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# THE ROLE OF ATTENTION AND EMOTIONS IN NEUROMARKETING – A SYSTEMATIC LITERATURE REVIEW AND FUTURE RESEARCH AGENDA

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**Purpose:** Emotions and attention can have a significant impact on consumer behavior. Therefore, the purpose of this work is to review the existing literature in the context of neuromarketing.

**Methodology:** The systematic literature review mapped the important topics in the analysis. The bibliographic coupling method was used to cluster these thematic areas.

**Conclusion:** The work contributes in the theoretical dimension to deepen the literature, and in a practical aspect to provide marketers and practitioners with an overview of practices.

**Originality/value:** The work yields value because it is the first literature review in this area, making it the only one to provide a comprehensive overview of the current body of knowledge in the domain.

**Keywords**

Neuromarketing, Attention, Emotion, Bibliographic coupling, Systematic literature review

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List of Abbreviations

ad……*Advertisement*

AIDA……*Attention, Interest, Desire, Action*

BPM……*Beats per minute*

EDA……*Electrodermal Activity*

EEG……*Electroencephalography*

ERP……*Event-related potentials*

ET……*Eye Tracking*

fEMG……*Facial Electromyography*

fMRI……*Functional Resonance Imaging*

fNIRS……*Functional near-infrared spectroscopy*

GSR……*Galvanic Skin Response*

HR……*Heart Rate*

IAT……*Implicit Association Tests*

LPP……*Late positive potentials*

MEG……*Magnetoencephalography*

PET……*Positron Emission Tomography*

PSW……*Positive slow waves*

TMS……*Transcranial Magnetic Stimulation*

# 1 Introduction

In an ever-changing, increasingly competitive environment, consumer behavior, among other things, is changing significantly, and marketers must embrace and adapt to these changes to survive sustainably in the market (Schiffman et al. 2013). Therefore, it is essential to understand consumer behavior comprehensively to adjust one's marketing activities accordingly. However, within this changing environment, new technologies and opportunities are also emerging that can be leveraged to the advantage of organizations to adjust to evolving consumer behavior patterns. In this sense, neuromarketing has become an increasingly important and relevant tool for marketing industries since it first emerged. Neuromarketing is an interdisciplinary field that combines the disciplines of economics, psychology, and neuroscience to gain a more comprehensive understanding of consumer behavior (Fisher et al. 2010).

Traditional research methods, such as surveys or focus groups, can only measure and analyze the conscious level of consumers, as these techniques depend entirely on the respondent's capacity and motivation to provide correct information about their opinions (Grover and Vriens 2006). For this reason, neuromarketing tools are becoming more and more prevalent, as they can analyze unconscious consumer behavior by measuring psychophysiological reactions. Those psychophysiological reactions are evoked when consumers are exposed to stimuli since those elicit metrics such as emotions and attention (González-Mena et al. 2022). As emotions and attention can influence consumers' purchasing decisions, those attributes are essential to marketers (Guerreiro et al. 2015). Previous systematic reviews focused on the current status of neuromarketing, its tools, and its methodology (Espinoza Mina and Gallegos Barzola 2018; Duque-Hurtado et al. 2020). However, the importance of attention and emotions in marketing is inevitable. In this perspective, the present work maps the primary research at the intersection of neuromarketing and emotions and

attention. The primary lines of research are identified through bibliographic coupling. In the course of that, research gaps and topics for future research are suggested.

## 2 Methodology

While various kinds of systematic literature reviews exist, they all aim to give a comprehensive overview of the research of the selected topic, identify critical research gaps based on those findings, and provide an outlook on future research fields (Paul and Criado 2020; Littell et al. 2008). As Littell et al. (2008, 27) stated, "A systematic review aims to comprehensively locate and synthesize research that bears on a particular question, using organized, transparent, and replicable procedures at each step in the process." In this paper, the method of bibliographic coupling was used. (Paul and Criado 2020). Two publications are bibliographic coupled if a third publication is cited by both publications (Kessler 1963). It follows that the more citations two articles have in common, the more substantial the bibliographic relationship. Thus, the two articles' content is highly likely similar (Zupic and Čater 2015). This results in the emergence of different clusters, which can be subdivided according to subject areas. A systematic overview of the hotspots of scientific articles in this area can be derived from this. In contrast to the co-citation method, bibliographic coupling does not show which works are the most important based on the number of citations. However, the bibliographic coupling can also include new publications that have not yet been cited. While the co-citation method is reliable and highlights the most important publications in a field based on citations, new papers and publications in general that have not been cited much are not included in the analysis (Zupic and Čater 2015).

To conduct bibliographic coupling, the software of VOSviewer (Version 1.6.18) was used to visualize and provide a graphical analysis of the clusters of the bibliographic coupling network (Mas-Tur et al. 2020). Van Eck and Waltmann (2010) created VOSviewer to construct and view bibliometric maps.

A three-step process was followed to generate the database, as illustrated in Figure 1 (Aguinis et al. 2020). The keyword “neuromarketing" was searched for in the two large databases, namely Web of Science and Scopus in the first step.

