



## Investigating the cognitive process of attention while watching sports advertisements in interested and non-interested people using Electroencephalogram technology

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### ABSTRACT

This study aims to investigate the attention cognitive process while watching sports advertisements in interested and non-interested people using electroencephalogram technology. The research method was semi-experimental and the population included 30 students of Birjand University who were selected randomly as a sample. To collect data, the General Health and Sanchez-Torres Questionnaire (2021) was used. Then to record the brain signal, the 21-channel Electroencephalography Instrument was used. The results revealed a significant difference in attention index (AI) between sports advertising and non-sport advertising. Also, the attention index in people who were interested in sports showed a significant difference compared to those who were not. It can be concluded that sports are a suitable platform for advertising products so that it can create a positive effect through increasing the customers' attention. The level of interest also in sports may be a persuasive calculation of consideration for publicizing.

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## **Introduction**

Today, there is fierce competition between the advertising and commercial markets. Every year the number of brands introduced through media broadcasts and commercial ads increases while the goal of all these brands is to attract and retain customers (Aminiroshan et al., 2021; Golnar-Nik et al., 2019; Shakibaei Fard et al., 2020). To this end, the role of advertising is crucial to be successful or be defeated (Simmonds et al., 2019) because the most important marketing strategy to attract better attention of consumers is advertising (Golnar-Nik et al., 2019). Advertising is a key tool that organizations use to develop and promote an idea, service, or product (Onișor & Ioniță, 2021) and plays an essential role in communicating between consumers and manufactured products (Eijlers et al., 2020). Advertising means using different methods to communicate with customers to introduce products or services in exchange for payment (Herrera et al., 2002). In this regard, choosing and preparing an effective advertisement is an important challenge (Golnar-Nik et al., 2019). Many researchers have investigated the factors affecting the success and effectiveness of advertisements. Most of them have introduced the three factors of attention, pleasantness, and memorability of advertisements as key factors in the effectiveness of advertisements (Harris et al., 2019; Kolar et al., 2021; Vecchiato et al., 2012; Yen & Chiang, 2021). The effectiveness of an advertisement seeks to reveal how much the advertisement has helped the company in achieving the main goal and to what extent it has been able to attract attention by creating a long-lasting and memorable effect in the audience's mind, and finally, how much it can stimulate customers to purchase the product (Poorkarimi, 2002). Harris (2019) considers attention to be a key factor and the most critical factor in advertising success (Harris et al., 2019).

According to Simmonds (2019), advertisements will be useless if they cannot attract the attention of the audience (Simmonds et al., 2019) because attracting the customer's attention has a meaningful impact on the intention to purchase a product (Harrison, 2013; Rice & Bennett, 1998; Vaughan et al., 2016). Advertisements can stimulate customers (Sharifi et al., 2019) drive them to a new brand, and increase the market share, sales, and profits of the company, provided that they can attract customer attention (Riebe et al., 2014). To this end, during the last two decades, the topic of attention came into the spotlight (Orquin & Wedel, 2020; Romaniuk & Nguyen, 2017).

Attention is a cognitive process to identify and select relevant events against distracting factors (Onișor & Ioniță, 2021) and people should use attention as a selection mechanism in information-rich environments (Isaacovitz, 2006). Consumers are constantly exposed to various information about companies and advertisements; therefore, this issue makes companies face greater challenges attracting customer attention (Fortenberry & McGoldrick, 2020) in such a way that they constantly seek to attract more people or create more positive feelings in consumers towards their services or products (Semerádová & Weinlich, 2022). Given this, in this research, we first sought to find the answer to the question of whether advertisements can attract people's attention or not. This research is looking for cognitive evaluations through electroencephalogram technology while watching sports commercials in people who are interested and non-interested in sports. Therefore, after answering these research questions, we would have a better understanding of how the cognitive processes work in attracting people's attention through advertisements.

Sports is one of the fields that can be used for better visibility. During the last few decades, sports have become a revenue-generating industry in developed countries (Gholamian et al., 2022). To this end, the amount of advertising through sports has experienced notable growth (Bruce & Tini, 2008). Also, the unique potentials of sports have prompted business owners and investors to have a special look at sports to introduce their products and services (Pyun & James, 2009) because sports can be not only an important social event but also it is a commercial phenomenon (James, 2011). In this regard, many researchers argued that sports create a positive attitude toward advertisements (Masanovic, 2018). Hence, it seems that using sports for the advertising industry is one of the ways that on the one hand, increases the sales and profits of companies, and on the other hand, creates a huge financial turnover in the sports industry.

In various pieces of research, several reasons for the importance of advertising through sports have been argued including increasing people's awareness of a new brand while watching a sports match, wide and numerous media coverage, flexibility, movement, and dynamism in advertising (Aminiroshan et al., 2021; Ghaedi et al., 2020; James, 2011; Kordlu et al., 2015; Kropp et al., 1999;

Lyberger & McCarthy, 2002; Pyun & James, 2009). Many researchers have concluded that the attitude of people towards advertisements through sports is positive and also this can be more positive than the attitude towards general advertisements, television, and other online advertisements (Esmaeili & Amani, 2018; Masanovic, 2018; Zorić et al., 2018).

According to the research conducted by Rumpf & Breuer (2018), the viewer's attention to visible sponsor signs during sports broadcasts leads to important results such as brand recall, emotions, or choice (Rumpf & Breuer, 2018). Also, Gijsenberg (2014) stated that the effect of advertising in major sports events increases because a great deal of advertising messages are seen by a sizable chunk of people. Kim et al. (2017) also concluded that due to the availability of televisions enjoying large screens, high image quality, and even 3D viewing, the experience of watching sports at home is increasingly matching the right conditions on the scene; therefore, live broadcasting of important sports events can create significant stimulation for the viewers (Kim et al., 2017).

Another research that can be mentioned in this field is Masonovich's research (2018). In a study, he investigated the effect of advertising through sports and its relationship with watching sports events. He concluded that not only advertising through sports will be very effective but also the effect of advertising through sports on a group of people who mostly watch sports events is much more (Masanovic, 2018). On the other hand, customers' buying behavior has complex and irregular structures and they are unable to discover the reality of what is the main reason for customers' buying behavior (Bazzani et al., 2020; Boksem & Smidts, 2015; Gordon et al., 2018; Verhulst et al., 2019; Verhulst et al., 2020). That's why marketers are more and more hesitant to use verbal and traditional methods such as focus groups for advertising pre-testing (Davidson, 2004; Lee et al., 2014; Morin, 2011; Ohme et al., 2010); therefore, they try to measure the effectiveness and efficiency of advertisements using neuromarketing methods (Garczarek-Bąk et al., 2021; Russo et al., 2022) which can leave positive effects on the business performance of organizations and bring about more growth (Tajeddini, 2011).

Therefore, nowadays neuromarketing methods are used more than before to analyze brain responses to advertisements (Ariely & Berns, 2010; Calvert & Brammer, 2012b; Fischer et al., 2018; González-Morales, 2020; Harmon -Jones et al., 2010; Harmon-Jones & Gable, 2018; Harris et al., 2019; Hernando et al., 2022; Raiesdana & Mousakhani, 2022).

