hit the person's eyes, and after entering the eyes, these signals directly enter the thalamus of the brain and then are directed to the visual cortex, but in top-down attention, first the prefrontal cortex of the brain of active people. and then the signals enter the parietal cortex and after analyzing these signals enter the visual cortex) (Alsharif et al., 2022). When utilizing EEG, it is imperative to consider the following parameters for measuring attention: 1. The reduction of alpha brain waves in the frontal and prefrontal regions (8 to 13 Hz band) is associated with increased visual attention (Simons et al., 2003). 2. The augmentation of beta band activity in the

frontal and prefrontal areas (Moon et al., 2019). 3. Alpha band power in the occipital lobe (Yazid et al., 2020). 4. ERP amplitude (P200, P300) (Byrne et al., 2022). In addition, when employing eye tracking, researchers have determined that visual attention towards advertisements correlates positively with fixation duration (the length of time a person fixates on a point without making eye movements), as demonstrated in studies by Tangmanee (2013). This finding is noteworthy, and the number of fixations has been identified as a significant factor (Borys & Plechawska-Wójcik, 2017).

*2- Emotions*

They represent the internal state of an individual and manifest as physical signals that our body constantly emits in response to various stimuli (such as changes in skin conductivity, increased heart rate, or variations in pupil size). It is important to acknowledge that emotions are unconscious and cannot be directly perceived, as they arise prior to our conscious awareness of them. On the other hand, feelings refer to a relatively conscious experience of an emotional state that is influenced by individual judgments, such as the degree of pleasure or displeasure towards something. The speed at which emotions change in response to external stimuli is considerable, and this process occurs unconsciously in individuals. Conversely, feelings encompass the dominant emotional response that is conscious and emerges as a result of all the emotions experienced when encountering a stimulus. When measuring emotions, two components are assessed: 1) the intensity of emotions (arousal), which gauges the strength of the emotional response without determining its specific direction, and 2) the direction of emotion (valence), which refers to the general emotional orientation without providing an indication of its intensity (Alsharif et al., 2022).

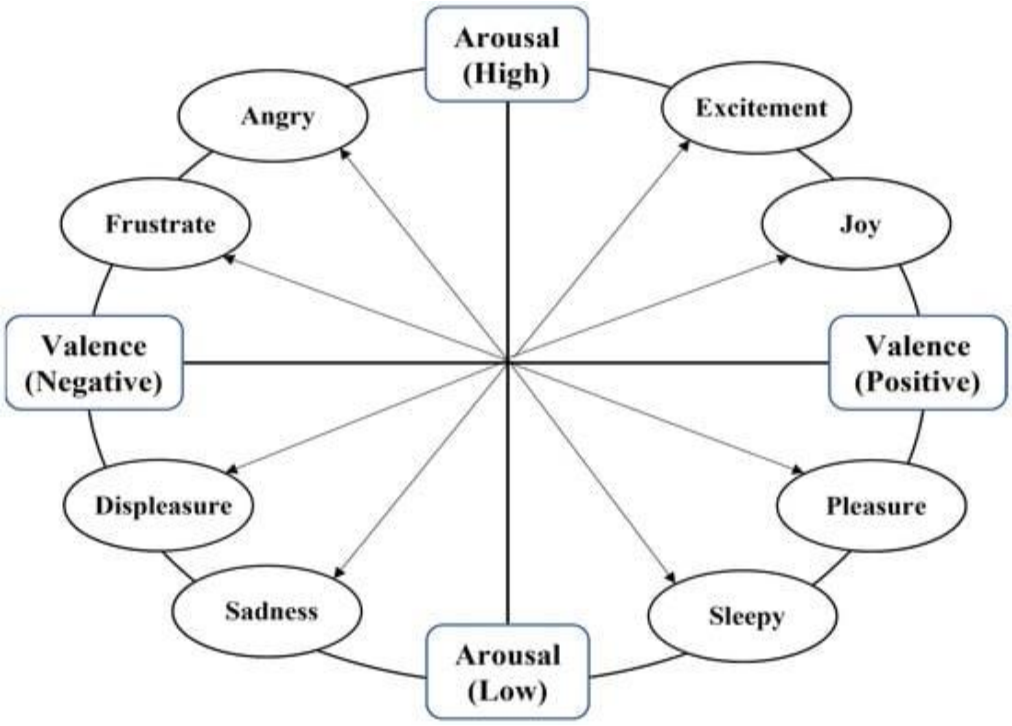


**Figure 2.** Dimensional model of emotions (Alsharif et al., 2022)

Scientists posit that the right and left hemispheres of the brain not only differ anatomically but also in their functional capacities. When one hemisphere outperforms the opposite hemisphere in a specialized task, it is referred to as lateralization. Lateralization also pertains to brain asymmetry, which denotes greater activation in one hemisphere compared to the other (Touchette & Lee, 2017). Previous studies in neuroscience highlight the significance of frontal alpha activity in emotional processes. The frontal alpha asymmetry index, as proposed by Davidson (1984), suggests that the left frontal region is involved in the experience of positive emotions, encompassing motivation and

desire. Conversely, the right frontal area is implicated in the experience of negative emotions, including avoidance and withdrawal. Consequently, if the power of left frontal alpha is lower than that of right frontal alpha, it indicates the processing of positive stimuli, implying activation of the left frontal region. Additionally, Vecchiato et al. (2010); Vecchiato et al. (2012) discovered that left frontal activity was associated with pleasant advertisements, whereas right frontal activity was linked to unpleasant advertisements. Furthermore, Vecchiato et al. (2014) revealed gender differences in interest in commercial categories and scenes in two advertisements, distinguishing between males and females. When employing EEG, it is crucial to consider the following parameters for measuring emotions: 1. Frontal alpha asymmetry (Davidson, 1984), 2. Beta activity in the left and right frontal regions (Demos, 2005), 3. ERP amplitude (LPP) (Byrne et al., 2022), and 4. ERP domain (P300) (Jartarkar et al., 2022). Similarly, with regard to the eye tracker, the following parameters are important in measuring emotions: 1. Pupil dilation in response to emotional stimuli (Harris et al., 2018), and 2. Blinking rate (Skaramagkas et al., 2021).