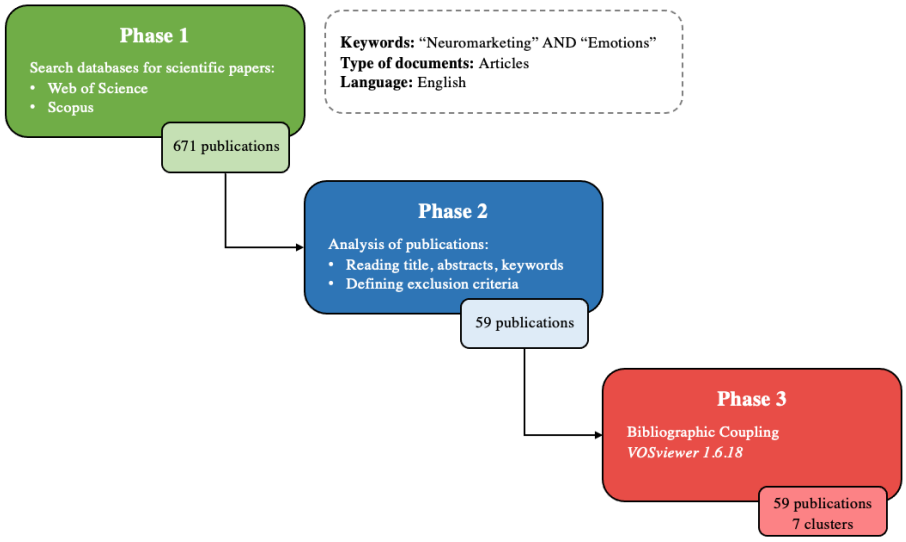


*Figure 1 - Structure of Systematic Literature Review Approach*

Due to the addition of reference handling capabilities and the fact that these two are the primary sources for citation data, Web of Science and Scopus were employed as databases (Ellegaard and Wallin 2015; Mongeon and Paul-Hus 2016). This yielded 671 results. The keyword “emotions" was added to break these down further, resulting in 203 articles. In the second step, the titles, abstracts, and keywords plus were read to decide which articles were relevant. For papers that were not clear, the introduction and conclusion, or in some cases the full text, were also read. Exclusion criteria were that the search was limited to peer-reviewed journal articles written in English. Books, book chapters, conference proceedings, editorials, and other non-refereed publications were omitted. Furthermore, repetitive articles and articles where it was not possible to obtain the original text were excluded. Lastly, articles that did not include emotions, attention, neuromarketing, or neuromarketing techniques and methods were excluded. In the third step, these 59 articles were exported to VOSviewer and divided into seven clusters, as seen in Figure 2. Since there are technical limitations to the software

VOSviewer, publications from Scopus were manually added to Web of Science and exported from there into VOSviewer.

# 3 Results

## *3.1 Descriptive Analysis*

The 59 papers in the analysis were published in 52 different journals. Most of the papers were published in the "Frontiers in Psychology" journal (4), followed by "Frontiers in Neuroscience" with three publications (Appendix I.II). Looking at the distribution of publications over the years (Appendix I.I), it is apparent that there has been a significant increase since 2017, with six papers published in 2017 compared to one paper in 2016. In 2020, the highest number of papers was published (14), suggesting that the topic of attention and emotions in a neuromarketing context is becoming more appealing, leading to more publications.

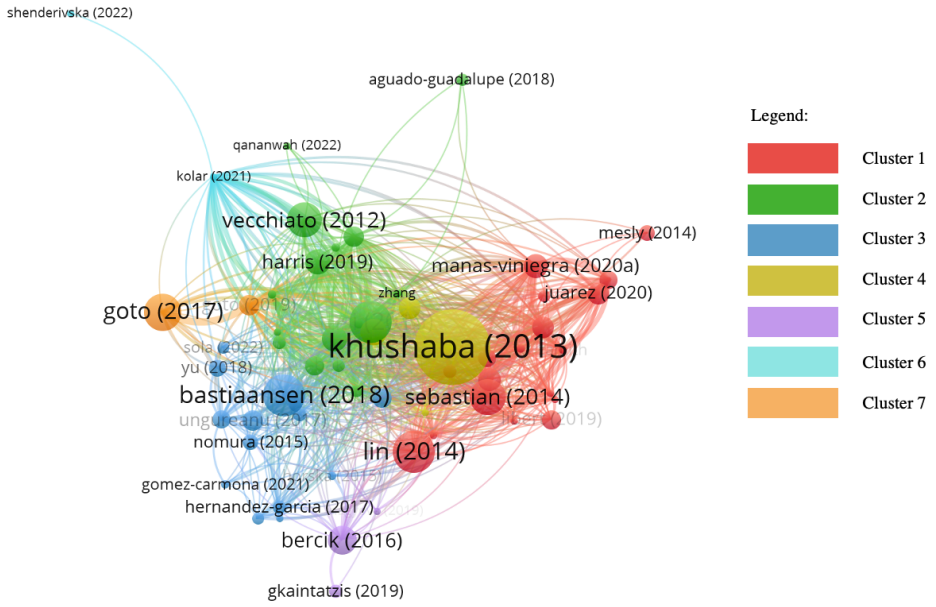


*Figure 2 - Final Cluster Output*

## *3.2 Analysis of Bibliographic Coupling*

### *3.2.1 Cluster 1 – Neuromarketing Tools to Improve Emotions and Attention (n = 18)*

18 papers contribute evidence to the inherent need to implement neuromarketing tools to measure emotions and attention effectively compared to traditional methods since those can

uncover consumers' unconscious needs and wants. Some papers focus on the practical application of neuromarketing tools in various studies to measure attention and emotion. Other papers center on the theoretical application. In doing so, they give clear indications to marketers, practitioners, and management on how to implement neuromarketing tools.

Bercik and Paluchova (2017) uncover that traditional research forms in the Slovak market are questionnaire surveys, individual/ focus group interviews, panels, and mystery shopping/ observation. They emphasize that those traditional methods regarding consumer behavioral patterns are insufficient and that neuromarketing tools can uncover consumers' subconsciousness. Therefore, innovative research forms in laboratory conditions are elaborated, separating those in (1) Emotional attention of respondents in testing various stimuli, where the level of attention is measured using various methods. (2) Respondents' emotions in the testing of different stimuli, where detailed information about emotion is measured and changes are monitored. (3) Respondents' visual attention during the research of various stimuli, meaning final graphic maps of respondents' visual attention, which could be heat maps, fixation points, and clusters. Sebastian (2014) presents that neuromarketing tools are the foundation for understanding consumer behavior and thus improve marketing. He discusses the technologies introduced in the literature so far. On the one hand, technologies that measure brain wave activity, such as Electroencephalography (EEG), Transcranial Magnetic Stimulation (TMS), Magnetoencephalography (MEG), Functional Resonance Imaging (fMRI), and Positron Emission Tomography (PET). On the other hand, Sebastian (2014) discusses biometric tools, such as eye tracking (ET) and Implicit Association Tests (IAT). Gani et al. (2018) explore the challenges and prospects of neuromarketing tools in Bangladesh. They argue that Bangladesh has a huge market potential due to its giant population and that implementing new innovative research methods compared to traditional ones would thus benefit companies. They also consider challenges, such as high costs of neuromarketing tools, lack of awareness of those tools among marketers, absence of education, or skepticism and misconception among

consumers, that those tools will be harmful to their brain activities. As a result, marketers must be familiarized with those devices. Additionally, the government should inform customers in this regard to overcome misconceptions. Filipovic et al. (2019) focus on the application of Artificial Intelligence to measure emotions. Respondents and the company play a crucial role to ensure the best results. The company provides the advertising material in the application, and the respondents actively evaluate the content through a survey. The application considers the emotional reactions of the respondents and records them. This application can be beneficial for companies to measure better and analyze the emotions of consumers. Lin et al. (2014) examined how much information is needed to classify emotions using EEG. Thus, the results show that whole-head EEG results are enough, while the EEG results used in real contexts, including significantly fewer electrodes, are insufficient. However, in this case, the music modality played a complementary role, which improved the EEG classification of emotions.