Neuromarketing is a hybrid discipline that includes the three main areas of neuroscience, psychology, and marketing (Mansor & Isa, 2020). It is a term used to describe the application of neuroscience cognitive tools in marketing aimed at measuring unconscious responses and revealing the true feelings of consumers (Vecchiato et al., 2014). In other words, Neuromarketing means analyzing the brainwaves of customers aimed at identifying their needs and attitudes toward the desired products with the help of special neuroscience tools (Venkatraman et al., 2015). Therefore, researchers try to investigate the signs in the brain activities related to the success signs of advertisements namely the increase in attention, memory, and emotions involved while watching commercial ads (Bazzani et al., 2020; Borawska & Łatuszyńska, 2020; Eijlers et al., 2020; Jesulola et al., 2015; Singh et al., 2020; Vasiljević et al., 2019).

Neuroscience studies indicate that the alpha power in the frontal part of the brain can be related to the level of people's attention to the observed subject; thus, when attention increases, the power of the alpha band in the frontal part of the brain decreases. On the other hand, when attention decreases, the power of the alpha band increases in the frontal part (Moon et al., 2019; Van Diepen et al., 2019).

Considering this issue and using the alpha band power, in the field of neuromarketing and advertising evaluation, the alpha band power has been used as a determining indicator in measuring attention to ads (Baraybar-Fernández et al., 2017; Harris et al. al., 2019; Raiesdana & Mousakhani, 2022; Vecchiato et al., 2011; Vecchiato et al., 2012). In this context, the research of Raiesdana & Mousakhani (2022) can be mentioned. He investigated the customer preferences for buying electric cars using the neuromarketing approach. He concluded that in such cases where people like a car and pay more attention to it, the power of the alpha band in the frontal part decreases (Raiesdana & Mousakhani, 2022). Also, in another study, Harris et al. (2019) examined the effectiveness and efficiency of health ads and introduced attention as a key factor in determining the effectiveness of advertisements. They also stated that based on the electroencephalogram results, they observed theta synchronization (increase) and alpha desynchronization (decrease) during increased attention (Harris

et al., 2019). Vasiljević et al (2019) also conducted a study aimed at evaluating the level of consumers' attention to Nestle products and stated that the attention of consumers to the advertisement is related to the amount of alpha band power and the viewer's preference to buy the product (Vasiljević et al., 2019). Also, Kolar et al (2019) in research entitled "How real-time electroencephalogram measurement increases the evaluation of ad effectiveness" stated that the use of neuromarketing methods is preferable to old methods; also, the power of the alpha band has a lot to do with the amount of noise (Kolar et al., 2021).

Among other available research in this field, it can be referred to the research of Vakshiato et al. (2010). In a study on the amount of attention paid to the advertised product brand among two groups of consumers and non-consumers, they argued that a decrease in alpha power in the frontal part of the brain will increase attention to advertisements.

They also argued in another research entitled "Understanding the Effects of Television Advertisements" that the advertisements that seem pleasant to the audience cause increased attention and as a result, decreased alpha power (Vecchiato et al., 2010). Simon et al. (2003) also conducted a study on the amount of people's attention to advertisements and the power of the alpha band through electroencephalogram (Simons et al., 2003). Concerning existing research in this field, the following questions are raised: Are sports advertisements able to attract more attention than non-sports advertisements? Do sports ads cause more reduction of alpha power in the frontal brain compared to non-sports ads?

The next issue that was examined in this research was the effect of interest in sports on the level of attention of people. Based on the research conducted in this field, the level of interest in the advertised subject is an influencing factor in the decision to buy and pay attention to the advertisement (Custdio, 2011; Darabi et al., 2018; Dehghanpouri, 2014; Patrícia, 2010; Vecchiato et al., 2011; Custdio, 2011; Darabi et al., 2018; Dehghanpouri, 2014; Patrícia, 2010; Vecchiato et al., 2011). Also, recognizing the audience's tendency and interests is a fundamental factor in the success of a business and has a great impact on efficiency and effectiveness (Tajeddini et al., 2013).

In this regard, we can refer to the research of Vaughan, Beal & Romaniuk (2016). They concluded that consumers and users of a product pay more attention to product advertisements than non-users as well as remembering them for a longer period (Vaughan et al., 2016). Custdio (2010) also investigated the alpha wave activity in two groups\_ interested and not interested in a brand. The results of this research showed that in the group interested in the brand, the alpha wave power in the occipital cortex decreased while watching the advertising film but, in the other group, not interested in the brand, the alpha wave distribution in the occipital cortex increased (Custdio, 2011). Also, Patrícia and his colleagues (2010) stated that alpha brain frequency is different between people interested and non-interested (Patrícia, 2010).

In their research, Darabi et al. (2017) also examined the effect of sports advertisements by Nike Company on customers and announced that the strength of alpha, beta, and theta bands increased significantly in the group who are interested in sports, but the strength of alpha and theta bands in those who are not interested in sports remained unchanged. He also stated that sports advertisements can have a significant effect on people's decisions to buy a product (Darabi et al., 2018).

Hence, the third question of the current research is that is there a difference in the amount of attention paid to advertisements between people who are interested in sports and those who are not interested in sports.

Background analysis showed that despite the issue of neuromarketing in gaining a competitive advantage in recent decades as a global issue and the high position of neuromarketing in advertising development, so far, no research in this area has been carried out in Iran; also, the research which has been conducted have only examined advertisements or sports elements alone while in the present study, one sports advertisement from the same brand was examined for each sports advertisement. Consequently, it seems that there is a research gap here and it enjoys great importance to research and investigate the cognitive process of attention while watching advertisements in interested and non-interested people using electroencephalogram technology.

Advertisements can stimulate customers to buy the product and lead them to the new brand; consequently, it increases the market share, sales, and profits of the company, provided that they can attract customer's emotions, interest, and attention (Riebe et al., 2014). But today, the main concern of

many companies and business owners is why despite producing high-quality products and using advertisements to introduce products, they do not have enough sales and profits and cannot attract the attention of customers. Statistics show that today, 80% of all new products introduced fail in the first three years and do not achieve their goals (Calvert & Brammer, 2012a). On the other hand, research results indicate that people's attitudes toward public advertisements have gradually become more negative due to the repetition of advertising methods (Kordlu et al., 2015). Also, the growing use of new methods, channels, and media to advertise different brands increases the complexity of the media, scatters the minds of viewers, and spends a lot of time seeing these advertisements, which ultimately leads to a decrease in people's interest in advertisements. Therefore, consumers are always trying to ignore advertisements and not pay attention to them. Many of them believe that advertisements distract them and divert them from what they want to do. Given this, researchers are looking to discover how to observe information in an advertisement from the customers' side and also to identify factors influencing the attention to advertisements (Harris et al., 2019; Myers et al., 2020) so that they can minimize the phenomenon of avoiding advertisements because attention is a limited resource (Foulsham & Kingstone, 2017; Onișor & Ioniță, 2021). On the other hand, most of the time, customers' buying behavior has complex and irregular structures and they are unable to discover the reality of what makes customers buy. The main issue is that most decision-making processes are done in the unconscious part of the brain, not at the conscious level while human behaviors occur through processes at a level lower than the level of conscious awareness (Calvert & Brammer, 2012a). In this regard, sports events create extraordinary opportunities for companies to introduce their brands and products through advertising (Keshkar et al., 2019) as well as being effective in the growth and promotion of companies. Along with this issue, one of the things that determines the importance of investigating neuromarketing in the cognitive process of watching advertisements is that understanding people's cognitive states regarding an advertisement accurately through self-expression and traditional ways (self-expression, questionnaires, etc.) cannot be evaluated and many internal neurophysiological processes remain unknown. Therefore, this research aims to measure and compare the amount of attention paid to non-sports product advertisements in both modes (sports and non-sports) considering the importance of sports in the world of advertising and also considering the use of neuromarketing as a type of advanced marketing. Thus, given the mentioned issues and the important role of sports in paying attention to advertisements, we sought answers to the questions raised in the research process.