*3- Memory*

Memory is a cognitive process involved in the retention and utilization of information. It encompasses a series of ongoing functions within the brain, with encoding serving as the input phase and retrieval as the output phase. Memory is of particular significance in the realm of advertising research (Alsharif et al., 2022). In their psychological work, Myers and DeWall (2021) put forth a model that delineates memory into three distinct stages: sensory memory, short-term memory (STM), and long-term memory (LTM) (see figure 3).

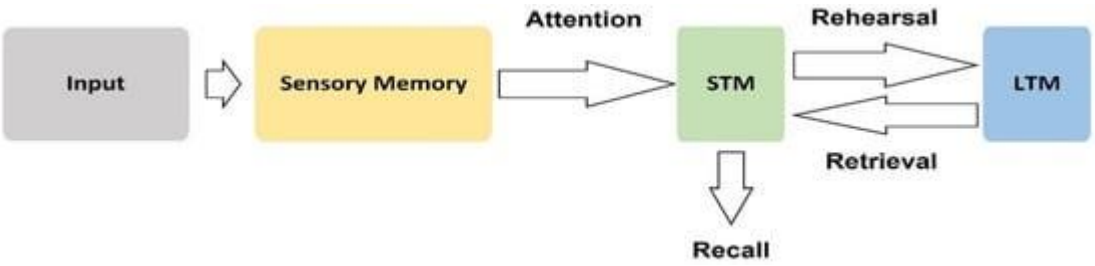


**Figure3.** Processes of memory processing and remembering in people (Alsharif et al., 2022)

Shapiro and Krishnan (2001) proposed a division of memory into implicit and explicit memory. Implicit memory occurs without conscious and deliberate recall, while explicit memory involves deliberate and conscious efforts to remember. Research on brain processes related to memory has yielded valuable findings regarding factors that influence consumer behavior, such as recall and recognition of advertisements (McGaugh, 2000). There is a close relationship between memory and emotion, with previous studies confirming that emotional events are typically better remembered than neutral events, especially when the emotions align with the events at that moment (Bradley et al., 1992). Studies on the memory process by McGaugh (2000) concluded that the hippocampus, located in the temporal lobe, plays a significant role in the formation and processing of memories. Hippocampal activation is strongly linked to both long-term and short-term memory, which greatly influences consumer purchasing decisions (Murty & Adcock, 2014; Wittmann et al., 2005). Additionally, the amygdala, situated next to and in close proximity to the hippocampus, is vital for the memory system (McGaugh et al., 1996). Rossiter et al. (2001) used EEG to investigate the brain regions involved in encoding visual memory in relation to dynamic visual stimuli. Their findings indicate that the transfer of short-term to long-term memory for television commercial information occurs in the left hemisphere. They concluded that activation of the left frontal region, as evidenced by reduced alpha activity, reliably predicts that commercial scenes will be better encoded in long-

term memory and subsequently more easily recognized. Similar patterns of frontal alpha activity in relation to memory encoding while watching television commercials that elicited high subjective interest were also found in other EEG studies (Smith & Gevins, 2004).

Morey (2017) examined the effect of advertising messages on recognition memory. These findings revealed stronger activity in the gamma band, which directly impacts memory. Bakalash and Riemer (2013) and Seelig et al. (2014) conducted fMRI studies on the connection between brain regions and memory, demonstrating that stronger activity in the amygdala region and temporal frontal areas is associated with remembered ads. These effects are not permanent but rather relevant. Similarly, Langleben et al. (2009) conducted experiments investigating the impact of ad content on frontal and memory area activation. The findings indicated that ad content increases activity in frontal areas and the encoding function of memory. Vecchiato et al. (2010), in an EEG experiment investigating changes in brain activity during the viewing of television commercials, found an increase in theta activity in the left frontal region when viewing pleasant commercials, which correlated with better memory for the commercials. They argue that these results are in line with the role of frontal and prefrontal regions in the transfer of sensory perceptions from short-term to long-term memory, as emphasized in the HERA model (Tulving et al., 1994). This model suggests that the left hemisphere plays a key role in encoding information from short-term memory to long-term memory, while the right hemisphere is involved in retrieving such information. Moreover, positive and negative emotional processing has been shown to create enduring memory traces during advertising (Aldayel et al., 2020). When employing EEG techniques, it is imperative to consider the following parameters for measuring memory: 1. Theta band activity in the left and right frontal and prefrontal areas (Vecchiato et al., 2010). 2. Augmentation in midline theta power (Byrne et al., 2022). 3. Vigorous engagement in gamma band activity (Morey, 2017). 4. Evoked response potential (ERP) domain, specifically N400 (Lin et al., 2018). 5. ERP domain, specifically P300 (Aldayel et al., 2020).