Gonzalez-Mena et al. (2022) prove, using neuromarketing tools, that in the dynamic website design, more engagement, attention, and emotions were measured compared to the static website design. These results imply that it would not have been possible to measure attention and emotions as accurately with conventional methods and that it would therefore not have been possible to design the website as efficiently as it could to guarantee the best possible user experience and thus also to steer the success of the company. Hsu and Chen (2019) also apply neuromarketing tools to explore wine tasting from a neuromarketing perspective. Specifically, they use EEG to measure brainwave activity while exposing subjects to music while tasting different kinds of wine. Results of the study showed a significant association between musical stimulus genre and participant change in wine selection, which gives clear indications for marketing strategies of wine sales by applying priming effects of music before consumers arrive at the point of sale. Juarez and Mengual's (2020) study aims to measure emotions and attention of parents, to identify the cognitive perception related to educational toys. Different elements of the packaging are measured to give management indications for

improvement. Results show that graphic elements attract more attention. Also, educational factors and a lower price opt for the product. Kral'ovičová (2019) focuses on neuromarketing in children. An essential finding is the strong influence of emotions on children's purchase decisions. Children make their decisions almost exclusively for emotional reasons and strongly influence their parents' buying behavior, thus impacting a large proportion of consumers. Practitioners need to include this variable. Libert and Hulle (2019) prove that using neuromarketing tools makes it possible to determine whether a consumer will skip an ad prematurely. User engagement, valence, and arousal were measured within the study using EEG. This finding indicates practical implementations, as this technology can modify advertising, so consumers skip it as late as possible. Using neuromarketing tools in the context of a social media study, Manas-Viniegra et al. (2020) demonstrate that young people focus significantly more attention and emotion on the nude body than on the brand, and thus give implications to global brands that they must pay attention to how influencers they promote, handle body image photographic. In Manas-Viniegra et al. (2020), it is shown that recordings of drones evoke higher emotions and attention in the audience than conventional recordings. This is an important finding because drone footage is often much less expensive and can film from angles that conventional camera work does not capture. Scenes shot with drones also activate more emotion than they elicit attention in consumers, as these shots capture spectaculars at a wider angle, and attention is more distributed.

Another study by Manas-Viniegra et al. (2020) also applied neuromarketing tools to assess the extent to which young people perceive new flat logos compared to conventional 3D logos by measuring fixation and arousal. The results show that young people have adopted the flat logos used in the digital context of companies compared to conventional logos. In their study, Mengual-Recuerda et al. (2020) managed to create a significantly improved menu for a Michelin Star restaurant by analyzing different menu variables using neuromarketing tools to determine where weaknesses related to guests' emotions and attention could be identified. Since

it is essential to excite the user in the haute cuisine culture as well as in other luxury areas, these findings and methods can also be very promising in other industries. Mesly's (2014) paper focuses on the hypothalamus as the core cerebral structure that leads to predatory financial behavior. He emphasizes the value of neuromarketing tools in delving deeper into consciousness and understanding various unconscious processes. In their paper, Nunez-Gomez et al. (2020) highlight the importance of integrating minorities into society. Therefore, the paper focuses on the extent to which advertising is perceived by neurotypical consumers and consumers with Asperger's Syndrome and the extent to which it is thus effective. The study's finding shows that with the use of neuromarketing tools, attention and emotion are perceived very differently between these two groups. While neurotypical consumers are captivated by more complex stories, Asperger's consumers have difficulty following lengthy progressions and lose interest. Yang (2018) shows that neuromarketing can also be used effectively in healthcare. Using neuromarketing tools, she studies how smokers can be most effectively targeted to quit through message framing. She uses EEG to replace self-reports and shows that smokers display greater attention to positively framed messages, while non-smokers demonstrate greater attention to negatively framed messages. Zamith et al. (2021) present that when measuring attention, it can be derived which form of advertising is perceived best in the digital press. Results show that non-intrusively integrating branded content achieves the best results, while advertisements (ad) identified as branded content received less attention.

In summary, all the papers in the cluster contribute evidence that leveraging neuromarketing can detect emotions and attention and that their use enables marketers to improve outcomes effectively.

### *3.2.2 Cluster 2 – Neuromarketing Technologies (n = 16)*

In this cluster, the authors cover neuromarketing technologies that are available to date for market research. The different tools are discussed in detail. Furthermore, the authors in this

cluster consider the challenges and limitations of these tools and various studies which examine the applicability of the tools.

In their paper, Sung et al. (2019) provide an overview of various neuromarketing tools, their functionalities, and their limitations. First, a distinction is made between somatic, central, and involuntary autonomic nervous system measures. For somatic nervous system measures, facial expression analysis is used to replace self-reports and thus obtain more reliable results about consumers' emotions. The technology is limited, however, because it recognizes more significant emotional facial expressions more clearly than the less obvious ones. Therefore, a much-used alternative is facial electromyography (fEMG), which precisely measures facial movements, even those invisible to humans. Limitations are the costs of the technology and unnecessary movements of the subjects, which can lead to distortions of the results. Eye movement analysis uses infrared light diodes to measure eye behavior. Fixation is one of the main points analyzed, as it can be associated with memory and attention. Using ET, voluntary and involuntary attention can be measured and analyzed in real time. In addition, measuring pupillometric movements can be used to analyze the extent to which a stimulus evokes arousal, as the size of the pupils reflects the extent to which a consumer processes information. The low cost and the ability to process a large amount of information are a big asset of this technology.

