Danica Radević Pavličić, MSc

Assistant
HEC Faculty of international Tourism and Hotel Management, Montenegro
E-mail: danicaradevic@gmail.com
Orcid: https://orcid.org/0009-0006-2168-3690

MINDING THE BRANDING – HOW CAN EEG HELP? A LITERATURE REVIEW ON APPLICATION OF ELECTROENCEPHALOGRAPHY IN BRANDING

Abstract

Emotion, perception, connection, affection – these are all delicate, hard to notice and often consciously undisclosed factors of influence on consumer behavior, starting from brand awareness to final call on buying the product or service, or even beyond. Having that in mind, the purpose of this paper is to explore and present current findings related to the use of neuroscience methods in branding research, more precisely, the application of electroencephalography in empirical studies conducted in this field. Considering the importance of all phases of branding process for creating a long term relationship between the brand and the consumer, it is vital to understand both cognitive and emotional reactions related to that experience. After reviewing current body of literature using PRISMA research method combined with qualitative content analysis, and presenting key findings and conclusion from articles relevant to this topic, it can be confirmed that electroencephalography is considered to be the neuromarketing method that can present this set of data in fast, non-invasive and low cost manner, which justifies the further research of its applications.

Keywords: neuroscience, neuromarketing, electroencephalography, EEG, branding

1.   INTRODUCTION

Use of neuroscience methods in marketing research process has proven to be very helpful, as it can discover how decision making process works on

subconscious level and which elements of product or service can trigger the emotion that could result with the wanted reaction (purchase, engagement, loyalty etc.). Since in branding it is all about creating a memorable identity and positive association in the mind of a consumer, most preferable technique used in this process should be the one which records attention, excitement, emotional valence and other important reactions to the marketing stimuli.

Having that in mind, this research is meant to further explore the possibilities of neuromarketing application in the process of branding, specifically the findings discovered by the use of electroencephalography. Answers should be provided for following research questions:

- Is the topic of application of EEG in branding explored enough in the current body of literature?
- What key findings of previously conducted branding research were revealed by the use of EEG alone or in combination with other research tools?
- What are the main benefits of application of EEG in branding research?
- In which phases of the branding process can the application of EEG offer useful insights?
- What were the common limitations in use of EEG in previously conducted empirical studies?
- What recommendation can be given for further application of EEG in branding research?

The goal of this research is to provide relevant insights into current knowledge that could be of use when creating and implementing branding strategies, and aiming to efficiently communicate with target groups, presenting distinctive and innovative product or service. Highlighting the key findings and both benefits and limitations of using EEG in branding, can encourage other authors to recognize the value of this neuromarketing tool in ensuring important data about consumers' subconscious cognitive reactions, and utilize it more in their future studies. Also, their research results will offer practitioners significant inputs about consumer perception and behavior in various phases of branding process, on which they can base their strategic decisions and activities.

In order to achieve the above mentioned goal, first step was use of PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analysis), which has provided an overview of academic articles available at two relevant databases - Web of Science and Scopus. Review was conducted in April 2024 based on terms "*electroencephalography*" or "*EEG*" and "*branding*" with no limitation in regards to date of publishing. Databases search has initially revealed 189 articles that included the above mentioned terms in the title and/or abstract and/or keywords. After screening and eligibility assessment according to the already established criteria (open access, published in English, topic relevance), only 31 article was identified as relevant for the research topic. Upon completing the content

analysis, 28 articles were taken into further consideration based on the use of EEG in empirical studies related to branding process or certain brand elements.

This article presents an overview of current research on the use of EEG in branding, as well as the key findings and limitations of the reviewed studies, which can be of great benefit to marketing practitioners and decision-makers. At the same time, it highlights the areas that could be further explored in order to answer other research questions that have not been addressed in the existing literature.

2.   THEORETICAL BACKGROUND

2.1.   Neuromarketing

Many psychological concepts can be effectively used in marketing theory to provide explanation for consumer behavior and various steps of decision making process, especially the ones that happen on subconscious level (Wei, Wu, Wang X., Supratak, Wang P. & Guo, 2023). Scientists agree that there are certain limitations that can be noted in traditional methods of marketing research – the participants may hold back in expressing their reaction honestly or may not be able to do so (Ariely & Berns, 2010). In addition, personal biases of each participant can be a factor of influence that cannot be easily measured by widely used methods such as interviews, focus groups, questionnaires etc., as the emotions associated with these biases can be hard to notice (Martinez-Fiestas, Viedma del Jesus, Sanchez-Fernandez & Montoro-Rios, 2015). At the same time, neuroscience can provide insights into neural and metabolic activity related to specific marketing stimuli, as a different and innovative approach when compared to traditional marketing methods (Vlasceanu, 2014). It has been emphasized on many occasions that neuromarketing methods should be used together with self-reporting tools, as it is important to record every reaction to marketing stimuli, even those that are not clear and visible, such as "*visceral, somatic and neural responses*" (Casado-Aranda, 2021, p.7).

As it is very important for marketing researchers to enter the consumers' mind and see the product through the eyes of the consumer, neuroscience can provide insight into emotions that create the image and learn how to trigger those emotions and influence the decision making (Vashishta & Balaji, 2012). According to Walvis, there are three important steps in that process which are subject of neuroscience – "*perceiving the world around us, recalling that perception from memory and acting on the memory of that perception*" (Walvis, 2008, p.178). As neuromarketing tools are meant to detect neural or metabolic activity in actual time of exposure, the participant's response can be very precisely determined and connected to proper stimuli (Casado Aranda & Fernandez, 2022).

There is wide consensus among authors that neuromarketing is still an emerging field which is yet to be explored, a promising field of research that enables predictions related to consumer behavior, especially "*the cognitive processes, reactions and selection within the context of branding and sales*"

(Kocaçınar, Inan, Zamur, Calsimsek, Akbuluk & Catal, 2024, p.1). The constant growth of interest in this field, both in research and practical use, can be explained by the role of neuromarketing methods in better understanding the consumers' needs and, in order to achieve their satisfaction, *"in designing more suitable product or service"* (Caldeira de Oliveira & de Moura Engracia Giraldi, 2019, p.1). Cherubino and colleagues claim that "*neuromarketing is an exciting promise for marketing evolution in the future and at present*", having in mind that it is not only important to identify consumers' reactions and their consequences, but also to "*define the best strategies*" based on this information (Cherubino, Martinez-Levy, Caratu, Cartocci, Di Flumeri, Modica, Rossi, Mancini & Trettel, 2019, p.5). It is also worth noting that we are living in a world that has undergone (and it is still undergoing) a serious digital transformation, while the majority of communication takes place in digital environment. Measuring user experience under these circumstances is a new necessity (Babac & Yüncü, 2022), which can also benefit from the use of neuromarketing techniques.

2.2. Brand and branding

In defining brand, key term is association – what thoughts or feelings consumer associates in his brain with a brand name (Franzen & Bouwman, 2001). Having that in mind, the process of branding is defined by Walvis as "*the activity by brand owners of associating the brand name with those pieces of information, meanings, emotions, images, intentions, etc.*" (Walvis, 2008, p.180). For a successful brand it is important to properly and reliably represent the products and services that a company has to offer, thus easily set apart from others in the eye of the consumer (Cherubino et al., 2019).

Of course, every consumer will perceive the brand in light of previous experience and the associated cognitive and emotional reactions, but a strategy for building a brand preference can be developed even in cases where the actual preference tends towards a different choice (Walvis, 2008). At the same time, if we consider brand preference as one of the key objectives of any marketing strategy (paving the way for brand loyalty and brand engagement), we need to understand every step along the way fostering brand awareness, shaping brand personality, exploring brand experience, securing adequate brand positioning, etc., as "*brands constitute one of the most remarkable cues in the product purchase decision process*" (Casado Aranda & Fernandez, 2022, p.14).

Brand familiarity is also an influencing factor in this process that should not be neglected – many authors agree that previous positive experience with now familiar brands generally leads to faster and easier purchasing decisions for different reasons:
- it takes less time and less effort to process information (Tam, 2008);
- positive experience leads to positive associations and possible brand attachment (Esch, Möll, Schmitt, Elger, Neuhaus & Weber, 2012);
- "winner takes it all" effect of familiar brand which triggers emotions that lead to a purchase (Deppe, Schwindt, Kugel, Plassmann & Kenning, 2005).