*4- Preferences*

Preference can be defined as a human attitude towards a set of factors and things, which can manifest as a specific decision-making process. It can also be regarded as a value judgment in terms of liking or disliking an object (Aldayel et al., 2020). When discussing preferences, it is important to consider the two categories of liking and wanting, which are closely associated with preferences. A study on consumer decision-making using fMRI by Knutson et al. (2007) revealed a link between the nucleus accumbens (a brain structure located near and associated with the amygdala) and the preference for a particular product. The nucleus accumbens is commonly implicated in the cognitive processing of motivation, reward, reinforcement learning, and addiction. In a study, participants were asked to passively view descriptions of food from restaurant menus and either imagine the food or choose the dish they preferred. The amygdala and orbitofrontal cortex showed greater activity when participants selected highly preferred foods compared to less preferred foods, and amygdala activity was associated with participants' pre-established food preferences (Fellows, 2004). Boksem and Smidts (2015) demonstrated that the midfrontal cortex is linked to individual preferences in the beta range (16-18 Hz) within the midfrontal brain. Several research studies have examined ERP-related components in the cognitive processes related to preferences. Wang and Han (2014) used the P300 as a measure of consumer preferences for specific product attributes. Goto et al. (2017) suggested the N200 component as an indicator of product preferences. Lin et al. (2018) investigated the N400 component and found that it can predict consumer preferences. When using EEG, it is important to consider the following parameters for measuring preferences: 1. Theta band in the occipital region (Kawasaki & Yamaguchi, 2012) 2. Theta relative power changes in the left and right frontal region (Vecchiato et al., 2011) 3. ERP domain (P300) (Wang & Han, 2014) 4. ERP domain (N400) (Lin et al., 2018).

*5- Decision making*

Decision-making is a fundamental human behavior that has been extensively studied across various disciplines, ranging from cognitive psychology to economics (Fellows, 2004). In their seminal works, Kahneman (2003, 2011) introduced a two-system approach to evaluate judgments and the

decision-making process. The first system operates automatically, with speed and minimal effort. It relies on intuitive thinking and associative memory mechanisms. Emotions and experiences influence this system, which is considered natural and observable among animals. In contrast, the second system operates through controlled operations and requires concentration and mental exertion. It relies on facts, logic, and reasoning, and is slower compared to the first system. It is specific to humans and entails conscious attitudes. Kahneman distinguished the first system as being related to unconscious processing and the second system as being related to conscious processing, highlighting the difference in processing capacity and storage between the two systems. The second system utilizes information provided by the first system. Notably, the systems approach reveals that people predominantly rely on the first system (unconscious system) when making decisions.

Solnais et al. (2013) reviewed several articles in consumer research and decision-making and identified several areas of the prefrontal cortex associated with the decision-making process. The orbitofrontal cortex plays a crucial role in selecting appropriate behaviors, particularly in unpredictable situations. A significant brain parameter related to decision-making is the selection index, which is linked to gamma band and beta band asymmetry in the frontal region (Aldayel et al., 2020). In their study, Garczarek-Bąk and Disterheft (2018) presented participants with two options (national brand or private label) for various products (hand cream, liquid soap, shaving foam, shampoo, facial scrub, soap, and toothpaste). They found that the frontal asymmetry score was higher for national brand products than for private label products. The frontal beta asymmetry index and brand type were identified as good predictors of purchasing decisions. They concluded that greater differences in EEG beta band fluctuations corresponded to a higher likelihood of purchase, and larger deviations in the brand type coefficient indicated a greater intention to purchase the national brand. In another study on indicators of willingness to pay for a product, Ramsøy et al. (2018) found that higher asymmetry of the gamma band (greater activation of the left frontal region) was significantly associated with a higher willingness to pay for the product (bags and shoes). However, they observed no relationship between beta band asymmetry and willingness to pay, suggesting its limited importance. Caution was advised when interpreting beta band asymmetry results. When employing EEG, it is crucial to consider the following parameters for measuring decision-making: 1. Frontal beta band asymmetry (Garczarek-Bąk & Disterheft, 2018) and 2. Frontal gamma band asymmetry (Ramsøy et al., 2018).

## Methodology

Our study involves a systematic literature review on the topic of neuromarketing, specifically focusing on articles that utilize EEG and eye tracking devices, or a combination of both, to investigate various cognitive processes such as attention, emotions, memory, decision making, and consumer preferences during stimulus presentation. The scope of our review includes advertisements with diverse advertising appeals and the display of the product itself. A distinguishing feature of a systematic review is its high reliability and reproducibility. It encompasses multiple stages, beginning with a broad and highly sensitive search and gradually narrowing down to specific criteria in the later stages. This method is a valuable tool for comprehensive exploration, diagnosis, and analysis of existing studies in order to address research questions effectively. Our research question aims to obtain comprehensive and useful information about the background of research on advertising appeals and cognitive processes of consumers in the field of neuromarketing, with a specific focus on the use of electroencephalogram and eye tracking devices, either individually or in combination. We conducted a comprehensive and systematic review to collect pertinent articles that address our research question. We followed the methodology outlined by Boland et al. (2017) in conducting our systematic review. In the first step, we formulated the program and determined the methods and data collection process based on our research questions. The second step involved searching various library and internet sources to gather relevant data. To accomplish this, we identified key terms such as Neuromarketing, Consumer Neuroscience, Electroencephalogram (EEG), Eye tracking, Eye movement, Advertising, Advertisement, Attention, and Visual attention. We then conducted searches in the Google Scholar

database and other sources. Our search yielded 171 articles. Using the Prisma approach by Moher et al. (2009), we systematically screened these articles in several steps. Initially, we excluded articles that did not meet the general criteria for inclusion in our study, including duplicate articles, non-English articles, book chapters, theses, and articles outside the specified time limit. Subsequently, we reviewed the remaining articles and eliminated those that were deemed irrelevant or non-experimental based on their content and research methods. In the final step, we selected only those articles indexed in the Scopus database, ensuring a high scientific standard for our systematic review. Ultimately, we included 43 articles that aligned with the objectives of our study.