Central nervous system analysis includes fMRI. It is a widely used method where neural activity is measured to see which parts of the brain react most actively to a stimulus to predict attention, decision-making, and purchasing behavior. However, the biggest barriers to using fMRI are the high cost and the medical context in which they are applied, making it difficult to imitate a real-life context. Functional near-infrared spectroscopy (fNIRS) is a method that measures brain activity while monitoring changes to detect attention and decision-making. Mobile fNIRS devices allow the analysis and measurement of experiments in real-life settings. However, it has its drawbacks, such as low spatial resolution. The last method listed for central nervous measures is EEG. It measures neurons' electrical activity to reflect neuronal activity in

the brain area. Subjects are equipped with a cap with electrodes that measure such activity. Disadvantages of this technology are small sample sizes that restrict the generalizability of EEG, and blinks and muscle contractions can distort the recording.

In the area of involuntary nervous system measures, the technology of electrodermal activity (EDA) measures the responses of the autonomic nervous system, as they are involved with emotional responses. EDA is associated with significant increases in psychological arousal when subjects are exposed to emotional stimuli. It can distinguish between emotional and non-emotional stimuli and is therefore more helpful than self-reports. However, it is limited in that it measures both, pleasure and arousal and thus cannot distinguish between them. Heart Rate (HR) is measured using an electrocardiogram, which records the heart's electrical activity. HR measures the valence of emotions, such as arousal, approach, and withdrawal. In addition, decelerated heart rate is an indication of increased attention. Sung et al. (2019) also address the challenges of neuromarketing in their paper. Firstly, small sample sizes decrease reliability. Therefore, the authors propose the application of meta-analyses to enhance statistical power. A second challenge is inference. This can be tackled by incorporating multiple techniques to address the drawbacks of reverse inferences. Additionally, costs play a significant role in using neuromarketing tools, as not only are the machines costly, but access to them is limited, and personnel must be well-trained. As a solution, co-working systems are proposed. Lastly, the authors address the ethics issue since the loss of privacy over brain data is a significant matter. Zhang et al. (2022) discuss various neuromarketing tools and their restrictions as well. In addition to Sung et al. (2019), the method of IAT is presented. IAT is a computer-based test that measures subjects' spontaneous responses to stimuli. Thus, IAT provides a significant link between reaction time and emotion and can detect associations with memory when subjects react quickly. IAT has the advantage of being very inexpensive. However, limitations are that the test is subject to salience asymmetries, and familiarities may distort the accurate interpretation of the results. Zhang et al. (2022) also discuss various limitations and solutions

of neuromarketing tools. First, general aspects of the use of neuromarketing tools are considered. While some tools show a high temporal resolution, they have a low spatial resolution or vice versa. This leads, on the one hand, to the fact that researchers cannot detect changes in deeper brain areas or, on the other hand, to the fact that the real-time responses of the consumers cannot be recorded because of a delay. One solution is to use different tools together or in combination with traditional research methods. Another problem is that these experiments are primarily conducted in the laboratory and thus cannot truly replicate a real-life experience. Therefore, it must be ensured that the experiments are designed more naturally so that results are more representative. Furthermore, in many neuromarketing studies, only psychophysiological changes are measured. However, more theory-driven studies must build on broad explanatory frameworks. In addition, the authors note that there are few high-quality neuromarketing papers on which researchers can build. It is, therefore, crucial that more articles on neuromarketing methodology will be published in high-ranked journals.

McInnes et al. (2022) give a deeper insight into EEG technology and show how attentional and emotional processes can be identified. Event-related potentials (ERPs) identify stimuli most likely to capture a person's attention. Of interest in this context is the P200 component, which has been related to the rapid automatic use of attention resources on various stimuli. The P200 component is amplified when negative aspects are noted by the consumer so that it can be useful for packaging design from a management point of view. A decrease in alpha-band power is associated with the activation of attentional processes. Thus, the spectral content of the EEG signal may also indicate attentional processes. The P200 component also plays a role in emotional processes, as it is modulated by the emotional content of a stimulus. Furthermore, late positive potentials (LPPs) can be an indicator of emotional processing: a higher LPP amplitude for positive and negative stimuli compared to neutral stimuli. However, this also makes it infeasible to differentiate which emotions are evoked. For this purpose, analyses of the prefrontal cortex asymmetry are used. While the left hemisphere shows

increased activity during positive emotions, the right hemisphere shows increased activity during negative emotions. The calculation of the difference between these asymmetries is not only helpful concerning emotions but also in motivation to approach or avoid a stimulus. Thus, the EEG analysis is also relevant for measuring consumer preferences. In their paper, Calvert et al. Feld (2020) propose a new technology: the IMPULSE moment-by-moment test. IMPULSE is a test that measures consumers' cognitive and affective responses to audiovisual content. It can be analyzed whether the subject is congruent with the displayed content. Further, it can detect positive or negative emotions and more complex ones, such as amusement, confidence, and satisfaction. The authors emphasize the advantages compared to self-reports since complex emotions can be analyzed, which are not necessarily determined or indicated in the self-reports. In addition, advantages over psychophysiological tests are that they can be performed online and not in a laboratory, saving time and costs.

While the various neuromarketing tools, their benefits, and their imitations have been presented, Stasi (2018) addresses the relevance of applying these tools in real-life contexts. He argues that consumer decisions depend on countless factors that cannot all be imitated in the laboratory. For example, the fMRI method is insufficient since the consumer lies in a tube and gets images displayed, which cannot be compared to the reaction when someone stands in front of a shelf in a supermarket. Therefore, the focus should be on mobile neuromarketing tools. For this purpose, EEG, ET, skin conductance, and face reading technology are promising. The methods could be combined and used simultaneously to enable researchers to examine processes in real-life. Baldo et al. (2022) address how combining different neuromarketing tools can effectively predict how consumers respond to different types of audiovisual advertising. They conclude that (1) skin conductance is not an effective tool for ad effectiveness and prediction of emotional valence. (2) On the other hand, HR was found to predict valences for all stimuli. (3) No correlation was found between frontal alpha asymmetry and emotional valence. (4) It can be shown that frontal alpha asymmetry, combined with HR, is a significant