Familiarity with the brand gives consumers a sense of security as they recollect positive memories that reassure them that they can trust the brand when making another purchasing decision. It represents a certain guarantee that their expectations will be fulfilled and they will not be disappointed, which can be considered as "*the added value*" (Nakamura, Miura, Matsuda, & Taki, 2016, p.1750). Gonzales-Morales and colleagues have pointed out that this term does not refer only to the value for the company, but also to the value for the consumer, better known as brand equity (Gonzales-Morales, Mitrovic & Garcia, 2020).

Brand equity concept consists of various factors which can influence brand / consumer relationship. Kotler and Keller in their work recognize not only the product or service itself, together with all marketing elements and activities, but also "*other associations indirectly transferred to the brand*" (Kotler & Keller, 2009, p.352). That is why it can be crucial to understand how information on brand is being processed in the mind of the consumer, how it stimulates their brain, what emotional reaction it provokes and how to be present as part of their life (Martinez, 2011).

The way in which consumers process information was the subject of research conducted by Samson and Voyer, who have introduced the terms System 1 and System 2 to describe different approaches to processing information, where System 1 relies on subconscious and intuitive thinking, while System 2 is responsible for more studious and thorough thoughts as a basis for decision making (Samson & Voyer, 2012). It is considered that this model can also be applied to the process of brand selection, where subconscious thoughts and emotions can play a very significant role. Gonzales - Morales et al. also recognize the importance of the subconscious for both the cognitive and emotional aspects in each phase of the processing of brand information – from the reaction to the stimuli exposure and developing and retaining associations in their memory, to the final purchasing decision (Gonzales - Morales et al., 2020).

2.3.   Electroencephalography (EEG)

The convergence of neuroscience and marketing, which has led to the increasing popularity of neuromarketing in the last decade, can provide significant contribution to analyzing the psychology of consumers based on their attention and reactions to products (Kim J.Y. & Kim M.Y., 2023). There is a set of neuroscience techniques that marketing researchers can use in order to better understand the consumer behavior and their perception of specific brands, products or services, such as electroencephalography (EEG), facial expression analysis (FEA), functional magnetic resonance imaging (fMRI), galvanic skin response (GSR), heart rate (HR), eye-tracking (ET) and other.

Electroencephalography (EEG) was introduced in the first half of the 20th century, thanks to the experiments conducted by Hans Berger, who provided the first recorded electroencephalogram in 1925. The EEG measures and records the electrical activities of the brain and changes that are happening under specified

conditions. More precisely, "*it records the frequency of brain electrical currents and changes in their voltage*" (Casado Aranda & Fernandez, 2022, p.10). These records can provide us with brain's response to the presented marketing stimuli at the very moment of reaction (Brown, Randolph & Burkhalter 2012). According to the research conducted by Davidson et al. (1990), if relative left frontal EEG activity is greater, it is a signal of positive stimuli perception, such as happiness, while the greater relative right frontal EEG activity is a signal for negative reaction, such as disgust or the like (Davidson, Ekman, Saron, Senulis & Friesen, 1990).

The influence of the unconscious on consumer behavior is of great interest to researchers (Ramsoy, 2017), especially considering that certain empirical studies have shown that the brain's electrical responses can quite differ from the reactions displayed in self-reports. One of most frequently mentioned studies is the one by McClure and colleagues (2004), where participants in the first phase of testing (blind test) have mostly chosen Pepsi over Coke, while afterwords, given the choice, large number has expressed their preference for Coke. By the use of fMRI, a strong activity in the prefrontal cortex and the hippocampus has been recorded in the second phase of testing, pointing out higher cognitive and memory functions during that process (McClure, Tomlin, Cypert, Montague L.M. & Montague P.R, 2004).

One example where brain electrical activity can provide useful inputs for promotion strategy is a study which was exploring the influence of food sample tasting on perception of brand packaging (Nittono & Watari, 2017). In this study, the recorded cognitive processes were in favor of using food sample tasting as an action that can lead to brand familiarity and preference, rather than just reading product information from the standard package.

The fact that the EEG can be an efficient tool for measuring consumer behavior and attitudes towards various brands has also been demonstrated in other empirical studies. When investigating the reaction to the logo presentation of both familiar and unfamiliar brands, Azevedo has noted that activation in the frontal cortex was only present at the very beginning for familiar brands, as well as stronger activation in the centroparietal regions, which indicated attention and preference (Azevedo, 2010). Furthermore, an experiment conducted by Bosshard and colleagues has shown that "*liked brands reflect more motivational aspects and activity signals in the right parietal cortices than disliked brands*" (Bosshard, Bourke, Kunaharan, Koller & Walla, 2016, p.1)

From the above, it is clear that current empirical research recognizes the electrical activity of the brain and EEG records as a neuromarketing method well founded in the prediction of consumer behavior related to brand selection and preference (Garczarek-Bąk, Szymkowiak, Gaczek & Disterheft, 2021), brand experience or brand loyalty (Casado Aranda & Fernandez, 2022) – all phases of the relationship that has to be built between the consumer and the brand to ensure that the purchase decision is made not just once but on every other occasion where positive associations with the brand can be recalled from past experiences.

In their work, Cherubino et al. (2019) pointed out the business application of EEG, as well as the advantages and limit ations of using this method in marketing research, as displayed in the table below.

Table 1 Applications of EEG in marketing research by Cherubino et al. (2019)

Neuromarketing tools	What is measured?	Business application	Advantages	Limitations
Electroencephalography (EEG)	Attention, engagement, excitement, emotional valence, cognition, memory encoding, recognition, approach withdrawal, and mental workload	It is used to test advertisements, movie trailers, website design and usability, app and social media, in-store experiences, print and image design, new product, packaging design, pricing, sensory studies, outdoor advertisements, political debate, and other marketing stimuli.	High temporal resolution, relative low equipment costs, noninvasiveness, valid measure for cognitive information processing, and portability	Low spatial resolution, nonscalable, and susceptibility of the results to the influence of the moving artifacts

Having in mind all above mentioned, it can be easily understood why EEG is the second most commonly used neuroimaging tool (after fMRI), since 30% of marketing research studies base their findings on use of this technique (Sanchez-Fernandez et al., 2021). At the same time, the results of the literature review conducted by Al-Sharif and colleagues (2023) have shown that EEG was used in 37 articles related to the application of neuromaging methods in the marketing mix, which represents almost 35% of their total sample. This study further emphasize the importance of these methods, as they are "*highly significant to capture/record consumers' mental and physiological responses toward the marketing mix*" (Al-Sharif, Salleh, Abdullah, Khraiwish & Ashaari, 2023, p.16).

The frequent use of EEG in marketing research, which has been evident in recent studies, can be explained by several advantages of this technique compared to other neuroimaging tools. Namely, EEG devices are not as expensive as other, they are widely available, can be easily acquired and transferred from one location to another; they are non-invasive, which enables participants to act more naturally in every kind of testing environment; and, what is most important, they provide record of cognitive processes in timeframe measurable by milliseconds which is well corresponding to time sequences of stimuli exposure, thanks to the high temporal resolution of these devices (Bazzani, Ravaioli Trieste, Faraguna & Turchetti, 2009; Cohen, 2011; Telpaz, Webb & Levy, 2015).

3.   METHODOLOGY

For the purpose of this study, literature review was chosen to give insight into the current academic knowledge on the topic of interest, which is coherent with the main goals of this research – to provide an overview of key findings and limitations offered by the currentliterature, while, at the same time, pointing out to research gaps and areas that should be explored in the future. The benefits of a literature review for this type of study are its contribution in creating theoretical framework based on previous research results (Snyder, 2019) and in presenting foundation for further elaboration of research questions and findings (Mahrool, 2020).