The article selection and screening process was conducted as follows (Figure 4):

1. Nine duplicate studies were eliminated.
2. All articles included in the study were in English due to its status as the primary language for scientific research. Therefore, studies written in other languages (23 cases) were excluded.
3. Chapters from books and dissertations (a total of 7 items) were omitted.
4. The selected studies spanned the period from 2008 to 2023. This timeframe was chosen due to the limited availability of valid articles in this field prior to 2008. Additionally, the number of articles published in this field has significantly increased since 2008, indicating a greater level of research interest. Consequently, three articles were excluded.
5. All articles included in the study were experimental in nature and utilized neuromarketing tools. As a result, 31 articles lacking this essential feature were excluded.
6. Our analysis focused exclusively on studies that investigated neuromarketing or consumer neuroscience as a research topic. Therefore, 22 studies unrelated to marketing were eliminated.
7. In order to enhance the rigor of our study, we further refined our selection by using the Scopus database. We specifically examined articles indexed in this database that met the five aforementioned criteria. Consequently, 33 articles that were not indexed in Scopus were excluded. The Scopus database was chosen due to its prominence as one of the largest and most comprehensive scientific databases globally, providing access to vital research conducted worldwide.

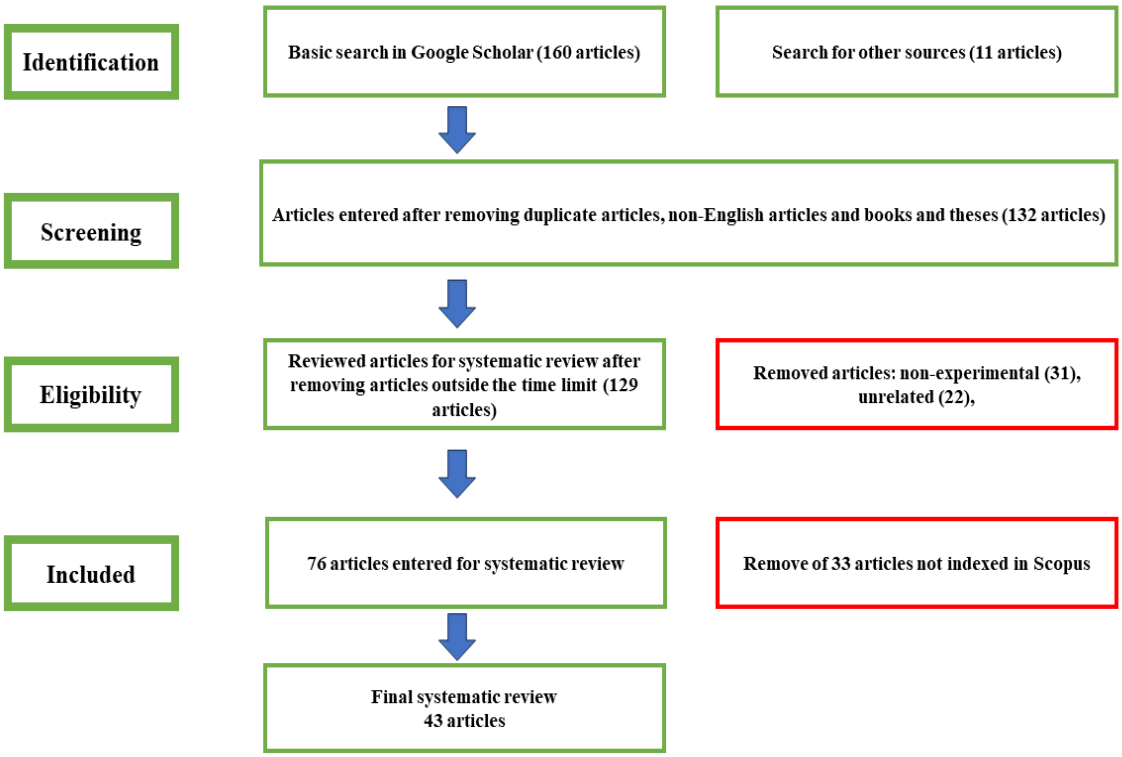


**Figure 4.** Selection and screening of articles by Prisma method (Moher et al., 2009)

## Results

We conducted an analysis of 43 eligible articles, considering factors such as the year of publication, the instrument utilized, the number of participants (differentiated by gender), the cognitive and emotional processes examined, as well as the type of stimulus presented. Subsequently, we derived the following findings:

**Table 1.** Analysis of articles (articles related to the field of sports are marked with*)

| Name of the author (year) | Tool | Number of samples Male (M) Female (F) | Cognitive/Emotional processes | Marketing stimuli | Stimulus presentation |
|---|---|---|---|---|---|
| (Astolfi et al., 2008) | EEG | 10 | Recall | Advertisements for cars, food, etc | Presentation of advertisements 6 minutes after, in the middle and 6 minutes before the end of the documentary |
| (Ohme et al., 2009) | EEG-GSR - EMG | 45 F | Emotion | TV commercials | Presenting the advertisement once with the presence of the female model and once without it |
| (Strick et al., 2009) | ET | 30 (10M/20F) | Attention, Memory | Image and text | Presentation of 9 brands in three humorous, positive but non-humorous and neutral conditions (control) |
| (Gidlöf et al., 2013) | ET | 40 | Attention, Decision making | Pasta packages | The presence of people in the store and choosing from 13 brands and 90 products on the shelf |
| (Khushaba et al., 2013) | EEG-ET | 18 | Preference | Cracker (food) | Presenting the image of crackers with different shapes, flavors and toppings |
| (Asyali et al., 2014) | EEG | 15 (5M/10F) | Emotion, Preference | Shoes | Presenting images of 16 shoes with different designs and colors |
| (Ho, 2014) | ET | 33 F | Attention | Ladies Handbag | Providing an image of branded and unbranded bags |
| (Behe et al., 2014) | ET | 330 | Attention, Decision making | Plant packaging | Providing three types of packaging with different information: 1. Production method 2. Price 3. Type of plant |
| (Telpaz et al., 2015) | EEG | 15 (8M/7F) | Preference | Consumer goods | Presenting products first in real form and then behind the monitor |
| (Hernández-Méndez & Muñoz-Leiva, 2015) | ET | 60 (30M/30F) | Attention | Airlines and hotels | Providing advertising in both static and dynamic ways using celebrities |
| )Valuch et al., 2015( | ET | 40 (20M/20F) | Attention | People's faces | Presentation of faces of people with blue and brown eyes |
| (Rojas et al., 2015) | ET | 38 (17M/21F) | Attention, Emotion | Beverages | Presenting the image of the drink once in the monitor and once in the virtual reality headset from different views |
| (Boerman et al., 2015) | ET | 180 (49M/131F) | Attention, Memory | Hot drink | Presentation of the product in the film in three forms: logo, name disclosure and a combination of both |
| (Yang, 2015) | ET | 108 (59M/49F) | Attention, Decision making | Camera, Mobile phone, Espresso machine, Air purifier and Fat analyzer | Providing information such as the name, image, transaction profit, feature and side indication of the product |