predictor of emotional valence. When combined in one model, these indicators' complementary nature led to a more accurate estimate of the effectiveness of ads. Garczarek et al. (2021) discuss which neuromarketing tools are most effective in predicting consumer behavior based on TV advertising. The first finding is that EEG is not a technology that can predict behavior. Although prefrontal cortex asymmetry can capture approach-withdrawal motivation, this is not significant enough. On the other hand, EDA shows predictive power, as emotional arousal is a clear indicator of product and brand preference. ET can also measure the level of interest in a product by the time the eyes stay at a certain point. However, this is less significant than EDA. Combining multiple methods to achieve an accurate result is most beneficial. Marketing communications should be created to increase emotional stimulation connected with the brand because emotional arousal is a strong predictor of product choice. Higher emotional arousal ads are easier to remember and receive more favorable evaluations. Aguado-Guadalupe and Garcia-Garcia (2018) show metrics and methods that should be used in inbound marketing to achieve more efficient results. On the one hand, they discuss behavioral metrics such as social mention, SWB Social, and more. On the other hand, neuromarketing companies that perform various analyses in this context are referred to. For example, Sociograph is a company that uses EDA to measure a particular stimulus's attention and impact. De-Frutos-Arranz and Lopez (2022) conclude that tools are important in neuromarketing in tourism. In practice, mainly ET and EEG are used by marketers. But also, the application for more futuristic tools in the industry is considered, including nanotechnologies to monitor emotions, and augmented and virtual reality.

The following papers address a specific use case of the neuromarketing tools described above and to what extent they can achieve the marketing goal. In their paper, Qananwah et al. (2022) use EEG to analyze consumers' responses to test video clips. The study’s implications show that EEG can be used to determine which parts of a video are interesting for consumers in terms of attention, so these can be improved. Vecchiato et al. (2012) analyze the impact of TV advertising on consumers in terms of attention and memory, using EEG and fMRI. They

demonstrated that, as described above, the asymmetry in the prefrontal cortex can be associated with negative and positive emotions. The study proves this by measuring more intense emotions, i.e., more peaks in EEG cortical spectral activity, during TV commercials than during documentaries. Another finding is that cortical spectral patterns showed different activities in consumers than in non-consumers. This can be important for marketers to target specific audiences. Since an increase in spectral EEG activity in the theta band is strictly correlated with an increase in the likelihood of remembering a TV commercial, it is possible to extract information on the memorization of a TV commercial from brain activity.

Martinez-Levy et al. (2022) use neuromarketing tools to increase the effectiveness of non-profit advertisements. EEG recording, blood volume pulse, galvanic skin response (GSR), ET, and visual attention are used to measure and analyze cognitive and emotional responses. Results show that advertising was effectively increased, resulting in a growth in donations. The study thus demonstrates not only that the implementation of neuromarketing tools increases the effectiveness of advertising but also that the approach of many different tools in combination is effective. The study by Harris et al. (2019) shows that using EEG (1) reveals which emotions are important in the context of public health and social cause advertisements and (2) that psychophysiological means can measure emotions more effectively than self-reports. Specifically, the study shows that action-based ads are more effective than rational ones. EEG results showed that attention was an important factor in ad effectiveness. In addition, the inclusion of faces showed an increase in attention. Levrini et al. (2019) address that music can lead to stronger brand recall. Using psychophysiological technologies, it was found that emotional music increased consumers' emotional response in terms of intensity and valence. Balconi et al. (2022) show that using negative emotions in the context of COVID-19 can be effective in consumer behavior. The fNIRS method is applied in this study to show to what extent emotions and motivation change when the consumer is exposed to such stimuli. An important finding of the study is that advertisements must balance negative and positive

emotions to effectively influence consumer behavior. In their paper, Moya et al. (2020) analyze the neuromarketing methodologies and techniques used in food packaging. They measure the extent to which consumers perceive various products differently. However, no significant differences were found. It was also tested whether the same results were obtained in two studies using the same method and metric. This was also not the case, as the same brain performs different processes, influenced by many factors. Neuromarketing results should therefore be treated with caution. Problems that arise are the experimental design's complexity, the stimuli's nature, and how other method-induced variables impact the results. Therefore, the authors propose using a multi-method approach to strengthen the results.

In conclusion, adopting a multi-method approach involving many different neuromarketing tools is necessary to provide consistent and reliable results. Furthermore, it will be important to use mobile versions of the technologies to perform the test environment in a realistic scenario. Therefore, the most promising methods are EEG, skin conductance, and ET, while methods such as fMRI and MEG will continue to take a further step back due to their cost and the fact that they must be performed in the laboratory.

### *3.2.3 Cluster 3 – Influence of Audio, Visual, and Audiovisual Stimuli (n = 14)*

The papers in this cluster contribute to the need to analyze the influence of audio, visual, and audiovisual content on consumer emotions and attention.

Bastiaansen's (2018) paper addresses whether it is effective to associate positive emotions with a destination, measuring emotional ERP components. Two participant groups watched either a positive movie about destination 1 or a negative one about destination 2. Results show that the P200 and LPP components are higher for more positive images. Thus, results support that a positive representation of a place has a positive emotional response to images of that destination in brain activity. Because this was not seen in the control group and ERP responses were measured fast after stimulus presentation, there is a clear indication that

these responses were subconscious and emotional, as conscious responses typically take longer to be recorded by the EEG. Horska and Galova (2016) prove in their study that there is a measurable emotional impact on consumers' visual merchandising experience when stimulated by music in the store. The study results show that the highest level of excitement is measured with Slovakian music, while the lowest values were measured in a sales environment without music. It also shows that consumers are positively influenced emotionally within a few seconds.