After the research protocol has been determined, the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) was used to present results of screening and obtaining articles most relevant for the research topic.
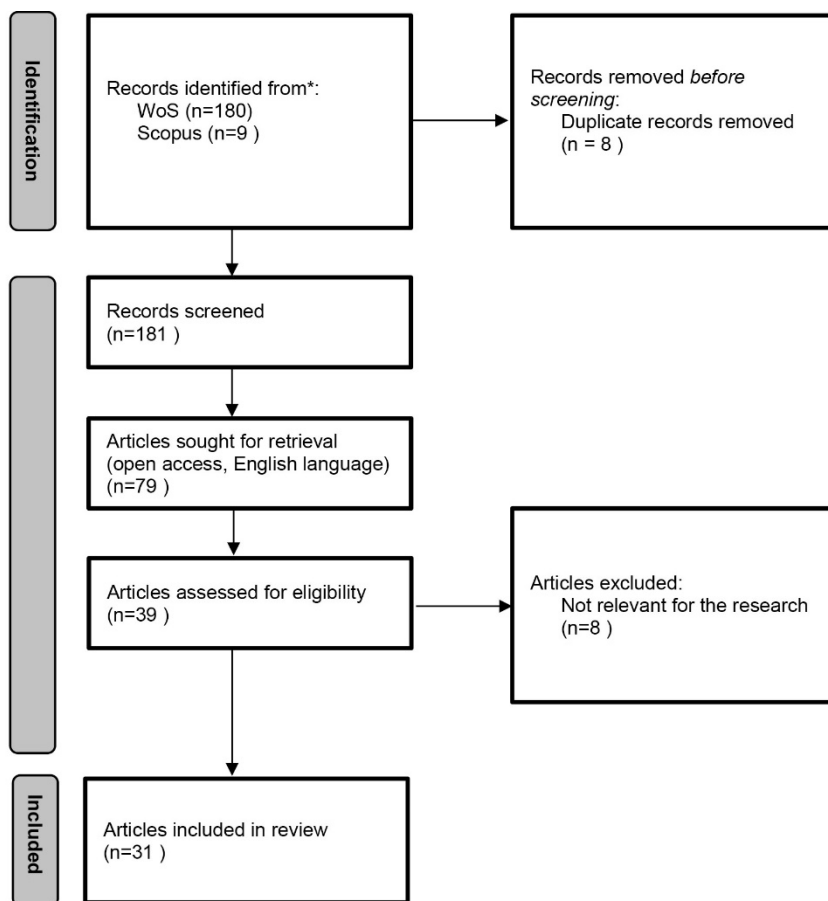

Figure 1 The article selection process presented in PRISMA flow diagram

Two (2) digital databases were used for selecting articles – Web of Science and Scopus. The search was conducted in April of 2024, using the terms "*electroencephalography*" and "*branding*" and "*EEG*" and "*branding*" contained in the title and/or abstract and/or keywords. Prior to the eligibility assessment, two (2) search filters also had to be activated for ensuring proper content analysis - "*published in English*" and "*open access*". Upon completing initial phase of this review, 31 articles have been recognized as relevant for the research topic and, according to that, included in the study as subject to full text analysis. This qualitative research technique has helped in identifying key findings about application of EEG in research related to branding and resulted with recommendations for future research areas.

It is also worth mentioning that all articles were published between 2016 and 2023 (mostly between 2018 and 2023), indicating that this field has gain importance just recently and it is still not explored enough, which is evident in the display of number of published articles presented in Figure 2 below.
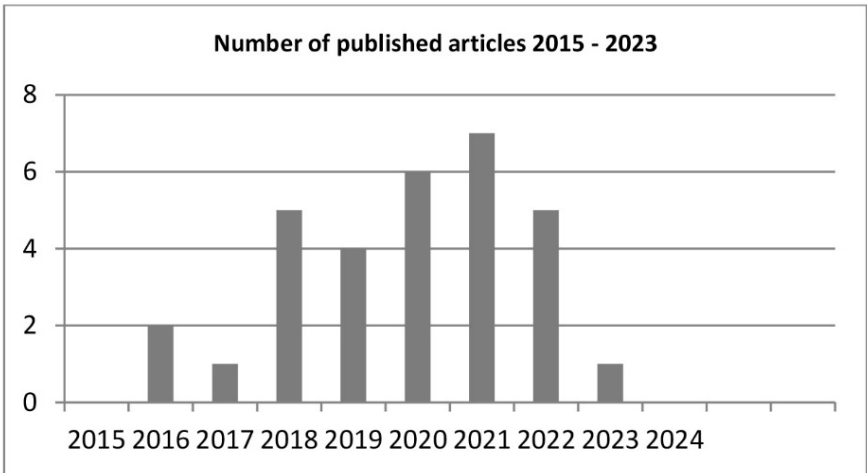

Number of published articles 2015 - 2023

Figure 2 Number of published articles in previous decade, according to Web of Science and Scopus results in April 2024

Source: Author's research

Regarding the location where most of the research related to this topic was conducted, Spain (6 articles) and China (5 articles) are leading, followed by Australia and Italy (3 articles each), and other, mostly European countries. As leading author, Shannon Boshard from University of Newcastle, Australia was most productive with 3 articles exploring brand related topics by using EEG metrics combined with different self-report forms in empirical part of her studies.

Following is presentation of number of articles by country of publishing in Figure 3, which confirms the leading positions of Spain and China.
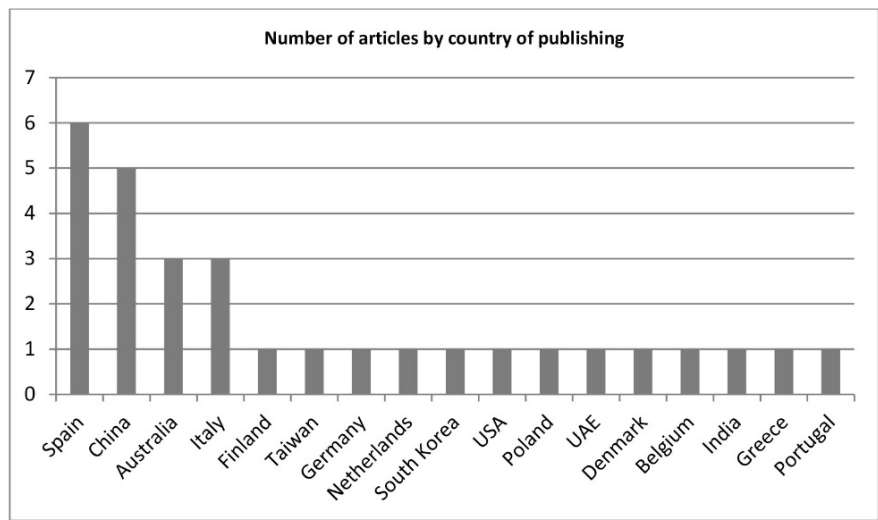
Number of articles by country of publishing

Figure 3 Number of published articles in countries where research was conducted, according to Web of Science and Scopus results in April 2024

Source: Author's research

As this literature review was conducted with a goal to identify and present relevant scientific papers on application of EEG in branding, the results that follow in table 2 show current research related to this topic.