| | | | | | |
|---|---|---|---|---|---|
| (Wang et al., 2016) | EEG | 30 (15M/15F) | Attention, Preference | Advertising | Presentation of advertisements with story structure and without story structure |
| (Trimble et al., 2016) | EEG-ET | 30 F | Decision making, Emotion | Clothing | The presence of samples in the clothing store |
| (Berčík et al., 2016) | EEG-ET | 11 | Attention, Emotion | Beverages | Presence of samples in the store with three music modes (fast, slow, no music) |
| (Guo et al., 2016) | ET | 26 (15M/11F) | Attention | Mobile | Presentation of images of four mobile phone brands |
| (Grigaliunaite & Pileliene, 2016) | ET | 30 (4M/26F) | Attention | Mineral water ads | Installing five emotional ads and five rational ads in printed form on the university wall |
| (Alonso Dos Santos et al., 2017) | EEG-ET | 40 (15M/25F) | Attention, Emotion | Charity ads | Presenting two positive and negative images in terms of valence |
| (Yadava et al., 2017) | EEG | 40 (25M/15F) | Preference | Bag, Shoes, Belt, Glasses, Jacket | Offering fourteen products (each product in three different models) |
| (Wei et al., 2018) | EEG | 30 M | Emotion | Advertising | Providing advertising related to cars, clothes, food and digital products |
| (Guo et al., 2018) | EEG-ET | 63 (32M/31F) | Attention, Emotion | Beverages | Providing advertisement in three forms: text, image or a combination of both |
| (Garczarek-Bąk & Disterheft, 2018) | EEG-ET-GSR-fEMG | 21 (10M/11F) | Decision making | Health products | Offering ten products two by two |
| *(Alonso Dos Santos & Calabuig Moreno, 2018) | EEG | 60 (30M/30F) | Attention | Sports posters | Presentation of different sports posters in: 1. Type of sport 2. Matching and not matching sponsor |
| )García-Madariaga et al., 2019( | EEG-ET | 40 (19M/21F) | Attention, Preference | Product packaging | Providing product packaging with different images, texts and colors |
| (Kong et al., 2019) | EEG-ET | 18 (9M/9F) | Attention, Memory | Two mobile phone brands | Advertising in two forms: music video and neutral video |
| (Muñoz-Leiva et al., 2019) | ET | 60 (30M/30F) | Attention, Recall | Visit the website | Providing a Facebook page, travel planning app and a hotel blog |
| (Wang, 2019) | EEG-ET | 100 | Attention, Preference | Travel tour advertising | Providing two types of advertisements 1. Different in the background 2. Different in terms of placement |
| *(Dos Santos et al., 2019) | ET | 240 (111M/129F) | Attention | Sport posters | Presenting twenty-four different sports posters in the type of sport, location of the sponsor, number of sponsors, and compatibility of the sponsor |
| (Dos Santos et al., 2019) | ET | 240 (111M/129F) | Decision making, Recall | Sport posters | Presenting twenty-four different sports posters in the type of sport, location of the sponsor, number of sponsors, and compatibility of the sponsor |
| )Golnar-Nik et al., 2019( | EEG | 16 (9M/7F) | Decision making, Preference | Mobile advertising | Advertising of four mobile phone brands (two familiar brands and two unfamiliar brands) |
| (Eijlers et al., 2020) | EEG-EOG | 31 (15m/16F) | Emotion | Advertising | Providing car ads to men, beauty products to women, and food to everyone |

| | | | | | |
|---|---|---|---|---|---|
| (Ciceri et al., 2020) | EEG-ET | 72 (36M/36F) | Attention, Memory | Advertising | Providing advertisements in three forms: print, website and PDF |
| *(Rumpf et al., 2020) | ET | 315 (198M/117F) | Attention | Sport sponsorship ads | Presentation of videos including exciting sports scenes, non-exciting sports scenes and non-sports scenes (athlete warming up) where the sponsor's advertisement was clear. |
| *(Aguiló-Lemoine et al., 2020) | ET | 42 (37M/5F) | Attention, Decision making, Recall | Sport sponsor | Presentation of four advertisements: two co-sponsors and two non-co-sponsors with the sports event |
| (Aguiló-Lemoine et al., 2020) | ET | 179 (120M/59F) | Attention, Decision making, Recall | Sport sponsor | Presentation of congruent, incongruent and mixed fake brands with sports event |
| (Moya et al., 2020) | EEG-ET-GSR | 43 (21M/22F) | Attention, Decision, making, Memory, Preference | Food packing | Providing product packaging in the same color and size |
| (Moya et al., 2020) | EEG-ET-GSR | 40 (19M/21F) | Attention, Decision, making, Memory, Preference | Soft drinks, Snacks, Appetizers | Providing three products with color packaging and one size in three food groups |
| (Garczarek-Bąk et al., 2021) | EEG-ET | 24 (14M/10F) | Emotion, Decision making | Advertising | Providing advertisements from familiar and unfamiliar stores (abroad) |
| *(Aminiroshan et al., 2021) | EEG | 30 (15M/15F) | Attention | Mobile advertising | Presentation of two advertisements: 1. Sports and 2. Non-sports regarding mobile phones |
| (Baldo et al., 2022) | EEG-ET-GSR-ECG | 93 (45M/48F) | Emotion | Advertisements and video clips | Providing ads and positive and negative videos (in terms of valence) and low and high stimulation |
| (Pelau et al., 2022) | ET | 24 | Attention | Beverage advertising | Presentation of three advertisements in which the position of the product, celebrity and logo are changed |
| (Kongmanon & Petison, 2022) | ET | 65 (37M/28F) | Attention, Recall | Motorcycle ads | Offer five types of ads: Sponsorship, Graphics, Product, Product Movement, and Integration |
| *(Oboudi et al., 2023) | ET | 60 (30M/30F) | Attention | A benevolent social message | Providing messages with four different colors when playing sensitive and normal football scenes |