## **Methodology**

This study is applied research and in terms of nature, it is semi-experimental. The statistical population was formed by the students of Birjand University. The research sample was random including 30 students who met the criteria for entering the research (between 20-35 years old, right-handed, without any background of illness, drug, or alcohol).

In this study, Goldberg's general health questionnaire (1979) including 28 items and four components (physical symptoms and general health, anxiety, social dysfunction, depression) was conducted using a simple Likert method (with scores of 0,1,2,3). The overall score of each person was obtained from the sum of the scores of four components. A low score on this scale means a sign of health and a high score shows a sign of poor health. Final scores from 14 to 21 in each subscale show the deterioration of the subject's condition in that factor. A total score of over 23 indicates a lack of general health and a score below 23 indicates mental health. Also, in the present study, the Sanchez-Torres (2021) questionnaire included 23 items and seven components (Physical condition, Mastery, Enjoyment, Self-regulation, Self-efficacy, perceived behavioral control, and attitude to practicing sport) with a five-point Likert scale (very low=1 to very high=5) was used (Sánchez Torres et al., 2021). It is obvious that the higher this score is, the greater the respondent's interest in sports and vice versa; therefore, people enjoying scores above 69 were identified as interested, and those enjoying scores lower than it were identified as non-interested. To record the signal, all the participants were individually asked to sit on the built-in chair in front of the computer monitor. Then, the special cap of the electroencephalography machine was set on their head. To conduct better and more brain waves, a special recording gel was injected into the desired channels. Next, the impedance of the channels was checked by Win Electroencephalogram software so that their resistance level reached less than 5-kilo

ohms. The room, where the main test and recording of brain activities was performed, was isolated and enjoyed a standard state of light and temperature. Before recording the signal, the implementation protocol was explained to all the subjects without referring to the main objective. Next, each person watched six commercials (including one sports ad and one non-sports ad) among the top three brands reported by Inter brand in 2020 (General Electric, Nissan, and McDonald's). The time of each advertisement was one minute and it should be noted that this time was equal for all advertisements. In total, the test took about ten minutes for each person. To maintain the same conditions in playing the clips for all samples, R software was used. Brain signals were recorded with a 21-channel electroencephalography device model 202 of Mitsar Company. The channels considered in this research included pairs of frontal and prefrontal electrodes (F7, F8, F3, F4, Fp1, Fp2). The electrodes used in the device are silver chloride electrodes, which are by the international 20-10 system. It is worth noting that all the mentioned steps were carried out under the supervision of the Ethics Committee of Birjand University of Medical Sciences. The protocol used to carry out this research includes the selection of people, recording the people's brain waves before watching advertisements of different brands for one minute with eyes open while sitting and playing advertising videos, and finally, recording people's brain waves while watching the desired videos.

### Data Analysis

For data analysis, MATLAB software was used. First, each channel signal was calculated relative to the reference of both ears ( $2/(A1+A2)$ ) and then the signals passed through a high-pass filter with a cut-off frequency of 0.5 Hz and a low-pass filter with a cut-off frequency of 45. Next, some parts of the recorded signal related to motion artifacts or artifacts caused by blinking were removed using the ICA independent component analysis method. Then the absolute power spectrum was calculated using the Welch method with Hanning windowing for a second and 50% overlap for brain signals and each channel; finally, the individual alpha peak (IAP) was calculated. Therefore, the individual frequency band based on the IAP parameter is defined in a way that covers the common alpha band which is "IAP-2Hz IAP+2HZ". Then, to compare people, the z-score obtained from the calculation of the relative power spectrum of people while watching advertisements was used in such a way that the z-score obtained from watching non-sports advertisements was subtracted from the z-score obtained from watching sports advertisements (Vecchiato et al., 2013).

Finally, SPSS software was used at a significance level of 0.05 to test the significance of this difference.

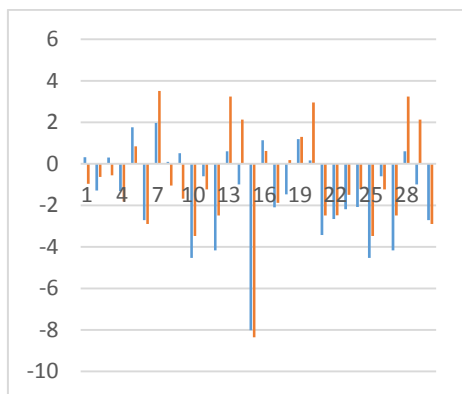
$$Z = \frac{\bar{x} - \mu}{\frac{\delta}{\sqrt{N}}} \quad GFP \ z(t) = \frac{GFP \ spot(t) - mean(GFP \ rest(t))}{std(GFP \ rest(t))} \quad (\text{Vecchiato et al., 2013})$$

$$Z = Z \text{ non-sport} - Z \text{ sport}$$

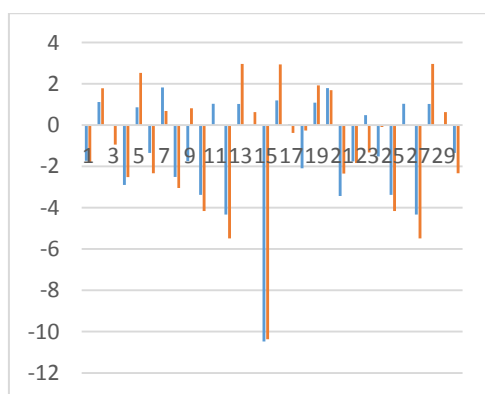
### Findings

The study's sample consisted of 30 subjects while 15 of them were male ( $\bar{x} = 24.81, Sd = 3.77$ ) and 15 were female ( $\bar{x} = 24.86, Sd = 3.11$ ). Also, based on the purpose of the research and using the sports interest questionnaire, the research sample was divided into two different groups: interested ( $\bar{x} = 26.35, Sd = 3.24$ ) and non-interested in sports ( $\bar{x} = 21.47, Sd = 2.33$ ). Among them, 61% had a bachelor's degree, 31% had a master's degree and 8% had a doctorate, meanwhile most of them were married (60%).

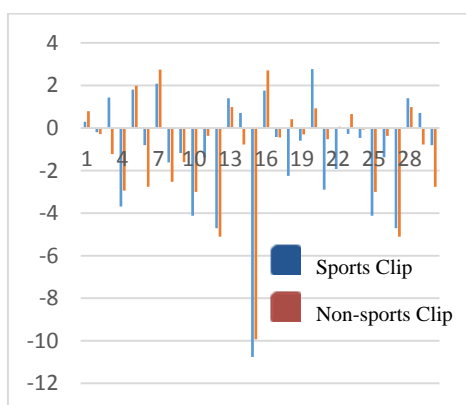
First, to compare the attractiveness of advertisements with sports and non-sports content and to examine the attention index (AI), the alpha band changes in the electrodes of the frontal part were examined. Then to compare people, we got the z scores of each person based on the relative power spectrum of people while watching advertising. The graphs related to the z scores of each brand, which includes sports and non-sports advertisements, are as follows (Charts 1, 2, and 3).