Table 2 Results of literature review on application of EEG in branding

No	Authors	Articles	Year	Country	Research topic	Methodology / Metrics	Variables	Key findings
1	Ausin-Azofra JM, Bigne E, Ruiz C, Marín-Morales J, Guixeres J and Alcañiz M	"Do You See What I See? Effectiveness of 360-Degree vs. 2D Video Ads Using a Neuroscience Approach"	2021	Spain	Difference in reactions on interactive 360 degree videos compared to static 2D ads, in relation to brand recognition, ad engagement and emotional response	EEG, eye-tracking, electrodermal activity and facial coding	Interactivity, brand recognition, ad engagement, emotional response	- Better effect in engagement and in emotional response is identified in the use of interactive 360 ads - The use of neurophysiological tools in exploring effects of interactive ads is highly recommended
2	Ausin-Azofra JM, Bigne E, Marín J, Guixeres J and Alcañiz M	"The background music-content congruence of TV advertisements: A neurophysiological study"	2021	Spain	Emotional and cognitive brain reactions to the music in TV ads that is coherent and non coherent to the ad content	EEG, eye-tracking	Congruent music, incongruent music, visual attention, cognitive workload, ad likeability, ad recall	- When music is not coherent with ad content, processing ad, information requires higher attention and mental engagement, though it does not significantly affect the ad's appeal
3	Yang T, Lee S, Seomoon E and Kim S-P	"Characteristics of Human Brain Activity during the Evaluation of Service-to-Service Brand Extension"	2018	South Korea	Evaluation of brand extensions related to service industry	EEG	Brand name, brand extension, cognitive response	- Cognitive response is not the same when assessing brand extensions related to service comparing to ones related to goods, which suggests that marketing approach and activities should also be different in these two cases
4	Laaksonen SM, Falco A, Salminen N, Aula P and Ravaja N	"Brand as a cognitive mediator: investigating the effect of media brands as a structural feature of textual news messages"	2018	Finland	Influence of brand credibility and familiarity on processing information in news messages	EEG, facial electromyography and self reports	News messages, media brands, attention, emotional response	- Brand familiarity and credibility affect the way how news information are being processed, as credible and familiar brands attract more attention and excitement

No.	Author	Title	Year	Country	Research focus	Methods	Variables	Key findings
5	Bosshaard S, Koller M and Walla P	"Can Evaluative Conditioning Change Well-Established Attitudes Towards Popular Brands? Your Brain Says Yes Even Though Your Mouth Says No"	2019	Australia	Possibility of modification strongly developed relationships towards brands through the use of evaluative conditioning	EEG, online survey, implicit association tests	Brand name, brand attitude, sound attitude, (conditioning effect), brain response	- No significant changes in attitude were observed via the use of explicit measures - EEG may be a useful tool in measuring the impact of evaluative conditioning that is not reflected in verbal response - The outcome of evaluative conditioning may depend on brand attitude
6	Wang WY, Chang YC and Chuang SW	"EEG Spectral Dynamics of Video Commercials: Impact of the Narrative on the Branding Product Preference"	2016	Taiwan	Characteristics of video commercial content that can affect commercial and branding product preference	EEG	Ad narrative, frequency of product exposures, ad preference, brand preference	- Both narrative structure and repeated presence of product can positively result in regards of consumers preference
7	Bosshard S, Bourke JD, Kunaharan S, Koller M and Walla P	"Established liked versus disliked brands: Brain activity, implicit associations and explicit responses"	2016	Australia	Accordance between implicit testing results and explicit answers in regards to brands likeability	EEG, implicit association tests, self reports	Implicit and explicit brand attitudes	- There can be higher motivation in purchase decision making process when it is about liked brands - It is necessary to include implicit measures in research, so it can provide more extensive results
8	Moya I, Madariaga JG and Blasco MF	"What Can Neuromarketing Tell Us about Food Packaging"	2020	Spain	The use of neuromarketing metrics in research related to food packaging	EEG, GSR, eye tracking, questionnaires	Food packaging, brand attitude, purchase intention, brand preference	- The combination of neuromarketing and traditional methods can lead to more comprehensive and valid study results - Neuromarketing research can be of benefit for practitioners in food packaging design, if there is a strong theoretical structure that can confirm its validity and reliability

#	Authors	Title	Year	Country	Aim	Method	Variables	Findings
9	Bazzani A, Ravaioli S, Trieste L, Faraguna U and Turchetti G	"Is EEG Suitable for Marketing Research?"	2020	Italy	Overview of EEG applications in consumer neuroscience	Literature review	n/a	- Use of EEG has many benefits compared to other neurophysiological tools – easy to find, purchase at low cost and use regardless of the location make it convenient for various experiments that can provide useful inputs for further marketing activities
10	Gonzales-Morales A	"Right evaluation of marketing stimuli with neuroscience. An electroencephalography experiment"	2020	Spain	Use of EEG in examining emotional valence of stimuli exposure in marketing actions	EEG	Emotional valence, visual stimuli, brain activity	- There is a difference in brain activity between left and right hemisphere during the exposure to visual stimuli – which is significantly more evident in case of positive valence - Ecological EEG can be used in evaluation of marketing stimuli and their effect on purchase decision
11	Wang B, Wu M, Rau PP and Gao Q	"Influence of Native Video Advertisement Duration and Key Elements on Advertising Effectiveness in Mobile Feeds"	2020	China	Impact of certain video ad design features on its effectiveness in mobile feeds	Eye tracking, EEG, interviews, questionnaires	Ad duration, ad elements, ad effectiveness	- Short video ads in mobile feed can result in higher excitement and positive emotions, but at the same time be hard to understand and memorize - Additional textual elements can contribute to better understanding of short video ads
12	Schoen F, Lochmann M, Prell J, Herfurth K and Rampp S	"Neuronal Correlates of Product Feature Attractiveness"	2018	Germany	Evaluation of the effects of different product features on brain activity and whether MEG and EEG could potentially be used for marketing and product design	EEG, magneto encephalography	Product elements, brand logo, brain activity, brand preference	- EEG and MEG can be used in assessment of personal preference, by analyzing brain activity as a response to certain product features

No.	Author	Title	Year	Country	Aim	Method	Variables	Findings
13	Alvino L, Pavone L, Abhishta A and Robben H	"Picking Your Brains: Where and How Neuroscience Tools Can Enhance Marketing Research"	2020	Netherlands	Current findings in consumer neuroscience related to used tools and their features	Literature review	n/a	- Methodology in empirical studies in area of consumer science is mostly based on EEG and eye tracking, as these two methods are most frequently used
14	Baldo D, Viswanathan VS and Timpone R	"The heart, brain, and body of marketing: Complementary roles of neurophysiological measures in tracking emotions, memory, and ad effectiveness"	2022	USA	Association between neurophysiological measures, psychological responses and marketing outcomes	Heart rate, GSR, EEG	Emotional valence, arousal, ad recognition, ad effectiveness	- EEG, GSR and hear rate can be used in measuring ad and brand recognition and willingness to buy
15	Bosshard, S. and Walla, P.	"Sonic Influence on Initially Neutral Brands: Using EEG to Unveil the Secrets of Audio Evaluative Conditioning"	2023	Australia	Evaluative conditioning and examining the difference in use explicit and implicit measures of brand attitude	EEG and self reports	Brand name, sound, brain activity, brand attitude	- When examining consumer attitude, it is recommended to include neuroscience measures; specifically EEG in research related to the effects of evaluative conditioning
16	Wang A, Lyu D, Liu Y, Liu J, Gao L and Jin J	"Country-Brand Fit: The Effect of COO Stereotypes and Brand Positioning Consistency on Consumer Behavior: Evidence From EEG Theta-Band Oscillation"	2022	China	Consumer behavior under the influence of COO stereotypes and brand positioning	EEG	COO stereotypes (competence / warmth), brand positioning features (images, slogan), purchase intention	- Coherent perception of COO and brand position positively affect purchase intention, where competence prevails over warmth
17	Casado-Aranda LA and Sanchey – Fernandez J	"Advances in neuroscience and marketing: analyzing tool possibilities and research opportunities"	2021	Spain	Introduction to consumer neuroscience, analysis of neurophysiological tools and recommendations for their application in future marketing research	Literature review	n/a	- Neurophysiological tools can be beneficial to empirical studies in consumer neuroscience, in order to have more comprehensive and inclusive approach