After conducting the aforementioned analysis, we proceeded to create tables utilizing the aforementioned information. These tables serve a crucial role in facilitating a comprehensive review and analysis of articles, thereby providing valuable information to readers. By utilizing these tables, readers are able to gain insights into the process of publishing articles within the field of Neuromarketing. Key components included in these tables are: prominent publishers within the field, frequently repeated keywords, the percentage of tools employed, the gender distribution of participants, significant topics influencing stimuli and advertisements, the types of advertising appeals employed in the research, as well as the number of emotional and cognitive processes discussed within the articles.

**Table 2.** Number of articles published each year

| Year of publication | Number of published articles | Year of Publication | Number of Published Articles |
|---|---|---|---|
| **2008** | 1 | **2016** | 5 |
| **2009** | 2 | **2017** | 2 |

| | | | |
|---|---|---|---|
| **2010** | 0 | **2018** | 4 |
| **2011** | 0 | **2019** | 7 |
| **2012** | 0 | **2020** | 5 |
| **2013** | 2 | **2021** | 2 |
| **2014** | 3 | **2022** | 3 |
| **2015** | 6 | **2023** | 1 |

Neuromarketing has experienced a significant growth trajectory from 2008 onwards, as evidenced by the data presented in Table 2. However, in 2019, the number of published articles in this field experienced a decline. It is speculated that the COVID-19 pandemic may have contributed to this decrease, as many neuromarketing studies require in-person participation for experimental purposes. Despite the challenges faced, neuromarketing continues to hold importance and allure as a novel approach within the marketing field. Further expansion of this discipline has the potential to directly impact research and contribute to the scientific advancement of marketing studies.

**Table 3.** Publishers

| Publishers | Number of published articles | Percent |
|---|---|---|
| **Elsevier** | 11 | % 25.58 |
| **Taylor & Francis** | 4 | % 9.3 |
| **Wiley** | 3 | % 6.97 |
| **Frontiers** | 3 | % 6.97 |
| **Emerald** | 3 | % 6.97 |
| **MDPI** | 3 | % 6.97 |
| **ASA** | 2 | % 4.65 |

As expected, the most authoritative publishers covering the fields of psychology, cognitive science, social science, marketing, and management have the most authoritative articles published in the field of neuromarketing. In Table 3, according to the number of articles, Elsevier with 11 and Taylor Francis with 4 articles have the most published articles, and Wiley, Frontiers and Emerald are in the next rank.

**Table 4.** Keywords

| Key words | Number of repetitions |
|---|---|
| **Eye tracking** | 18 |
| **Neuromarketing** | 17 |
| **EEG** | 17 |
| **Attention** | 10 |
| **Visual Attention** | 5 |
| **Consumer Neuroscience** | 4 |

According to Table 4, a notable observation emerges. Researchers demonstrate a significantly higher level of interest in neuromarketing, a field of study focused on commercial research, compared to consumer neuroscience, which entails academic research. Additionally, it is worth noting that the term "eye tracker" exhibits the highest frequency among the analyzed keywords. This finding suggests a potential correlation with the growing usage of eye tracking systems in recent years, as opposed to EEG and fMRI. The popularity of eye trackers can be attributed to their affordability, portability, ease of interpretation, non-invasiveness, and absence of participant apprehension. Significantly, unlike other tools, eye tracking allows participants to physically visit retail stores to make their purchases, thus enhancing the ecological validity of the experiments.

**Table 5.** Tools used in research (in percent)

| Tool | Number of use | Percent |
|---|---|---|
| **Eye tracking** | 19 | %44 |
| **EEG + Eye tracking** | 13 | %30 |
| **EEG** | 10 | %23 |

| | | |
|---|---|---|
| **Other** | 1 | %3 |

Numerous previous studies assert that Eyetracking is the third most frequently employed tool in the field of neuromarketing, following EEG and fMRI. Nevertheless, our research yields contrary results, which can be attributed to two primary factors. First, a substantial number of studies conducted with EEG were excluded during the article screening process due to their intended publication in less reputable journals. Second, the advancements made in Eyetracking technology in recent years, such as its reasonable cost, straightforward interpretation, and reduced user apprehension compared to EEG and fMRI, may have led researchers to preferentially opt for this device.

**Table 6.** Gender participants (in percent)

| Gender | Number of participants | Percent |
|---|---|---|
| **Men** | 1250 | % 41 |
| **Women** | 1292 | % 42 |
| **Gender not mentioned** | 533 | % 17 |

The collective number of participants in the 43 articles under review amounted to 3075 individuals. Although 17% of these participants (533 individuals) were not identified by gender in the research, it is evident that the number of male and female participants was approximately equal (1250 men and 1292 women). Consequently, researchers in the field of neuromarketing and consumer neuroscience face no significant hindrances in utilizing both genders as samples in their experimental research.