**Fig. 1.** Z-Scores of GE Sports and Non-Sports Advertisement Attention Index



**Fig. 2.** Z-Scores of Nissan Sports and Non-Sports Advertisement Attention Index



**Fig. 3.** Z-Scores of McDonald Sports and Non-Sports Advertisement Attention Index

Figures 1, 2, and 3 show the distribution of each person's z scores in all advertisements. These scores were obtained based on the calculated GFPs related to the electrodes of the frontal brain area during the time watching the advertisements. Sports videos are shown in blue and non-sports ones are shown in red. On the x-axis, the number of participants, and on the y-axis, the smoothed values with a z-score of GFP are considered. As seen in figures 1, 2, and 3, sports clips have been able to generate more peaks (increased attention) than non-sports clips; therefore, it can be argued that sports clips have more ability and potential to attract attention.

In the next step, the z-score obtained from watching the non-sports advertisement of each person was subtracted from the z-score obtained from watching the sports advertisement and was tested by a one-sample t-test at the significance level of  $p = 0.05$ .

**Table 1.** Results of One-Sample T-test of Attention Index

	T-test for Equality of Means					
	t	Df	sig	Mean Difference	95% confidence interval of the Difference	
					Lower	Upper
General Electric	-3.99	29	.001	-.286	-.433	-.139
Nissan	-3.60	29	.001	-.219	-.344	-.095
McDonald	-2.07	29	.047	-.124	-.248	-.001

The results showed a significant difference at the level of 0.05 between sports and non-sports in attracting audience attention to advertising. The negative difference between the mean between sports and non-sports based on the difference in z scores indicated that sports ads have a greater impact on the index and can attract the attention of the audience with more power than the non-sports ( $\alpha_{GE} = 0.001$ ,  $\alpha_{Nissan} = 0.001$ ,  $\alpha_{McDonald} = 0.047$ ).

Then, to investigate the effect of sports interest on people's attention index, the independent t-test was used, the results of which are as follows (Table 2).

**Table 2.** Results of t-test based on interest in sports

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig	T	df	Sig	Mean Difference	Std.Error Difference	95% confidence interval of the Difference	
									Lower	Upper
General Electric	Equal variances not assumed	6.008	.021	2.942	21.413	.008	.384	.130	.113	.656
Nissan	Equal variances assumed	1.534	.226	3.580	28	.001	.368	.103	.157	.579
McDonald	Equal variances assumed	.602	.444	.836	28	.410	.101	.121	-.147	.350

Results showed that in 0.05 level attention to advertising two of three brands in this research, there was a significant difference between people who were interested in sports and those who were not interested, and according to the low and high limits obtained from the test (both of them is positive), this difference was due to the average created by people interested in sports.

## Conclusion

Nowadays, due to the sizable chunk of advertisements, consumers' attention to advertising products seems limited, and companies always have to pay some budget to attract consumers' attention. This cost has increased in recent years because today sizable chunk of companies along with a great body of brands and products are competing with each other to attract the attention of customers but the level of attention of consumers does not match this demand, that's why marketers and industry owners are looking for a solution to solve this problem in advance. On the other hand, according to research, people's attitude toward advertisements has become negative due to the use of repetitive advertising methods (Kordlu et al., 2015) and people do not accept any message or advertisement easily. Given this, it is suggested that advertising should be designed and produced so that it would be capable of competitive advantage (Aminiroshan et al., 2021).

Nowadays, one of the suitable platforms for advertising, which has grown a lot, is sports. According to some research, many researchers have concluded that people's attitude toward advertising through sports is positive (Bennett et al., 2006; Bjelica et al., 2014; Kordlu et al., 2015; Muratovic et al., 2014; Pyun & James, 2009) and even advertising through sports can have a more positive effect compared to advertising through television and online advertising (Zorić et al., 2018); they also announced that sponsorship in sports events also possesses a positive effect on brand



awareness (Breuer et al., 2021). In this regard, in this research, it's been decided to investigate the potential of sports and advertising through sports in terms of attracting people's attention to advertisements and comparing them to non-sports advertisements.

The results obtained from the present research showed that among the advertising videos (sports and non-sports), sports ads were able to decrease the amount of frontal alpha power, and as a result, they increased the attention index. As mentioned earlier, important cognitive skills such as attention, problem-solving, working memory, goal setting, and emotional control are managed in the frontal lobe, and high executive functions are performed in this part of the brain. This part of the brain is responsible for immediate and sustained attention and also includes social skills, decision-making, problem-solving, working memory, and executive planning (Morin & Renvoisé, 2018). Research in the area of neuroscience shows that the lower the alpha level in the frontal area, the higher the level of involvement and cognitive load in this area of the brain, also considering that the frontal lobe plays an important role in attention and decision-making, the reduction of alpha waves in this lobe indicates an increase in the amount of attention and cognitive load. Regarding that, the results of the present research show that advertising through exercise reduces alpha waves in the frontal area of the brain, which is the reason for this decrease can be the rise of attention and engagement created in this area, which shows the positive effect of sports. The results of the present research are consistent in line with the research results of Rais Dana and Musa Khani (2022), Quaidi et al. (2020), Klar et al. (2021), Vasilich et al. et al. (2017), Moon et al. (2018), Berger & Davelaar (2018), Vecchiato (2011 and 2012), Custudio (2011), Simon et al. (2003) (Berger & Davelaar, 2018; Custudio, 2011; Harris et al., 2019; Kolar et al., 2021; Moon et al., 2019; Raiesdana & Mousakhani, 2022; Simons et al., 2003; Van Diepen et al., 2019; Vasiljević et al., 2019; Vecchiato et al., 2011; Vecchiato et al., 2012). The results obtained from all the mentioned research have shown the changes in alpha power in the frontal area are directly related to the changes in the amount of attention to the observed subject so that the decrease in the activity of the alpha band in the frontal part of the brain is in line with increasing attention to advertisements; likewise, the increase in the power of the alpha band is associated with decreased attention. In this regard, Smith and Gevins (2009) in the review "Attention and Brain Activity While Watching Television: Components of Viewer Engagement" stated clearly that there is room for content manipulations to also modulate alpha band electroencephalogram measures (Smith and Gevins, 2009).

In terms of the effectiveness of sports, the results of this research are in line with the results of many other scientists. For instance, Ghasemi Siyani et al. (2022) in this context, in research titled "The role of advertisements related to park-sports in the changes of brain waves of people using QEEG", concluded that advertisements related to sports can reduce alpha waves and increase the cognitive load (Ghasemi Siani et al., 2022). Among the other available research in this regard, it is possible to mention the research of Kurdello et al. (2015), who stated that, unlike public advertisements, the respondents generally have a positive attitude towards advertisements through sports. So, it is argued that the unique characteristics of sports as an advertising media play a role in delivering a positive attitude towards advertising through sports (Kordlu et al., 2015). In another study, Zorić et al. (2018) showed that people show more interest and attention to advertisements through sports (Zorić et al., 2018). Popovic et al. (2015), Bjelica et al. (2014), Muratovic (2014), and Esmaili (2017) also announced that the beliefs and tendencies of people towards a product advertised through sports are much more positive compared to other methods, besides the advertisements that are done through sports are more noticed by people (Bjelica et al., 2014; Esmaili & Amani, 2018; Muratovic et al., 2014; Popović et al., 2015). In this regard, Bennett (2006) stated that the use of athlete endorsers has a valuable role in developing the brand name of products and services (Bennett et al., 2006). Pyun (2006) and Pyun and James (2009) also stated in other research that whenever advertising is carried out through sports, it has gained more notice by people since it is fun and enjoyable (James, 2011; Pyun & James, 2009) because the sports' nature is such that one can be innovative and sports consumers use technology in different ways based on their requirements and expectations.