#	Authors	Title	Year	Country	Focus	Methods	Variables	Findings
18	GarczarekBąk A, Szymkowiak A, Gaczek P and Disterheft A	"A comparative analysis of neuromarketing methods for brand purchasing predictions among young adults"	2021	Poland	The use of neuromarketing methods in predicting purchase behavior, influenced also by brand familiarity	Electrodermal activity, eye-tracking, EEG, self reports	Brand familiarity, emotional arousal, purchase intention	- Brand familiarity affects purchase intentions - EDA can be recommended for use in marketing research, specifically in predicting brand performance, evaluation of market potential etc.
19	Balconi M, Sebastiani R and Angioletti L	"A Neuroscientific Approach to Explore Consumers' Intentions Towards Sustainability within the Luxury Fashion Industry"	2019	Italy	The use of neuroscientific methods in exploring consumer behavior related to sustainability in high fashion	EEG, interaction	Attitude towards sustainability, brain activity	- EEG is useful tool in examining reaction to sustainability based stimuli - During the exposure to sustainability based stimuli there is greater cortical activity that does not depend on consumers attitudes towards sustainability
20	Ma Q, Wang M, Hu L, Zhang L and Hua Z	"A Novel Recurrent Neural Network to Classify EEG Signals for Customers' Decision-Making Behavior Prediction in Brand Extension Scenario"	2021	China	The use of recurrent t-SNE neural network in predicting consumer behavior related to brand extension	EEG	Brand extensions, neural reactions	- This neural network can be used as efficient and non-expensive technique for examining consumer behavior and understanding decision making process
21	Abdour A, Agiel A and Ghoudi K	"Assessing the Emotional Affordance of Brand Image and Foreign Image Based on a Physiological Method Using Examples from Dubai: Exploratory Study"	2022	UAE	Emotional responses to different architectural styles in UAE	EEG, facial electromyography and self reports	Brand image, architectural style, participants' place of living, emotional response	- Architectural style affects motivations and emotions - Physiological methods can be efficient in exploring emotional responses to different architectural styles
22	Zhang W, Jin J, Wang A, Ma Q and Yu H	"Consumers' Implicit Motivation Of Purchasing Luxury Brands: An EEG Study"	2019	China	Investigation of unstated consumers motivation for buying luxury brands	EEG, self reports	Brand prominence, motivation, brand preference, purchase intention	- Precondition for luxury brand preference and consumptions is satisfaction of social goals

23	Gupta A, Sheyram R, Garg R and Sayed T	"Correlation of Neuromarketing to Neurology"	2017	India	Application of EEG in the identification of brand preference	EEG	Brand preference, purchase intention	- EEG can be successfully used in studies that examine consumer behavior and detecting brand preference
24	Dinni H, Simonetti A, Bigne E and Bruni LE	"EEG theta and N400 responses to congruent versus incongruent brand logos"	2022	Denmark	Influence of coherency in brand logo and picture presentation on cognitive processing of brand	EEG	Brand logo, brand pictures, brain reactions	- Brands and various forms of its presentation are stored in consumers' memory, so any incoherence with subconscious knowledge can require higher cognitive engagement
25	Camarrone F and Van Hulle MM	"Measuring brand association strength with EEG: A single-trial N400 ERP study"	2019	Belgium	Use of EEG in identifying brand association	EEG and online survey	Brand image (associations), brand identity, brand relations	- N-400 responses can be used in measurement of strength of brand association and brand relations, which can be helpful in creating differentiation strategy and shape brand image to desired associations
26	Kolar T, Batagelj Z, Omeragić l and Husić-Mehmedović M	"How Moment-to-Moment EEG Measures Enhance Ad Effectiveness Evaluation – Peak Emotions during Branding Moments as Key Indicators"	2021	European region	Examining the parallel between EEG ad indicators and survey indicators from a neuroscientific perspective	EEG and questionnaires	EEG indicators, survey indicators, relations and associations within indicators and between them	- EEG can be useful in examining and improving ad effectiveness, beyond limitations typical for survey indicators - Momentary EEG indicators are even superior in the same process, comparing to traditional ones

#	Authors	Title	Year	Country	Focus	Method	Variables	Findings
27	Modica E, Cartocci G, Rossi D, Martinez Levy AC, Cherubino P, Maglione AG, Di Flumeri G, Mancini M, Montanari M, Perrotta D, Di Feo P, Vozzi A, Ronza V, Arico P and Babiloni F	"Neurophysiological Responses to Different Product Experiences"	2018	Italy	Cognitive and emotional reactions to different food products, considering influence of brand, familiarity and hedonic value	EEG	Brand, familiarity, hedonic value, cognitive processing	- Results have shown positive towards comfort food, as well as higher mental effort during the interaction with foreign food products, while there was no significant difference in reaction on major brands compared to private labels
28	Janic M, Cirovic M, Dimitriadis N, Jovanovic Dimitriadis N and Alevizou P	"Neuroscience and CSR: Using EEG for Assessing the Effectiveness of Branded Videos Related to Environmental Issues"	2022	Greece	Use of neuroscience in exploring implicit perception of CSR video communications	EEG and self reports	Brand perception, environmental campaign, brain engagement	- CSR communications are often to complex and require high processing effort, which can lead to negative associations
29	Franco S, Abreu AM, Biscaia R and Gama S	"Sports ingroup love does not make me like the sponsor's beverage but gets me buying it"	2021	Portugal	Influence of social identification on product experience and purchase intentions	EEG and questionnaires	Social identity, sensory experience, purchase intentions	- The level of social identification can affect purchase intentions, regardless the sensorial experience
30	Garcia-Madariaga J, Moya I, Recuero N and Blasco MF	"Revealing Unconscious Consumer Reactions to Advertisements That Include Visual Metaphors. A Neurophysiological Experiment"	2020	Spain	Consumer behavior related to ads with visual metaphores	EEG, GSR and eye tracking	Visual metaphors, ad attitude, emotional reactions	- Metaphors can lead to positive reaction to the advertisement - Neurophysiological tools can be applied in determining the optimal way of using visual metaphors for efficient advertisements
31	Wei Z, Wu C, Wang X, Supratak A, Wang P and Guo Y	"Using Support Vector Machine on EEG for Advertisement Impact Assessment"	2018	China	Exploring advertisement impact on consumer behavior based on SVM method	EEG	Advertisement impact, consumer behaviour	- EEG can be helpful in providing information on consumers' behavior (willingness to buy product or service) while watching the advertisement

Sources: Web of Science and Scopus, 2024

4.   DISCUSSION

The results of the literature review presented above show points of interest in various areas related to brand and branding, where EEG could be applicable as an efficient research technique in empirical part of the study. From 31 articles that were subject to content analysis, 3 articles (9, 13, 17) presented a review of current academic knowledge related to the use of neurophysiological tools in consumer neuroscience and marketing, while other 28 contained an empirical research that included the application of EEG. Among these 28 articles, in 18 of them (3,5,6,7,10,15,16,19,20,22,23,24,25,26,27,28,29,31) EEG was used as a sole method of research, or combined with different self-report techniques (questionnaires, online surveys etc.), which makes almost 65% of the total number. In general, most authors recommend the combination of neurophysiological tools and different forms of self-reports in order to achieve unbiased and reliable research results. In the remaining 10 articles (1,2,4,8,11,12,14,18,21,30), EEG was combined with other neurophysiological tools, mostly eye tracking (ET) and galvanic skin response (GSR).

Considering the topics in the above mentioned articles, it can be noted that EEG itself was the subject of research in 12 articles (3,6,9,10,12,13,16,20,23,24,27,31), where the application of only this neurophysiological tool or combination with others, in context of marketing and branding related research, was either reviewed or evaluated or demonstrated. The findings of these articles present the advantages of using EEG, where the main benefits are as follows:

1) in combination with declarative methodology, it can strengthen the research results (Moya et al., 2020);

2) the provided research results can be a useful input for creating and improving marketing strategies, while the tool itself is efficient regardless of the experiment location (Bazzani et al., 2020);

3) it is helpful in identifying the valence of consumer response and neural reaction when exposed to selected marketing stimuli (Gonzales – Morales, 2020);

4) it is useful for the evaluation of subjective product preference (Schoen, Lochmann, Prell, Herfurth & Rampp, 2018);

5) it is complementary with other research methods that are already in use in empirical studies on marketing topics, together with other neuromarketing tools (Casado Aranda et al., 2021);

6) its indicators can distinctively enhance advertising effectiveness evaluation and enhancement (Kolar, Batagelj, Omeragić & Husić-Mehmedović, 2021);

7) key points are relatively low cost, minimally-invasiveness, and portability (Bazzani et al., 2020).

As this study is aimed to identify the possibilities of using EEG in research related to brand and branding, table 3 provides an overview of various aspects of brand research where EEG can be applicable and useful.