**Table 7.** Subject stimuli presented

| Stimulating topic | Number of uses | Percent |
|---|---|---|
| **Food and drink** | 13 | % 30.23 |
| **Sport** | 8 | % 18.6 |
| **Electronic tools** | 6 | % 13.95 |
| **Clothes, bags, shoes** | 5 | % 11.62 |
| **Car and motorcycle** | 4 | % 9.3 |
| **Travel and accommodation** | 3 | % 6.97 |
| **Beauty and health** | 2 | % 4.65 |
| **Ornamental plant** | 1 | % 2.32 |
| **Other** | 1 | % 2.32 |

Today, a wide range of products are being manufactured across various industries, with a focus on factors such as quality, design, and price. Simultaneously, consumer preferences are continuously evolving, markets are becoming saturated, and technology is advancing at a rapid pace. All these factors highlight that companies are faced with intense competition from their rivals in order to survive and thrive in the market. When we examine the turnover of different industries in 2023, we observe that the sports industry has a considerably lower turnover compared to sectors such as food, automotive, electronics, and clothing. However, it is noteworthy that Table 7 reveals the attention given to the sports industry by neuromarketing, following the food and beverage industry. This indicates the appeal of the sports industry vis-a-vis its competitors to such an extent that these very adversaries often incorporate captivating sporting scenes in their advertisements to establish an emotional connection with their target audience. Furthermore, they may also employ sports celebrities to endorse their products and services or strive to cultivate a positive mindset by sponsoring sporting events. By leveraging sports as a marketing tool, these companies aim to attain their objectives, recognizing the need for a larger customer base and the scarcity of global events that draw significant crowds. As such, sports provide them with a platform to achieve their goals.

**Table 8.** Types of advertising appeals

| Type of advertising appeals | Number of use |
|---|---|
| **Emotional** | 23 |
| **No advertising appeal** | 14 |
| **Rational** | 3 |
| **Ideal (Endorsement)** | 3 |
| **Intragroup values** | 3 |

Most individuals tend to seek quick and effortless solutions, as it is more challenging to logically substantiate the advantages of a product compared to emotional reasons. Companies typically employ emotional appeals to market their products. Researchers have discovered that emotional advertisements are generally more successful in influencing decision-making positively. Furthermore, they assert that emotional appeals are more prevalent in scientific literature, as confirmed by Table 8, and are more appealing, enjoyable, aesthetically pleasing, and effective for individuals. Table 8 shows that after emotional advertising appeals, products were showcased without any appeal, followed by rational appeal, ideal appeal, and in-group values. (Some studies have used two or more appeals.)

**Table 9.** Emotional and cognitive processes

| Cognitive and emotional processes | Number |
|---|---|
| **Attention** | 31 |
| **Decision making** | 12 |
| **Emotion** | 11 |
| **Preference** | 10 |
| **Memory** | 6 |
| **Recall** | 6 |

The most basic element in cognitive and emotional processes is attention. Attention of customers to advertisements is one of the key factors in the success of advertising campaigns. Companies advertise their products and services using various strategies to attract the attention of the audience and in this way they can present their desired message well. In fact, if the product and advertisement are not paid attention to, no purchase will be made. Therefore, as we can see in Table 9, the attention process is ranked first by a large margin and is used in 31 articles. Success in advertising means the ability to make decisions that lead customers to purchase the product or use the company's services, so it was expected that there would be a significant number of articles about the decision-making process among customers. After attention and decision making, the processes of emotions, preference, memory and recall are ranked next. It is important to mention that customers' emotions and emotions often influence their purchasing decisions and on the other hand, creating a strong and lasting memory in customers towards the brand or product is one of the main goals of advertising, therefore, although processes such as emotions, memory and Even remembering is in lower ranks than other cognitive and emotional processes, but this does not mean that they are less important. (In some studies, two or more emotional and cognitive processes have been examined).

## Discussion and Conclusion

Today, the production of sports products encompasses various aspects such as quality, design, and price. Simultaneously, customer preferences continually evolve, markets become saturated, and technology advances at a rapid pace. These circumstances highlight the intense competition faced by sports companies in their struggle for survival and growth. To succeed, a company must gain a

comprehensive understanding of its customers in order to fulfill their needs and achieve their satisfaction. Consequently, studying and analyzing customer thoughts and behaviors becomes imperative. In this regard, the application of neuromarketing emerges as a vital tool, as it allows for a deeper understanding of the fundamental functions of the sports consumer's brain, which in turn is crucial for examining purchasing behaviors. The present study employs a systematic review methodology to investigate the research conducted in the field of advertising appeals and the cognitive and emotional processes of consumers within the realm of neuromarketing. The Boland method, which offers a framework for conducting systematic reviews, was followed, as it was developed by Boland in 2017. The search and data analysis stages of this study were constructed according to the guidelines outlined in the Prisma standard guide (2009). In today's world, numerous industries, including the sports industry, allocate significant budgets to annual advertising costs. However, many fail to achieve their desired objectives due to a variety of reasons. One such reason is the improper use of advertising appeals, which stems from insufficient knowledge of customers. Unfortunately, despite the proven efficacy of neuromarketing in accessing consumers' subconscious, it remains a relatively overlooked area of study within marketing research.