Therefore, it can be said that sport can attract people's attention to advertised products; consequently, it can gain benefit from this issue to achieve its goals. Mancini and his colleagues also confirmed these results in Esports (Mancini et al., 2022). The importance of this issue increases since the relationship between paying more attention to a product and remembering and recalling it in

marketing, designing, and production of products has been scientifically proven, and scientists argued that the reduction of frontal alpha arises from the greater attention that it prompts people like an advertised product and eventually buy it (Bellman et al., 2017; Ehrenberg et al., 2002; Pieters et al., 2007).

The next issue that has been investigated in this research is the people's attention to sports and non-sports advertisements among two different groups of audiences\_ people interested in and not interested in sports. Preparing advertisements without researching the audience and lack of information could be like stepping into the darkness. Today many expensive commercial and cultural advertisements do not have the expected effect because those in charge have not realized one of the main issues of the advertising process, which is the sufficient information about their audiences. They also send advertising messages to a multitude of heterogeneous and inconsistent audiences (Eskandari, 2015). Identifying the interests, tendencies, and consumption patterns of the audience is a crucial point so that it can increase the competitive advantage of business owners, especially for those having limited resources (Tajeddini et al., 2013). Promotional activity must be accompanied by a plan and research about target people and the advertising process so that one can hope for the positive consequences of an advertising activity. Familiarity with the audience and customers' tendencies is the heart of marketing activities, and effective communication is inevitable without complete knowledge of the audience or customer community (Eskandari, 2015; Tajeddini & Trueman, 2008). In this regard, we can refer to the research of Tajeddini and Trueman, (2008). They examined the impact of customer orientation, recognition of trends, and innovation on the performance of small businesses and stated that being familiar with customers and their interests has a positive effect on the commercial performance of businesses (Tajeddini & Trueman, 2008).

In this regard, the results of the present research revealed that the attention to advertisements of two of the three studied brands had a more significant difference among people who were interested in sports than people who were not interested.

For people not interested in sports, there was no significant difference between sports and non-sports advertisements while in people interested in sports, a significant difference was seen between sports and non-sports advertisements, so that in those interested in sports, sports advertisements were able to reduce the power of the frontal alpha band and to increase attention but in ones not interested in sports, such a decrease in the power of the alpha band was not observed.

The results obtained from the present research are consistent with the results of other researchers including Soleimani et al (2020), Vaughan et al (2016), Vecchiato et al (2011), Castillo (2010), Patrica et al (2010), McClure et al. (2004), Schaefer et al. (2006); all researches also consider the effect of interest in the subject to be effective in reducing alpha frontal brain waves (Custdio, 2011; McClure et al., 2004; Patrícia, 2010; Schaefer et al., 2006; Vecchiato et al., 2011). Also, the results of the current research are in line with the research of Masanovich (2018) regarding the relationship between people interested in sports and their attention and inclination towards sports; He also concluded that those who spend more time watching sports events during a day and are more interested in sports have a more positive attitude towards advertisements displayed through sports (Masanovic, 2018). Moreover, Dehghanpuri (2015) concluded in his research that the average alpha frequency in the group of interested athletes and non-athletes while watching sports advertisements was higher than before advertisements but there was no significant difference in the group of uninterested athletes and interested athletes (Dehghanpouri, 2014). Darabi (2018) also reached the same results as the present research and announced that the strength of alpha, beta, and theta bands increased significantly in the group that was interested in sports. It can be said that the effect of advertising is greater in people who are interested in sports than in those who are not interested (Darabi et al., 2018).

Finally, according to the results obtained from the present research, it can be said that the use of sports advertisements causes more attention than non-sports advertisements. Therefore, marketing managers are suggested to use sports scenes to advertise their products as sports advertisements are likely to be able to create more and more meaningful changes in brain activities than non-sports ones. Sports scenes can create more attention for audiences by inducing positive emotions such as happiness, usefulness, pride, hope, a sense of duty, and competitiveness. The point is that more attention to advertising increases the possibility of introducing the advertised product and brand on behalf of viewers. It ultimately increases the probability of purchase, which is the ultimate goal of

companies. It is also suggested that advertisements should be designed in such a way that the advertised brand or product is exposed to the viewer with a lot of frequency. The concept, meaning, and spelling of the brand should be easy and convenient, so that creative images with low mental involvement should be used in printed advertisements, banners, etc. Also, happy and warm colors such as red should be used in advertising design as these colors gain more staring and mental engagement. In general, it can be said that advertising through sports is a way to achieve a competitive advantage, and influencing people's beliefs brings significant benefits for organizations that supply goods and services because exercise can increase people's attention and consequently increase their memorization and recall of products. Commercial companies can introduce their products and brand to their audience through sports advertising; and also encourage people to buy and get information about their products. Therefore, sports can be used as a suitable platform for introducing products and services. The results of this research can help the marketing and sales managers of companies to introduce their products and services to society through sports to achieve a better result. Given this, the results of this research can encourage the companies' owners to invest in sports, and this leads to companies' owners investing in the sports industry, and the sports industry can reduce its dependence on the government and take steps towards improving itself. As a result, the sports federations will be able to do plan better about the teams so that they can promote the growth and excellence of the sport, generate income, and even create jobs. Moreover, the results of this research can help clubs, federations, sports organizations, and leagues in different sports areas to attract sports supporters in various ways and solve their financial problems. Generally, the results of this research can be a driving factor for using sports and its related elements more and more in the marketing and advertising of non-sports products, and as a result, enhancing investment and revenue generation in this area.

Hence, other researchers are suggested as follows:

1. Investigating and comparing the use of sports advertisements based on the display of domestic and foreign examples and its effect on the effective factors of advertising, for example, Adidas advertising against Majid Company advertising.
2. You can investigate the effect of sports advertisements with the ERP method to compare and analyze the momentary effects of seeing sports scenes.
3. Examine other advertising methods, including print ads, environmental ads, etc., in sports and non-sports modes.
4. Using other neuromarketing tools such as eye tracking, fMRI, etc., measure and compare the effective indicators of advertising success between sports and non-sports ads.
5. To examine brain reactions and responses as accurately as possible, it is suggested to examine the subject in conditions outside the laboratory environment and to evaluate the brain activities of customers using wireless caps in environments like stadiums, stores, and other places.
6. To increase the accuracy of the results, it is suggested to use several devices at the same time, for example, electroencephalography, eye tracker, and galvanic activity recording devices record brain and biological activities at the same time.