Table 3 Phases of branding process where application of EEG can provide useful insights

BRAND	recognition	Ausin-Azofra, Bigne, Ruiz, Marín-Morales, Guixeres & Alcañiz (2021)
	extension	Yang, Lee, Seomoon & Kim (2018); Ma, Wang, Hu, Zhang & Hua (2021)
	relationship	Bosshard et al. (2019)
	preference / attitude	Wang et al. (2016); Bosshard et al. (2016); Bosshard, Bourke, Kunaharan, Koller & Walla (2023); Garczarek-Bak et al. (2021); Balconi, Sebastiani & Angioletti (2019); Zhang, Jin, Wang, Ma & Yu (2019), Gupta, Sheyram, Garg & Sayed (2019); Franco, Abreu, Biscaia & Gama (2021); Kolar et al. (2021)
	element design	Ausin-Azofra et al. (2021), Moya et al. (2020), Schoen et al. (2018), Garcia-Madariaga et al. (2020)
	positioning	Wang et al. (2022)
	image / credibility	Albdour, Agiel & Ghoudi (2022); Janic, Cirovic, Dimitriadis, Jovanovic, Dimitriadis N. & Alevizou (2022)
	influence	Laaksonen, Falco, Salminen, Aula & Ravaja (2018), Modica, Cartocci, Rossi, Martinez Levy, Cherubino, Maglione, Di Flumeri, Mancini, Montanari, Perrotta, Di Feo, Vozzi, Ronza, Arico & Babiloni (2018)

Sources: Web of Science and Scopus, 2024

Though all reviewed studies have presented significant results on the matter of using neurophysiological tools in marketing research, especially related to EEG and branding, every study had certain limitations that should be mentioned here in order to provide useful inputs for future researchers. The key limitations are as follows:

1) small number of participants (Laaksonen et al., 2018; Moya et al. 2020; Gonzales-Morales et al. 2020, Wang et al., 2020; Albdour et al., 2022, Gupta e al., 2017; Kolar et al., 2021; Modica et al. 2018; Franco et al., 2021; Garcia Madariaga et al., 2020);

2) same gender of participants (Ausin-Azofra et al., 2021; Albdour et al. 2022);

3) similarities among participants in cultural background, geographical area, age etc. (Wang et al., 2020; Zhang et al., 2019), Gupta et al., 2017; Janic et al., 2022; Garcia Madariaga et al., 2020);

4) small sample of stimuli that participants were exposed to (Ausin-Azofra et al., 2021; Yang et al., 2018; Wang et al., 2020; Modica et al., 2018; Janic et al., 2022);

5) lab experiment conditions (Laaksonen et al., 2018; Wang et al., 2022; Garcia Madariaga et al., 2020; Garczarek-Bak et al., 2021);

6) previous relationship with brand, possible preference (Ausin-Azofra et al., 2021).

5.   CONCLUSION

The aim of this literature review was to provide relevant insights into the current knowledge that could be of use when creating and implementing branding strategies aimed at communicating effectively with target groups and presenting distinctive and innovative products or services. Its intention is to highlight the main applications of EEG in branding, as well as the key findings and limitations of reviewed studies, which can be of great benefit to practitioners and decision-makers in marketing.

According to above presented results, it can be concluded that this topic is relatively new (the first articles appeared in 2016) and has not yet been sufficiently researched, taking into consideration the rather small number of articles where EEG was applied in empirical studies related to brand and branding. Nevertheless, findings of authors whose articles were reviewed suggest that there is a wide range of possible applications of EEG when exploring various phases in branding process, mostly in reference to brand preference and attitude towards brand, as well as design of certain brand elements and their role in advertisement process. It has been pointed out that EEG can "*strengthen the studies' results*" (Moya et al., 2020, p.1), "*improve marketing actions*" (Bazzani et al., 2020, p.14) and "*enhance advertising effectiveness*" (Kolar et al., 2021, p.1), while being very convenient for conducting the experiments regardless the location (Bazzani et al., 2020).

This overview is also intended to highlight the areas that could be explored in the future in order to answer other research questions that were not presented in the current body of literature. Recommendations are to expand the research on brand recognition and positioning by using EEG as a reliable tool in recording cognitive and emotional state of consumers' mind, as well as to include the areas of brand awareness, brand loyalty and brand engagement which play a significant role in strengthening the relationship with the brand and future re-purchase decisions. It is also recommended to ensure, if possible, a larger and more diverse group of participants, a greater number of stimuli to which they are exposed and experiment conditions that are as similar as possible to real life environment.

This study also has its own limitations, such as reviewing articles available in only 2 relevant databases and using "open access" as a mandatory filter. The result was a small number of available articles (31), but this was necessary for proper content analysis, so future review should include other sources as well.

6.   REFERENCES

Albdour, A., Agiel, A., & Ghoudi K. (2022). Assessing the Emotional Affordance of Brand Image and Foreign Image Based on a Physiological Method Using Examples from Dubai: Exploratory Study. *Buildings*, 12, 1650. https://doi.org/10.3390/buildings12101650

Alsharif, A. H., Salleh, N. Z. M., Abdullah, M., Khraiwish, A., & Ashaari, A. (2023). Neuromarketing Tools Used in the Marketing Mix: A Systematic Literature and Future Research Agenda. *Sage Open*, 13(1). https://doi.org/10.1177/21582440231156563

Alvino. L., Pavone, L., Abhishta, A., & Robben, H. (2020). Picking Your Brains: Where and How Neuroscience Tools Can Enhance Marketing Research. *Front. Neurosci*, 14, 577666. https://doi.org/10.3389/fnins.2020.577666

Ariely, D., Berns, G. S. (2010). Neuromarketing: the hope and hype of neuroimaging in business. *Nature Reviews Neuroscience*, 11(4), 284-292. https://doi.org/10.1038/nrn2795

Ausin-Azofra. J. M., Bigne, E., Marín, J., Guixeres, J., & Alcañiz, M. (2021). The background music-content congruence of TV advertisements: A neurophysiological study. *European research on management and business economics*, 27, 100154. https://doi.org/10.1016/j.iedeen.2021.100154

Ausin-Azofra J. M., Bigne E., Ruiz C., Marín-Morales J., Guixeres J., & Alcañiz M. (2021). Do You See What I See? Effectiveness of 360-Degree vs. 2D Video Ads Using a Neuroscience Approach. *Front. Psychol.*, 12, 612717. https://doi.org/10.3389/fpsyg.2021.612717

Babaç, E., Yüncü, H. R. (2022). Determination of user experience on food business websites using neuromarketing techniques. *Tourism & Management Studies*, 18(3). https://doi.org/10.18089/tms.2022.180304

Balconi, M., Sebastiani, R., & Angioletti, L. (2019). A Neuroscientific Approach to Explore Consumers' Intentions Towards Sustainability within the Luxury Fashion Industry. *Sustainability*, 11, 5105. https://doi.org/10.3390/su11185105

Baldo, D., Viswanathan, V. S., Timpone, R. (2022). The heart, brain, and body of marketing: Complementary roles of neurophysiological measures in tracking emotions,memory, and ad effectiveness. *Psychol Mark.*, 39, 1979-1991. https://doi.org/10.1002/mar.21697

Bazzani, A., Ravaioli, S., Trieste, L., Faraguna, U., & Turchetti, G. (2020). Is EEG Suitable for Marketing Research?. *Front. Neurosci*, 14, 594566. https://doi.org/10.3389/fnins.2020.594566

Bengtsson, M. (2016). How to plan and perform qualitative study using content analysis. *Nursing Plus Open*, 2. https://doi.org/10.1016/j.npls.2016.01.001

Bolfek, B., Jakičić, D., & Lončarić, B. (2014). Utjecaj marketinga na razvoj turističkog brenda Slavonije i Baranje. *Ekonomska misao i praksa*, 23(1), 247-276.