Many studies have investigated the most effective advertising appeals and the specific products with which they are associated. However, there is still considerable disagreement among researchers, and a precise classification system for advertising appeals is lacking. In most cases, appeals are divided into emotional and rational categories, as was done previously. It is therefore necessary to expand research in this field in order to develop a more accurate classification system for advertising appeals, as well as to identify which types of appeals are most successful for different products. A significant challenge in the marketing and advertising design field is the neglect of consumer gender, income level, product type, and psychology. Failure to consider consumers' cognitive and emotional processes frequently leads to unsuccessful outcomes. Additionally, ethical considerations must be upheld. As highlighted in numerous studies, people tend to place trust in sports and athletes. Consequently, companies often attempt to leverage this trust by employing emotional and ideal appeals related to sports. However, it is vital for companies to ensure that their products and services are of high quality and that their advertisements are not misleading. Failure to do so not only harms the company's image but also undermines trust in the sports industry as a whole. Therefore, companies that choose to utilize the appeal of sports in their advertisements should demonstrate great sensitivity and adhere to strict ethical guidelines. Ethical issues also arise in the context of ideal advertising appeals involving female athlete endorsers. Unfortunately, research has shown that attention is often given to female endorsers based solely on their gender and the attire they wear, rather than their athletic abilities. This disparity may be one of the reasons behind the lack of media coverage and less significance given to women's sports events. It is important to rectify this imbalance and promote gender equality in sports advertisements. Moreover, careful consideration should be given to the suitability of the endorser and the product being advertised. The use of an unsuitable endorser can divert attention away from the company and ultimately be detrimental to its overall performance.

Respecting consumer rights is another essential aspect of successful marketing. People from different nationalities and those who support different sports teams possess varying tastes and values. Therefore, companies must continuously update their knowledge of demographic information concerning sports consumers and act with respect and sensitivity. Failure to correctly comprehend the cognitive and emotional structures of consumers can severely damage a company's reputation. As observed by Kotler, an effective marketing research strategy involves using multiple data collection methods. Regarding the tools utilized in neuromarketing research, it is important to note that numerous reliable articles recommend the simultaneous integration of several devices. Each device, when used individually, may possess certain limitations, which could cast doubt on the accuracy and reliability of the findings. Unfortunately, many studies in the field of neuromarketing focus on employing only one tool, potentially indicating a weakness in this area of research. Moreover, experimental research within the field of neuromarketing often suffers from a limited number of participants. Consequently, increasing the number of participants is necessary to enhance

the validity of research outcomes. It is also worth noting that a significant portion of neuromarketing research takes place in laboratory environments rather than real market settings. As a result, the findings obtained in laboratory studies may differ from those in real-world environments. Furthermore, transient brain activities such as event-related potentials (ERPs) receive little attention in neuromarketing research. However, these activities have the potential to provide valuable insights to researchers.

In our research, we found that the majority of studies conducted using neuroscience tools are related to commercial neuromarketing research. Unfortunately, the role of consumer neuroscience, which pertains to academic research, remains underdeveloped. Researchers and practitioners in the field of physical education and sports should also be aware that sports-related advertising appeals are primarily employed for the purpose of selling products and services. However, health advertisements, physical activity promotions, and the benefits of sports, which are crucial for societal health, often suffer from numerous shortcomings. The commercial interests of large companies have compromised the appeal of sports. Considering that consumer buying behavior remains an unanswered question for marketers, it is worth noting that the brain often employs the first decision-making system, which is associated with the unconscious, to minimize energy expenditure. Consequently, further exploration and understanding of the cognitive and emotional processes of sports consumers through the expansion of neuromarketing research can greatly benefit companies seeking success through the use of sports-related advertising appeals. It is important, however, to approach neuromarketing with an open mind, recognizing it as a complementary tool rather than a complete and comprehensive solution to marketing challenges. Neuromarketing is presently being employed across diverse industries including food, automotive, tourism, electronic products, pharmaceuticals, fashion and clothing, and education. Its successful implementation in these sectors highlights its potential value. Given the significance and allure of the sports industry, and drawing upon the achievements of neuromarketing in other domains, it is plausible to extend its application to the sports industry as well.

The existing body of literature on the utilization of neuromarketing in the sports industry reveals several notable research gaps necessitating further examination and exploration. Firstly, while there is ample documentation regarding commercial neuromarketing research, the academic aspect, particularly in the field of consumer neuroscience, remains underdeveloped. This deficiency underscores the need for additional scholarly investigations delving into the neurological underpinnings of consumer behavior in the context of sports. Secondly, current classification systems for advertising appeals exhibit a lack of consensus on the most effective appeals, resulting in simplistic divisions into emotional and rational categories. To enhance our understanding and utilization of advertising appeals, it is imperative to develop more nuanced and precise classification systems. Furthermore, many studies neglect to consider critical factors such as consumer demographics (e.g., gender and income level), product type, and consumer psychology. Integrating these variables into future research is crucial for comprehending the diverse responses of consumers to advertising appeals. Additionally, ethical considerations surrounding the use of sports and athlete endorsements in advertising are frequently disregarded. To ensure the avoidance of consumer deception and the exploitation of their trust in sports, it is essential to conduct studies that address the ethical implications involved. Moreover, research in neuromarketing often relies on a single tool, which can restrict the reliability of findings. By incorporating multiple tools and techniques, a more comprehensive understanding of consumer behavior can be obtained. Furthermore, the experimental design and participant numbers in many neuromarketing studies are limited, with small sample sizes and laboratory settings that may not accurately reflect real-world environments. Increasing participant numbers and conducting studies in real market settings would enhance the validity of research outcomes. Lastly, neuromarketing research has insufficiently explored transient brain activities, such as event-related potentials (ERPs), which hold the potential to offer valuable insights into consumer behavior.

## Ethical Considerations

**Compliance with ethical guidelines:** Ethical points have been observed.

**Funding:** No specific financial resources have been used.

**Authors' contribution:** All authors have contributed to the design and implementation of this study.

**Conflict of interest:** There is no conflict of interest.

**Acknowledgments:** We are grateful to all individuals and organizations that helped us in this study.

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