Nomura and Mitsukura (2015) extend the research in this field by analyzing, using EEG, whether there are differences in TV commercials when subjects watch favorably or unfavorably ads. One interesting finding is the measurement of long-term effects, where respondents remembered more ads they favored, concluding that favorable impressions are anchored in the long term. This is important for marketers since advertisements target consumers' long-term memory. Russo et al. (2021) analyze to what extent consumers are subconsciously influenced by the information on a product in their decision and their willingness to pay. The study uses ET to measure the participants' attention to certain packaging details. An interesting finding is a measurable difference between genders: Women focus more on detailed information such as brand and brand name than men. Šola et al. (2022) prove to what extent ET and facial expression analysis can improve the advertising of social media pages. Subjects are exposed to the visual stimulus of a Facebook page. It was found that colors influence consumers' emotions. In addition, facial expression analysis has shown that the intensity of negative feelings can be lowered with pictures of human faces. Ungureanu et al. (2017) create a methodology that uses low-cost technologies and open-source software to effectively measure emotions and attention in a marketing context. The authors conclude that the combination of ET and GSR is the most reliable in the context of cost. The only significant criticisms are the calibration process and potential user movement during testing. Martinez-Herrador et al. (2020) test in their paper the Sociograph method, which measures simultaneous and time-synchronized EDA changes of individuals in group settings. Precisely, in this context, the emotions and attention of subjects

are measured while they are exposed to visual stimuli, in this case, erotic audiovisual stimuli. Using the analysis, the study was able to break down at which points in the video a product placement would make the most sense. In addition, similar to Russo et al. (2021), a gender difference was found in attention.

Kleinlein et al. (2019) focus on the extent to which individuals' attention to short movies can be predicted using EDA technology. The films were divided into segments depending on the increasing or decreasing attention of the subjects. Results show that audio alone can predict subjects' responses. The authors also reiterate that EDA is an increasingly popular tool for measuring subjects' emotions and attention to audiovisual content, as it is not only straightforward but also inexpensive. Hernandez-Garcia et al. (2017) explore whether it is possible to predict EDA responses of a group using the Sociograph while subjects are exposed to an audiovisual stimulus. Results show that brightness, color, variations in the shot, and composition, among other visual elements, impact autonomic and subconscious emotional and attentional responses. Although previous studies have shown a correlation between visual descriptors and other subjective information, it is a fundamental finding that EDA, as a psychophysiological response, measures emotional and attentional activation, thus avoiding conscious responses and opinions of subjects.

Gomez-Carmona et al. (2021) are the first in this cluster to use fMRI to measure the impact of visual stimuli on consumer emotion and attention. They specifically analyze the process that occurs in a consumer's brain before consuming a dish at a restaurant. Results show that different brain regions are activated depending on whether a dish is considered pleasant or not. Results clearly indicate to marketers how they should design their menus more effectively to trigger subconscious consumer behavior. Yu et al. (2018) investigate whether the event of winning or losing can affect the brand's perception. Subjects play an online game in which one group consistently loses and another wins. The results of this study's ERP analysis show that winning and losing elicit different incidental emotions, which favor the brand displayed. Ma et

al. (2018), similar to Yu et al.(2018), address the extent to which consumers, in a win or lose situation, are influenced by their emotions. In this case, ERPs are also being measured to capture the unconscious consumer behavior. Results of the study show that consumers are willing to pay more for a product when they are in a constant win situation. Thus, emotions play a significant role in price perception.

Finally, the following papers in this cluster discuss methods and cost-effective tools focusing on measuring consumers' emotions and attention to audiovisual content. Gill and Singh (2022) criticize some missing points in the current state of neuromarketing research in their paper. Points such as small sample sizes, lack of multi-linguistic features, and high costs using neuromarketing tools. As a result, the authors propose the following framework: (1) Create mechanisms for ensuring complete awareness and knowledge of the study through explicit explanations of the objectives, advantages, and risks of the experiment, (2) techniques for obtaining participant agreement, (3) privacy protection strategies, particularly for unintentional attacks, (4) strategies to protect vulnerable groups from neuromarketing experiments and (5) data reporting, collection, analysis, and interpretation system. Alsharif et al. (2021) provide an overview of neuromarketing over the past five years, focusing strongly on the use of neuromarketing tools. They conclude that EEG, ET, and GSR are the most widely used tools. Furthermore, the paper concludes that the top players in the field are the USA, Spain, Italy, the UK, and Germany.

In summary, there is a strong influence of audiovisual stimuli on consumer emotions and attention. This can also be measured and thus managed with the help of neuromarketing tools, often in combination with traditional methods. The most widely used neuromarketing tools in this context are EDA and EEG, with the conclusion that they are effective in measurement and while also being cost effective.

### *3.2.4 Cluster 4 – Emotions and Attention in the Decision-making Process (n = 4)*

The papers in this cluster deal with the extent to which and how consumers can be influenced in their decision-making process, with attention and emotions playing a decisive role. Different processes in brain areas play a key role in this context. On the one hand, the papers in the cluster address the general process steps and evaluate traditional mechanisms. On the other hand, examples are used to show how decision processes are influenced in studies.

Montazeribarforoushi et al. (2017) discuss the AIDA (attention, interest, desire, action) model, used extensively by marketers to provide a holistic overview of the communication process with prospective target markets. However, the authors conclude that this model is outdated and does not include many factors that are relevant in today's world. Since the AIDA model is based on overly simplistic assumptions, it is crucial to develop more complex models based on neuroscientific findings in the future. Two systems operate side by side, one involving the subconscious and the other the conscious parts of the brain in response to a stimulus. This results in four fundamental components of attention, perception, and psychophysics from a neuroscientific point of view: Bottom-up/Saliency Filters, Top-down Control, Competitive Visual Selection, and the Working Memory. Tichindelean et al. (2018) conducted interviews with international neuromarketing experts and concluded that neuromarketing is most relevant to the consumer goods industry. In the service industry, it is most relevant for the banking industry. Another interesting finding of the paper is that emotions are mainly analyzed using GSR, face coding, or a combination of both. At the same time, ET is most used to measure attention in practice. Furthermore, a combination of traditional and neuromarketing tools is most promising when measuring attention, emotion, pleasure, and visibility. These insights are helpful to analyze the decision-making process of consumers better to influence it in practice effectively. Turning to how decision-making processes can be implemented in practice, the results of the study by Hsu and Chen (2020) are particularly relevant. In their paper, they address the extent to which subliminal messages in the form of emojis can influence consumer

behavior, in this case specifically related to the hotel industry. In doing so, the study shows that promotional videos, including emojis, lead to changes in beta and theta bands, ultimately showing a change in consumer behavior. This proves that consumers are receptive to subconscious information and can thus be influenced by such usage. Khushaba et al. (2013) also show in their paper, using EEG and ET, that consumer preferences and, thus a decision path can be measured. Using EEG measurements not only can different cortical activities be measured, but it can also be determined what specifically is preferred by consumers.