Bosshard, S., Bourke, J.D., Kunaharan, S., Koller, M., & Walla, P. (2016). Established liked versus disliked brands: Brain activity, implicit associations and explicit responses. *Cogent Psychology*, 3(1), 1176691. https://doi.org/10.1080/23311908.2016.1176691

Bosshard, S., Koller, M., & Walla, P. (2019). Can Evaluative Conditioning Change Well-Established Attitudes Towards Popular Brands? Your Brain Says Yes Even Though Your Mouth Says No. *MDPI Brain Sci.*, 9, 106. https://doi.org/10.3390/brainsci9050106

Bosshard, S., & Walla, P. (2023). Sonic Influence on Initially Neutral Brands: Using EEG to Unveil the Secrets of Audio Evaluative Conditioning. *Brain Sci.*, 13, 1393. https://doi.org/10.3390/brainsci13101393

Brown, C., Randolph, A. B., & Burkhalter, J. N. (2012). The Story of Taste: Using EEGs and Self-Reports to Understand Consumer Choice. *The Kennesaw Journal of Undergraduate Research*, 2(1), 5. https://doi.org/10.32727/25.2019.5

Caldeira de Oliveira, J. H., & de Moura Engracia Giraldi, J. (2019). Neuromarketing and its implications for operations management: an experiment with two brands of beer. *Gest. Prod.*, 26(3), e3512. https://doi.org/10.1590/0104-530x3512-19

Camarrone, F., & Van Hulle, M. M. (2019). Measuring brand association strength with EEG: A single-trial N400 ERP study. *PLoS ONE*, 14(6), e0217125. https://doi.org/10.1371/ journal.pone.0217125

Casado-Aranda, L. A. (2021). *Neurociencia del consumidor*. Pirámide.·ISBN: 9788436845389.

Casado-Aranda, L. A., & Fernandez, J. S. (2022). Advances in neuroscience and marketing: analyzing tool possibilities and research opportunities. *Spanish Journal of Marketing – ESIC*, 26(1), 3-22. https://doi.org/10.1108/SJME-10-2021-0196

Casado-Aranda, L. A., & Sanchey-Fernandez, J. (2021). Advances in neuroscience and marketing: analyzing tool possibilities and research opportunities. *Spanish Journal of Marketing – ESIC*, 26(1), 3-22. https://doi.org/10.1108/SJME-10-2021-0196

Cherubino , P., Martinez-Levy, A. C., Caratu, M., Cartocci, G., Di Flumeri , G., Modica, E., Rossi, D., Mancini, M., & Trettel, A. (2019). Consumer Behaviour through the Eyes of Neurophysiological Measures: State-of-the-Art and Future Trends. Computational Intelligence and Neuroscience. ID: 1976847. https://doi.org/10.1155/2019/1976847

Davidson, R. J., Ekman, P., Saron, C. D., Senulis, J. A., & Friesen, W. V. (1990). Approach-Withdrawal and Cerebral Asymmetry: Emotional Expression and Brain Physiology. *Journal of Personality and Social Psychology*, 58(2), 330-341. https://doi.org/10.1037/0022-3514.58.2.330

De Azevedo, P. C. B. S. (2010). Perception of commercial brands and the emotional and social value: A spatiotemporal EEG analysis. Instituto Superior Técnico, Universidade Técnica de Lisboa.

Deppe, M., Schwindt, W., Kugel, H., Plassmann, H., & Kenning, P. (2005). Nonlinear responses within the medial prefrontal cortex reveal when specific implicit information influences economic decision making. *Journal of Neuroimaging*, 15(2), 171-182. https://doi.org/10.1111/j.1552-6569.2005.tb00303.x

Dinni, H., Simonetti, A., Bigne, E., & Bruni, L. E. (2022). EEG theta and N400 responses to congruent versus incongruent brand logos. *Scientific Reports*, 12, 4490. https://doi.org/10.1038/s41598-022-08363-1

Dropulić, B., Krupka, Z., & Vlašić, G. (2022). Brand equity in a digital age: A systematic literature review. *Ekonomska misao i praksa*, 31(1), 277-302. https://doi.org/10.17818/EMIP/2022/1.13

Esch, F. R., Möll, T., Schmitt, B., Elger, C. E., Neuhaus, C., & Weber, B. (2012). Brands on the Brain: Do Consumers Use Declarative Information or Experienced Emotions to Evaluate Brands?. *Journal of Consumer Psychology*, 22(1), 75-85. https://doi.org/10.1016/j.jcps.2010.08.004

Franco, S., Abreu, A. M., Biscaia, R., & Gama, S. (2021). Sports ingroup love does not make me like the sponsor's beverage but gets me buying it. *PLoS ONE*, 16(7), e0254940. https://doi.org/10.1371/journal.pone.0254940

Franzen, G., & Bouwman, M. (2001). *The Mental World of Brands: Mind, Memory and Brand Success*. Oxfordshire World Advertising Research Centre.

García-Madariaga, J., Moya, I., Recuero, N., & Blasco, M.F. (2020). Revealing Unconscious Consumer Reactions to Advertisements That Include Visual Metaphors. A Neurophysiological Experiment. *Front. Psychol.*, 11, 760. https://doi.org/10.3389/fpsyg.2020.00760

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, 171-185. https://doi.org/10.1057/s41262-020-00221-7

Gonzales-Morales, A. (2020). Right evaluation of marketing stimuli with neuroscience. An electroencephalography experiment. *Computers in Human Behavior Reports*, 2, 100030. https://doi.org/10.1016/j.chbr.2020.100030

Gonzales-Morales, A., Mitrovic, J., & Garcia, R. C. (2020). Ecological consumer neuroscience for competitive advantage and business or organizational differentiation. *European Research on Management and Business Economics*, 26, 174-180. https://doi.org/10.1016/j.iedeen.2020.05.001

Gupta, A., Sheyram, R., Garg, R., & Sayed, T. (2017). Correlation of Neuromarketing to Neurology. *IOP Conf. Series: Materials Science and Engineering*, 225, 012129. https://doi.org/10.1088/1757-899X/225/1/012129

Janic, M., Cirovic, M., Dimitriadis, N., Jovanovic, N., & Alevizou, P. (2022). Neuroscience and CSR: Using EEG for Assessing the Effectiveness of Branded Videos Related to Environmental Issues. *Sustainability*, 14, 1347. https://doi.org/10.3390/su14031347

Jukić, D. (2023). Beyond brand image: a neuromarketing perspective. *Communication Today*, 14(1). https://doi.org/10.34135/communicationtoday.2023.Vol.14.No.1.2

Kim, J. Y., & Kim, M. J. (2023). Identifying customer preferences through the eye-tracking in travel websites focusing on neuromarketing. *Journal of Asian Architecture and Building Engineering*. https://doi.org/10.1080/13467581.2023.2244566

Kocaçınar, B., Inan, P., Zamur, E. N., Calsimsek, B., Akbuluk, F. T., & Catal, C. (2024). NeuroBioSense: A multidimensional dataset for neuromarketing analysis. *Data in Brief*, 53, 110235. https://doi.org/10.1016/j.dib.2024.110235

Kolar, T., Batagelj, Z., Omeragić, I., & Husić-Mehmedović, M. (2021). How Moment-to-Moment EEG Measures Enhance Ad Effectiveness Evaluation. *Journal of Advertising Research*, 61(4), 365-381. https://doi.org/10.2501/JAR-2021-014

Kotler, P., & Keller, K. L. (2009). *Marketing management*. Upper Saddle River: Pearson Prentice Hall.

Laaksonen, S. M, Falco, A., Salminen, N., Aula, P., & Ravaja, N. (2018). Brand as a cognitive mediator: investigating the effect of media brands as a structural feature of textual news messages. *Journal of Product & Brand Management*, 28(1), 1-14. https://doi.org/10.1108/JPBM-01-2017-1394

Ma, Q., Wang, M., Hu, L., Zhang, L., & Hua, Z. (2021). A Novel Recurrent Neural Network to Classify EEG Signals for Customers' Decision-Making Behavior Prediction in Brand Extension Scenario. *Front. Hum. Neurosci.*, 15, 610890. https://doi.org/10.3389/fnhum.2021.610890

Mahrool, F. (2020). *Research Methodology: A guide for a literature review*. GRIN Verlag Munich.

Martinez, P. (2011). *The consumer mind: Brand perception and the implication for marketers*. London: Kogan Page.