## References

- Aminiroshan, Z., Azimzadeh, S. M., Talebpour, M., & Ghoshuni, M. (2021). The Effect of Sport Events Environments on Audience Attention to Advertising Using Brain Activity. *Annals of Applied Sport Science*, 9(1), 0-0.
- Ariely, D., & Berns, G. S. (2010). Neuromarketing: the hope and hype of neuroimaging in business. *Nature reviews neuroscience*, 11(4), 284.
- Baraybar-Fernández, A., Baños-González, M., Barquero-Pérez, Ó. Goya-Esteban, R., & de-la-Morena-Gómez, A. (2017). Evaluation of Emotional Responses to Television Advertising through Neuromarketing. *Comunicar: Media Education Research Journal*, 25(52), 19-28.
- Bazzani, A., Ravaioli, S., Trieste, L., Faraguna, U., & Turchetti, G. (2020). Is EEG suitable for marketing research? A systematic review. *Frontiers in Neuroscience*, 14, 594566.
- Bellman, S., Nenycz-Thiel, M., Kennedy, R., Larginat, L., McColl, B., & Varan, D. (2017). What Makes a Television Commercial Sell? Using Biometrics to Identify Successful Ads: Demonstrating Neuromasures' Potential on 100 Mars Brand Ads with Single-Source Data. *Journal of Advertising Research*, 57(1), 53-66.
- Bennett, G., Ferreira, M., Tsuji, Y., Siders, R., & Cianfrone, B. (2006). Analysing the effects of advertising type and antecedents on attitude towards advertising in sport. *International Journal of Sports Marketing and Sponsorship*, 8(1), 56-75.
- Berger, A. M., & Davelaar, E. J. (2018). Frontal alpha oscillations and attentional control: a virtual reality neurofeedback study. *Neuroscience*, 378, 189-197.
- Bjelica, D., Popović, S., Jakšić, D., Hadžić, R., & Akpinar, S. (2014). How Does Advertising through Sport Work? Evidence from Turkey. 7th international scientific conference on kinesiology Opatija, University of Zegreb, Faculty of Kinesiology.
- Boksem, M. A., & Smidts, A. (2015). Brain responses to movie trailers predict individual preferences for movies and their population-wide commercial success. *Journal of Marketing Research*, 52(4), 482-492.
- Borawska, A., & Łatuszyńska, M. (2020). The use of neurophysiological measures in studying social advertising effectiveness. *Procedia Computer Science*, 176, 2487-2496.
- Breuer, C., Boronczyk, F., & Rumpf, C. (2021). Message personalization and real-time adaptation as next innovations in sport sponsorship management? How run-of-play and team affiliation affect viewer response. *Journal of Business Research*, 133, 309-316.
- Bruce, T., & Tini, T. (2008). Unique crisis response strategies in sports public relations: Rugby league and the case for diversion. *Public Relations Review*, 34(2), 108-115.
- Calvert, G. A., & Brammer, M. J. (2012a). Predicting consumer behavior: using novel mind-reading approaches. *IEEE pulse* (3), 38-41. <https://doi.org/10.1109/MPUL.2012.2189167>
- Calvert, G. A., & Brammer, M. J. (2012b). Predicting consumer behavior: using novel mind-reading approaches. *IEEE pulse*, 3(3), 38-41.
- Custdio, P. (2011). Use of EEG as a neuroscientific approach to advertising research Master thesis]. Faculdade de medicina, Universidade de Lisboa.
- Darabi, M., Azizian Kohan, N., Moharamzade, M., & Nobakht, F. (2018). Processing and analysis of electroencephalography signal to evaluate the effect of sport advertisement on customers. *Journal of Advanced Sport Technology*, 3(1), 15-27.
- Davidson, R. J. (2004). What does the prefrontal cortex "do" in affect: perspectives on frontal EEG asymmetry research? *Biological psychology*, 67(1-2), 219-234. <https://doi.org/10.1016/j.biopsycho.2004.03.008>
- Dehghanpouri, H. (2014). The effectiveness of sports brand advertising on electroencephalographic changes and customers purchasing decision in neuromarketing Tabriz].
- Ehrenberg, A., Barnard, N., Kennedy, R., & Bloom, H. (2002). Brand advertising as creative publicity. *Journal of Advertising Research*, 42(4), 7-18.
- Eijlers, E., Boksem, M. A., & Smidts, A. (2020). Measuring neural arousal for advertisements and its relationship with advertising success. *Frontiers in neuroscience*, 14, 736.
- Eskandari, z. H. M., Sara. (2015, 30th November). International Conference ofn Management and Humanities, UAE-Dubai.
- Esmaili, M., & Amani, G. (2018). The role of attitude towards sports advertising on perceived value and purchase intention (case study: Customers of Chabahar free zone). *Research in Sports Management and Motor Behavior*, 8(16), 125-137.
- Fischer, N. L., Peres, R., & Fiorani, M. (2018). Frontal Alpha Asymmetry and Theta Oscillations Associated With Information Sharing Intention. *Frontiers in behavioral neuroscience*, 12.
- Fortenberry, J. L., & McGoldrick, P. J. (2020). Do Billboard Advertisements Drive Customer Retention?: Expanding the "AIDA" Model to "AIDAR". *Journal of Advertising Research*, 60(2), 135-147.