It can be concluded that emotions and attention unconsciously have a strong influence on the decision-making process.

### *3.2.5 Cluster 5 – Impact of External Influences on Emotion and Attention (n = 3)*

The authors in this cluster consider the extent to which external influences impact consumers' attention and emotions. The previous papers focused on the individual product, but these papers take a broader view and include external influences.

In their paper, Bercik et al. (2016) analyze the impact of environmental stimuli, in this case, different lighting influences on consumer behavior. As visual perception is one of the most important elements of consumer perception, it is strongly influenced by the lighting of products. The paper measures emotions with the help of EEG and ET. It concludes that the right setting makes it possible to elicit a positive emotional reaction in the customer and thus positively affect consumer behavior. Gkaintatzis et al. (2019) analyze the influence of background music as an external influence. They use EEG technology in combination with questionnaires to analyze how different beats per minute (BPM) of music affect consumer attention. Results show that the tempo of the BPM can influence consumer behavior in a positive way. Attention is expected to become decreased, and stress is expected to increase as the BPM of the music increases. Nagyova et al. (2019) measure the extent to which two advertisements recorded in completely different contexts, countries, and thus environments are

perceived emotionally by consumers. While ad 1 was produced in Slovakia aiming at making Slovaks more tolerant towards people of other cultures, ad 2 focused on South Africa to support young talented artists. Results after using ET and face reader show that ad 1 was more successful in influencing the message and consumer emotions. Ad 2 resulted in negative valency and was rated as unsympathetic. In addition, a difference was found in consumers' conscious and subconscious responses. While consciously fear and anger were not indicated, these emotions were subconsciously measured in a percentage of respondents.

In summary, environmental influences have an impact on consumer behavior and should not be neglected. These external stimuli must be measured using neuromarketing tools and applied in the respective marketing context to achieve an effective result and differentiate from the competition.

### *3.2.6 Cluster 6 – Traditional and Neuromarketing Research Methods (n = 2)*

The two papers in this cluster cover the extent to which traditional research methods correlate with neuromarketing methods. They elaborate on the competitive and complementary nature of the two research methods.

In their paper, Shenderivska et al. (2022) use a real-world example to show how traditional methods are less effective in website design than neuromarketing technologies prove to be. They compare the websites of different logistics companies in Ukraine, showing that the websites need improvement in most cases. ET results show that consumers place a high level of attention on faces, and thus more websites should show employee profiles to increase emotions and consumer attention. In their paper, Kolar et al. (2021) focus more on the theoretical comparison of neuromarketing tools (EEG) and traditional research (survey measures). The results show that neuromarketing tools measure emotions differently than traditional surveys. Emotions can be displayed on different levels. On the first level are the background emotions, followed by discrete emotions, and then the secondary emotions.

Different tools can capture these different levels of emotions. Therefore, the authors emphasize the importance of using neuromarketing tools and traditional research methods in a complementary and not competitive way to achieve the best results. It is of great importance to capture the different levels of emotions of the consumers.

Overall, using neuromarketing tools and traditional research methods in a complementary way yields the best results. Marketers should include but rather focus on the combination of both tools. Furthermore, it is important in this context to know what exactly is to be measured. Different methods measure different things.

### *3.2.7 Cluster 7 – Second-to-Second Consumer Behavior (n = 2)*

The two papers in the cluster address the extent to which certain ERPs can predict consumer behavior.

In their paper, Goto et al. (2017) analyze whether and which ERPs can predict consumer behavior. The ERPs N200, LPP, and positive slow waves (PSW) were modulated in their research, revealing that subsequent ERP measurements vary according to consumer preference and thus can predict consumer preferences. It is also concluded that there is a multistage process of evaluating motivational consumer goods, similar to processes of motivated attention: The first step is the early attention process, which rapidly directs attention to the preferred goods. Subsequently, the conscious identification of the stimulus engages. Finally, the perceptual resources are temporally engaged to initiate the elaborative decision process. Goto et al. (2019) analyze the predictive power of individual ERPs in more detail and conclude that later ERPs, i.e., LPP and PSW, have stronger predictive power than earlier ERPs such as N200. The study also explores the extent to which EEG analysis of single-item neural activity has more predictive power than that of group items. Previous literature has only focused on the analysis of group items. Results show that the predictive power of single-item ERPs was 70.8%, significantly higher than the random probability. However, this predictive power varies for

different time windows. While it is higher for later time windows, lower rates are measured for the frontal N200 ERPs. Furthermore, the framework mentioned in Goto et al. (2017) is applied to the ERPs: in the first step, early ERPs, such as N200, reflect a quick pre-attentive orientation of attention toward preferred goods. In the subsequent step, LPPs reflect the conscious identification of preferred products. In the last step, PSWs reflect the facilitation of "more elaborative cognitive processes." (Goto et al. (2019, 9)

In summary, ERPs can predict consumer behavior. Later ERPs have higher predictive power than earlier ones. Thus, LPP and PSW are more powerful than N200.