Martinez-Fiestas, M., Isabel Viedma del Jesus, M., Sanchez-Fernandez, J., & Montoro-Rios, F. (2015). A psychophysiological approach for measuring response to messaging: how consumers emotionally process green advertising. *Journal of Advertising Research*, 55(2), 192. https://doi.org/10.2501/JAR-55-2-192-205

McClure, S. M., Li, J., Tomlin, D., Cypert, K. S., Montague, L. M., & Montague, P. R. (2004). Neural correlates of behavioural preference for culturally familiar drinks. *Neuron*, 44(2), 379-387. https://doi.org/10.1016/j.neuron.2004.09.019

Modica, E., Cartocci, G., Rossi, D., Martinez Levy, A. C., Cherubino, P., Maglione, A. G., Di Flumeri, G., Mancini, M., Montanari, M., Perrotta, D., Di Feo, P., Vozzi, A., Ronza, V., Arico, P., & Babiloni, F. (2018). Neurophysiological Responses to Different Product Experiences. *Hindawi Computational Intelligence and Neuroscience*. ID 9616301. https://doi.org/10.1155/2018/9616301

Moya, I., Madariaga, J. G., & Blasco, M. F. (2020). What Can Neuromarketing Tell Us about Food Packaging. *MDPI Foods*, 9, 1856. https://doi.org/10.3390/foods9121856

Nakamura, R., Miura, H., Matsuda, N., & Taki, H. (2016). Analysis of the cerebral blood flow affected by brand impressions of the products. *Procedia Computer Science*, 96, 1748-1755. https://doi.org/10.1016/j.procs.2016.08.223

Nittono, H., & Wattari, K. (2017). Effects of food sampling on brain – potential responses to food branding. *Psychologia*, 60, 3-15. https://doi.org/10.2117/psysoc.2017.3

Ramsøy, T. Z., Jacobsen, C., Friis-Olivarius, M., Bagdziunaite, D., & Skov, M. (2017). Predictive Value of Body Posture and Pupil Dilation in Assessing Consumer Preference and Choice. *Journal of Neuroscience, Psychology, and Economics*, 10(2/3), 95-110. https://doi.org/10.1037/npe0000073

Samson, A., & Voyer, B. G. (2012). Two minds, three ways: dual system and dual process models in consumer psychology. *Ams Review*, 2(2-4), 48-71. https://doi.org/10.1007/s13162-012-0030-9

Sanchez-Fernandez, J., Casado-Aranda, L. A., & Bastidas-Manzano, A. B. (2021). Consumer neuroscience techniques in advertising research: a bibliometric citation analysis. *Sustainability, Multidisciplinary Digital Publishing Institute*, 13(3), 1589. https://doi.org/10.3390/su13031589

Schaefer, M., & Rotte, M. (2007). Favorite brands as cultural objects modulate reward circuit. *NeuroReport*, 18(2), 141-145. https://doi.org/10.1097/WNR.0b013e328010ac84

Schoen, F., Lochmann, M., Prell, J., Herfurth, K., & Rampp, S. (2018). Neuronal Correlates of Product Feature Attractiveness. *Front. Behav. Neurosci.*, 12, 147. https://doi.org/10.3389/fnbeh.2018.00147

Snyder, H. (2019). Literature review as a research methodology: overview and guidelines. *Journal of Business Research*, 104. https://doi.org/10.1016/j.jbusres.2019.07.039

Tam, J. L. (2008). Brand familiarity: Its efects on satisfaction evaluations. *Journal of Services Marketing*, 22(1), 3-12. https://doi.org/10.1108/08876040810851914

Telpaz, A., Webb, R., & Levy, D. J. (2015). Using EEG to Predict Consumers' Future Choices. *Journal of Marketing Research*, 52(4), 511-529. https://doi.org/10.1509/jmr.13.0564

Vashishta, D. S., & Balaji, B. (2012). Social cognitive neuroscience, marketing persuasion and customer relations. *Procedia: Social and Behavioral Sciences*, 65, 1033-1039. https://doi.org/10.1016/j.sbspro.2012.11.238

Vlasceanu, S. (2014). Neuromarketing and evaluation of cognitive and emotional responses of consumers to marketing stimuli. *Procedia – Social and Behavioral Sciences*, 127, 753-757. https://doi.org/10.1016/j.sbspro.2014.03.349

Walvis, H. T. (2008). Three laws of branding: Neuroscientific foundations of effective brand building. *Brand Management*, 16(3), 176-194. https://doi.org/10.1057/palgrave.bm.2550139

Wang, A., Lyu, D., Liu, Y., Liu, J., Gao, L., & Jin, J. (2022). Country-Brand Fit: The Effect of COO Stereotypes and Brand Positioning Consistency on Consumer Behavior: Evidence From EEG Theta-Band Oscillation. *Frontiers Research Foundation*. ID: 2667944692. https://doi.org/10.3389/fnins.2022.901123

Wang, B., Wu, M., Rau, P. P., & Gao, Q. (2020). Influence of Native Video Advertisement Duration and Key Elements on Advertising Effectiveness in Mobile Feeds. *Hindawi Mobile Information Systems*. ID: 8836195. https://doi.org/10.1155/2020/8836195

Wang, W. Y., Chang, Y. C., & Chuang, S. W. (2016). EEG Spectral Dynamics of Video Commercials: Impact of the Narrative on the Branding Product Preference. *Scientific Reports*, 6, 36487. https://doi.org/10.1038/srep36487

Wei, Z., Wu, C., Wang, X., Supratak, A., Wang, P., & Guo. Y. (2018). Using Support Vector Machine on EEG for Advertisement Impact Assessment. *Front. Neurosci.*, 12, 76. https://doi.org/10.3389/fnins.2018.00076

Wei, Q., Lv, D., Fu, S., Zhu, D., Zheng, M., Chen, S., & Zhen, S. (2023). The Influence of Tourist Attraction Type on Product Price Perception and Neural Mechanism in Tourism Consumption: An ERP Study. *Psychology Research and Behavior Management*, 16, 3787-3803. https://doi.org/10.2147/PRBM.S416821

Yang, T., Lee, S., Seomoon, E., & Kim, S. P. (2018). Characteristics of Human Brain Activity during the Evaluation of Service-to-Service Brand Extension. *Front. Hum. Neurosci.*, 12(44). https://doi.org/10.3389/fnhum.2018.00044

Zhang, W., Jin, J., Wang, A., Ma, Q., & Yu, H. (2019). Consumers' Implicit Motivation Of Purchasing Luxury Brands: An EEG Study. *Psychology Research and Behavior Management*, 12, 913-929. https://doi.org/10.2147/PRBM.S215751

Mr. sc. Danica Radević Pavličić

Asistentica
HEC Fakultet za internacionalni menadžment u turizmu i hotelijerstvu, Crna Gora
E-mail: danicaradevic@gmail.com
Orcid: https://orcid.org/0009-0006-2168-3690

MINDING THE BRANDING – KAKO EEG MOŽE POMOĆI? PREGLED LITERATURE O PRIMJENI ELEKTROENCEFALOGRAFIJE U BRENDIRANJU

Sažetak

Emocija, percepcija, povezanost, naklonost – sve su to osjetljivi, teško uočljivi i često svjesno neotkriveni čimbenici utjecaja na ponašanje potrošača, počevši od svijesti o brendu do konačnog poziva na kupnju proizvoda ili usluge, pa čak i šire. Imajući to u vidu, svrha je ovog rada istražiti i prikazati aktualna saznanja vezana uz korištenje neuroznanstvenim metodama u istraživanju brendiranja, točnije, primjenu elektroencefalografije u empirijskim istraživanjima koja se provode u ovom području.S obzirom na važnost svih faza procesa brendiranja za stvaranje dugotrajnog odnosa između brenda i potrošača, važno je razumjeti i kognitivne i emocionalne reakcije povezane s tim iskustvom. Nakon pregleda postojeće literature, koristeći se PRISMA metodom u kombinaciji s kvalitativnom analizom sadržaja te prezentiranjem ključnih nalaza i zaključaka iz članaka relevantnih za ovu temu, može se potvrditi da se elektroencefalografija smatra neuromarketinškom metodom koja može dati i prikazati ove podatke na brz, neinvazivan i pristupačan način, što opravdava daljnja istraživanja njezine primjene.

***Ključne riječi:** neuroznanost, neuromarketing, elektroencefalografija, EEG, brendiranje.*

JEL klasifikacija: D87, D91, M31, M37.