- Foulsham, T., & Kingstone, A. (2017). Are fixations in static natural scenes a useful predictor of attention in the real world? *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*, 71(2), 172.
- Garczarek-Bąk, U., Szymkowiak, A., Gaczek, P., & Disterheft, A. (2021). A comparative analysis of neuromarketing methods for brand purchasing predictions among young adults. *Journal of Brand Management*, 28(2), 171-185.
- Ghaedi, A., Izadi, B., & Ghasemian, M. R. (2020). Measuring brainwaves, arousal, pleasure and decision to purchase sport service industry. *Sport Management Review*, 13(2), 639-658.
- Ghasemi Siani, M., Mohammadi, S., & Soltan Hosseini, M. (2022). The Role of Sports-Related Advertising in the Park in Brainwave Changes of People Using QEEG. *Journal of Sport Management*, 13(4), 1197-1213. <https://doi.org/10.22059/jsm.2020.299301.2430>
- Gholamian, J., Darabi, M., Mahmoudi, A., & Azizi, B. (2022). Analysis of effective drivers in the development of the sports industry using the futures research approach. *Journal of Iran Futures Studies*, 7(1), 303-325. <https://doi.org/10.30479/jfs.2022.16473.1346>
- Gijsenberg, M. J. (2014). Going for gold: Investigating the (none) sense of increased advertising around major sports events. *International Journal of Research in Marketing*, 31(1), 2-15.
- Golnar-Nik, P., Farashi, S., & Safari, M.-S. (2019). The application of EEG power for the prediction and interpretation of consumer decision-making: A neuromarketing study. *Physiology & behavior*, 207, 90-98.
- González-Morales, A. (2020). Right evaluation of marketing stimuli with neuroscience. An electroencephalography experiment. *Computers in Human Behavior Reports*, 2, 100030.
- Gordon, R., Ciorciari, J., & van Laer, T. (2018). Using EEG to examine the role of attention, working memory, emotion, and imagination in narrative transportation. *European Journal of Marketing*.
- Harmon-Jones, E., & Gable, P. A. (2018). On the role of asymmetric frontal cortical activity in approach and withdrawal motivation: An updated review of the evidence. *Psychophysiology*, 55(1), e12879.
- Harmon-Jones, E., Gable, P. A., & Peterson, C. K. (2010). The role of asymmetric frontal cortical activity in emotion-related phenomena: A review and update. *Biological psychology*, 84(3), 451-462.
- Harris, J. M., Ciorciari, J., & Gountas, J. (2019). Consumer neuroscience and digital/social media health/social cause advertisement effectiveness. *Behavioral Sciences*, 9(4), 42.
- Harrison, F. (2013). Digging deeper down into the empirical generalization of brand recall: Adding owned and earned media to paid-media touchpoints. *Journal of Advertising Research*, 53(2), 181-185.
- Herrando, C., Jiménez-Martínez, J., Martín-De Hoyos, M. J., & Constantinides, E. (2022). Emotional contagion triggered by online consumer reviews: Evidence from a neuroscience study. *Journal of Retailing and Consumer Services*, 67, 102973.
- Herrera, F., López, E., & Rodriguez, M. A. (2002). A linguistic decision model for promotion mix management solved with genetic algorithms. *Fuzzy Sets and Systems*, 131(1), 47-61.
- Isaacowitz, D. M. (2006). Motivated gaze: The view from the gazer. *Current Directions in Psychological Science*, 15(2), 68-72.
- James, J. D. (2011). Attitude toward advertising through sport: A theoretical framework. *Sport Management Review*, 14(1), 33-41. <https://doi.org/10.1016/j.smr.2009.12.002>.
- Jesulola, E., Sharpley, C. F., Bitsika, V., Agnew, L. L., & Wilson, P. (2015). Frontal alpha asymmetry as a pathway to behavioural withdrawal in depression: Research findings and issues. *Behavioural Brain Research*, 292, 56-67. <https://doi.org/10.1016/j.bbr.2015.05.058>
- Keshkar, S., Lawrence, I., Dodds, M., Morris, E., Mahoney, T., Heisey, K., . . . Santomier, J. (2019). The Role of Culture in Sports Sponsorship: an Update. *Ann Appl Sport Sci*, 7(1), 57-81.
- Kim, J. W., Magnusen, M., & Lee, H.-W. (2017). Existence of mixed emotions during consumption of a sporting event: A real-time measure approach. *Journal of Sport Management*, 31(4), 360-373.
- Kolar, T., Batagelj, Z., Omeragić, I., & Husić-Mehmedović, M. (2021). How Moment-to-Moment EEG Measures Enhance Ad Effectiveness Evaluation: Peak Emotions during Branding Moments As Key Indicators. *Journal of Advertising Research*, 61(4), 365-381.
- Kordlu, H., Elahi, A., & Khodayari, A. (2015). The cause and effect relation between beliefs, attitude toward advertising through sport and attitude toward common advertising: the results of structural equations model. *Sport Management Review*, 30, 203-224
- Kropp, F., Lavack, A. M., Holden, S. J., & Dalakas, V. (1999). Attitudes toward beer and tobacco sports sponsorships. *Sport Marketing Quarterly*, 8, 49-58. [https://doi.org/http://www.researchgate.net/publication/236273385\\_Attitudes\\_toward\\_Beer\\_and\\_Tobacco\\_Sports\\_Sponsorships](https://doi.org/http://www.researchgate.net/publication/236273385_Attitudes_toward_Beer_and_Tobacco_Sports_Sponsorships)
- Lee, E.-J., Kwon, G., Shin, H. J., Yang, S., Lee, S., & Suh, M. (2014). The spell of green: Can frontal EEG activations identify green consumers? *Journal of business ethics*, 122(3), 511-521. <https://doi.org/10.1007/s40622-015-0113-1>

- Lyberger, M. R., & McCarthy, L. (2002). An analysis of volume consumption, consumer interest and perceptions of sport sponsorship as they relate to the Super Bowl. *International Journal of Sports Marketing and Sponsorship*, 3(4), 60-78. <https://doi.org/10.1108/JSMS-03-04-2002-B006>.
- Mancini, M.; Cherubino, P.; Cartocci, G.; Martinez, A.; Di Flumeri, G.; Petruzzellis, L.; Cimini, M.; Aricò, P.; Trettel, A.; Babiloni, F. (2022). Esports and Visual Attention: Evaluating In-Game Advertising through Eye-Tracking during the Game Viewing Experience. *Brain Sci.*(12), 1345. <https://doi.org/10.3390/brainsci12101345>
- Mansor, A. A., & Isa, S. M. (2020). Fundamentals of neuromarketing: What is it all about? *Neuroscience Research Notes*, 3(4), 22-28.
- Masanovic, B. (2018). Attitudes of consumers from Autonomous Province of Vojvodina toward advertising through sport in relation with the frequency of watching sports events. *Sport Mont*, 16(3), 91-96. <https://doi.org/10.26773/smj.181016>
- McClure, S. M., Li, J., Tomlin, D., Cypert, K. S., Montague, L. M., & Montague, P. R. (2004). Neural correlates of behavioral preference for culturally familiar drinks. *Neuron*, 44(2), 379-387.
- Michael E. Smith & Alan Gevins (2004). Attention and Brain Activity While Watching Television: Components of Viewer Engagement. *Media Psychology*, 6(3), 285-305, DOI: 10.1207/s1532785xmep0603\_3
- Moon, J., Kwon, Y., Park, J., & Yoon, W. C. (2019). Detecting user attention to video segments using interval EEG features. *Expert Systems with Applications*, 115, 578-592. <https://doi.org/10.1016/j.eswa.2018.08.016>
- Morin, C. (2011). Neuromarketing: the new science of consumer behavior. *Society*, 48(2), 131-135. <https://doi.org/10.1007/s12115-010-9408-1>
- Morin, C., & Renvoisé, P. (2018). The persuasion code: How neuromarketing can help you persuade anyone, anywhere, anytime. John Wiley & Sons.
- Muratovic, A., Bjelica, D., & Popovic, S. (2014). Examining beliefs and attitudes toward advertising through sport among montenegrin consumers. *Facta Universitatis, Series: Physical Education and Sport*, 95-104. <https://doi.org/http://casopisi.junis.ni.ac.rs/index.php/FUPhysEdSport/article/view/295>
- Myers, S. D., Deitz, G. D., Huhmann, B. A., Jha, S., & Tataru, J. H. (2020). An eye-tracking study of attention to brand-identifying content and recall of taboo advertising. *Journal of Business Research*, 111, 176-186.
- Ohme, R., Reykowska, D., Wiener, D., & Choromanska, A. (2010). Application of frontal EEG asymmetry to advertising research. *Journal of Economic Psychology*, 31(5), 785-793. <https://doi.org/10.1016/j.joep.2010.03.008>
- Onișor, L.-F., & Ioniță, D. (2021). How advertising avoidance affects visual attention and memory of advertisements. *Journal of Business Economics and Management*, 22(3), 656-674.
- Orquin, J. L., & Wedel, M. (2020). Contributions to attention based marketing: Foundations, insights, and challenges. In: Elsevier.
- Patrícia, F. C., Manuel Pinho. Maria, Teresa. Carla, Cristina. (2010). Use of EEG as a Neuroscientific Approach to Advertising Research Dissertação para obtenção do Grau de Mestre em Engenharia Biomédica, Faculdade de medicina, Universidade de Lisboa].
- Pieters, R., Wedel, M., & Zhang, J. (2007). Optimal feature advertising design under competitive clutter. *Management Science*, 53(11), 1815-1828.
- Poorkarimi, J. (2002). Media Advertising and Audience Change, A Psychological Approach to Advertising. *communication research*, 1381(29). <http://ensani.ir/fa/article/35598>
- Popović, S., Jakšić, D., Matić, R., Bjelica, D., & Maksimović, N. (2015). Examining Beliefs and Attitudes toward Advertising through Sport among Serbian Consumers. *Studia sportiva*, 9(1), 225-231.
- Pyun, D. Y., & James, J. D. (2009). Enhancing advertising communications: Developing a model of beliefs about advertising through sport. *International Journal of Sport Communication*, 2(1), 1-20. <https://doi.org/10.1123/ijsc.2.1.1>
- Raiesdana, S., & Mousakhani, M. (2022). An EEG-Based Neuromarketing Approach for Analyzing the Preference of an Electric Car. *Computational Intelligence and Neuroscience*, 2022.
- Ratten, V., & Tajeddini, K. (2019). Entrepreneurship and sport business research: Synthesis and lessons: Introduction to the special journal issue. *International Journal of Sport Management and Marketing*, 19(1/2), 1-7.
- Rice, B., & Bennett, R. (1998). The relationship between brand usage and advertising tracking measurements: International findings. *Journal of Advertising Research*, 38(3), 58-66.
- Riebe, E., Wright, M., Stern, P., & Sharp, B. (2014). How to grow a brand: retain or acquire customers? *Journal of Business Research*, 67(5), 990-997.
- Romaniuk, J., & Nguyen, C. (2017). Is consumer psychology research ready for today's attention economy? *Journal of Marketing Management*, 33(11-12), 909-916.
- Rumpf, C., & Breuer, C. (2018). Focus on brand choice: assessing the behavioral response to sponsorship-linked communication. *Journal of Sport Management*, 32(6), 531-541.

- Russo, V., Ma, Q., Clement, J., Jin, J., Liu, T., & Zito, M. (2022). Neuromanagement and Neuromarketing. *Frontiers in Psychology*, 13.
- Sánchez Torres, J. A., Argila Irurita, A. M., & Rivera Gonzalez, J. A. (2021). Attitude Towards Sport Practice: What Makes an Individual Continue Practice of Sport? *Trends in Psychology*, 2021, vol. 29, num. 2, p. 341-353.
- Schaefer, M., Berens, H., Heinze, H.-J., & Rotte, M. (2006). Neural correlates of culturally familiar brands of car manufacturers. *Neuroimage*, 31(2), 861-865.
- Semerádová, T., & Weinlich, P. (2022). Emotional, Cognitive and Conative Response to Influencer Marketing. Available at SSRN 4113052.
- Shakibaei Fard, E., Jamshidian, L., & Tork Far, A. (2020). Islamic Marketing Development Model Framework in Iranian Sport. *Sport Management Studies*, 12(63), 261-280. <https://doi.org/10.22089/smrj.2020.8539.2918>
- Sharifi, M., Pool, J. K., Jalilvand, M. R., Tabaeian, R. A., & Jooybari, M. G. (2019). Forecasting of advertising effectiveness for renewable energy technologies: A neural network analysis. *Technological Forecasting and Social Change*, 143, 154-161.
- Simmonds, L., Bellman, S., Kennedy, R., Nenycz-Thiel, M., & Bogomolova, S. (2019). Moderating effects of prior brand usage on visual attention to video advertising and recall: An eye-tracking investigation. *Journal of Business Research*.
- Simons, R. F., Detenber, B. H., Cuthbert, B. N., Schwartz, D. D., & Reiss, J. E. (2003). Attention to television: Alpha power and its relationship to image motion and emotional content. *Media Psychology*, 5(3), 283-301.
- Singh, J., Goyal, G., & Gill, R. (2020). Use of neurometrics to choose optimal advertisement method for omnichannel business. *Enterprise Information Systems*, 14(2), 243-265.
- Tajeddini, K. (2011). The effects of innovativeness on effectiveness and efficiency. *Education, Business and Society: Contemporary Middle Eastern Issues*.
- Tajeddini, K., Elg, U., & Trueman, M. (2013). Efficiency and effectiveness of small retailers: The role of customer and entrepreneurial orientation. *Journal of Retailing and Consumer Services*, 20(5), 453-462.
- Tajeddini, K., & Trueman, M. (2008). Effect of customer orientation and innovativeness on business performance: a study of small-sized service retailers. *International Journal of Entrepreneurship and Small Business*, 6(2), 280-295.
- Van Diepen, R., Foxe, J. J., & Mazaheri, A. (2019). The functional role of alpha-band activity in attentional processing: The current zeitgeist and future outlook. *Current Opinion in Psychology*.
- Vasiljević, T., Bogdanović, Z., Rodić, B., Naumović, T., & Labus, A. (2019). Designing IoT infrastructure for neuromarketing research. *World Conference on Information Systems and Technologies*.
- Vaughan, K., Beal, V., & Romaniuk, J. (2016). Can Brand Users Really Remember Advertising More Than Nonusers?: Testing an Empirical Generalization Across Six Advertising Awareness Measures. *Journal of Advertising Research*, 56(3), 311-320.
- Vecchiato, G., Astolfi, L., Fallani, F. D. V., Cincotti, F., Mattia, D., Salinari, S., . . . Babiloni, F. (2010). Changes in brain activity during the observation of TV commercials by using EEG, GSR and HR measurements. *Brain Topography*, 23(2), 165-179.
- Vecchiato, G., Babiloni, F., Astolfi, L., Toppi, J., Cherubino, P., Dai, J., . . . Wei, D. (2011). Enhance of theta EEG spectral activity related to the memorization of commercial advertisements in Chinese and Italian subjects. 2011 4th International Conference on Biomedical Engineering and Informatics (BMEI).
- Vecchiato, G., Cherubino, P., Maglione, A. G., Ezquierro, M. T. H., Marinozzi, F., Bini, F., . . . Babiloni, F. (2014). How to measure cerebral correlates of emotions in marketing relevant tasks. *Cognitive Computation*, 6(4), 856-871.
- Vecchiato, G., Cherubino, P., Trettel, A., & Babiloni, F. (2013). Neuroelectrical brain imaging tools for the study of the efficacy of TV advertising stimuli and their application to neuromarketing. Springer.
- Vecchiato, G., Kong, W., Giulio Maglione, A., & Wei, D. (2012). Understanding the impact of TV commercials. *IEEE Pulse*, 3(3), 42-47. <https://doi.org/10.1109/MPUL.2012.2189171>
- Venkatraman, V., Dimoka, A., Pavlou, P. A., Vo, K., Hampton, W., Bollinger, B., . . . Winer, R. S. (2015). Predicting advertising success beyond traditional measures: New insights from neurophysiological methods and market response modeling. *Journal of Marketing Research*, 52(4), 436-452.
- Verhulst, N., De Keyser, A., Gustafsson, A., Shams, P., & Van Vaerenbergh, Y. (2019). Neuroscience in service research: an overview and discussion of its possibilities. *Journal of Service Management*.
- Verhulst, N., Vermeir, I., Slabbinck, H., Larivière, B., Mauri, M., & Russo, V. (2020). A neurophysiological exploration of the dynamic nature of emotions during the customer experience. *Journal of Retailing and Consumer Services*, 57, 102217.
- Yen, C., & Chiang, M.-C. (2021). Examining the effect of online advertisement cues on human responses using eye-tracking, EEG, and MRI. *Behavioral Brain Research*, 402, 113128.

Zorić, G., Mašanović, B., & Gardašević, J. (2018). Attitudes of Montenegrin consumers toward advertising through sport among the question of how often consumers purchase sporting goods. *Journal of Anthropology of Sport and Physical Education*, 2(1), 21-25.