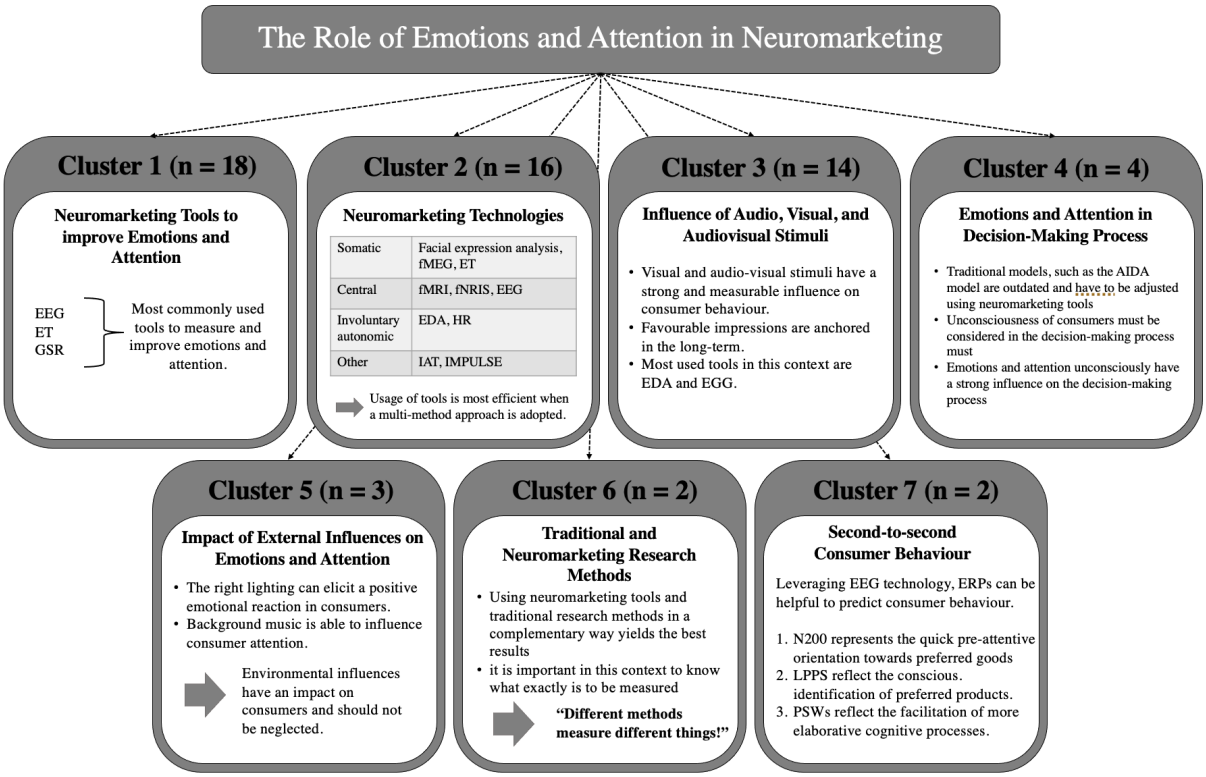


*Figure 3 – Overview Findings Cluster Analysis*

## 4 Conclusion, Future Research Agenda, and Limitations

This work sought to identify the importance of emotions and attention in neuromarketing. The relevance of the publications within every cluster from the bibliographic coupling shows that the literature comprehended the significance of using neuromarketing to detect emotions and attention to understand unconscious consumer behavior and which tools to use (clusters 1-3). The papers in the clusters indicate that EEG, EDA, and ET are the most

widely used devices in practice. They have advantages in that they are significantly less expensive than others, do not necessarily have to be performed in laboratories, and thus can better simulate real conditions. However, apart from this, as described in clusters 4-7, other factors will also have to be included, such as the external environment, the predictive power of emotions and attention, and the influence of emotions and attention on the consumer decision-making process.

In a theoretical and methodological sense, the current work contributes to a comprehensive overview of the research of emotions and attention in neuromarketing using the systematic literature approach. This provided an overview of the current research status, as well as uncovered gaps and provided a future research outlook, as can be seen in Appendix II.II. To name a few, almost all studies use relatively small sample sizes, which are not necessarily representative of the entire population. This issue also results from the fact that neuromarketing tools are relatively expensive to use, such as fMRI. Therefore, another research gap emerges in finding technologies and methods that make the use of neuromarketing tools more cost-effective and thus accessible. Another important point is that there are significant differences in emotions and attention in response to stimuli in different groups of people. For example, gender differences have been detected in some cases, as well as differences in neuronal-normal and non-normal groups. However, few studies exist in this area and could be further elaborated. In a practical sense, the paper contributes to marketers and managers by showing which neuromarketing tools are relevant, inexpensive, and thus ultimately most effective for measuring specific metrics. It also demonstrates which external influences and stimuli can be included in the marketing process that can be leveraged by neuromarketing to best impact consumers' emotions and attention.

The work is distinct from earlier systematic reviews as it is the first one to focus on attention and emotions in neuromarketing. The use of just two databases is a constraint that might have been avoided by including pertinent research studies.

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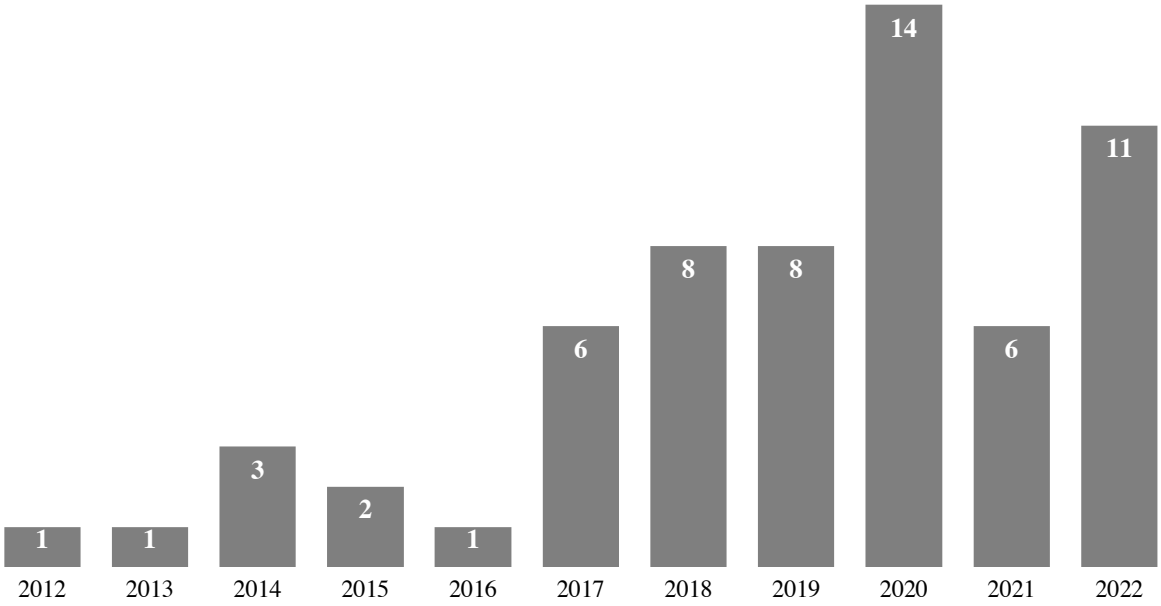
List of Annexes

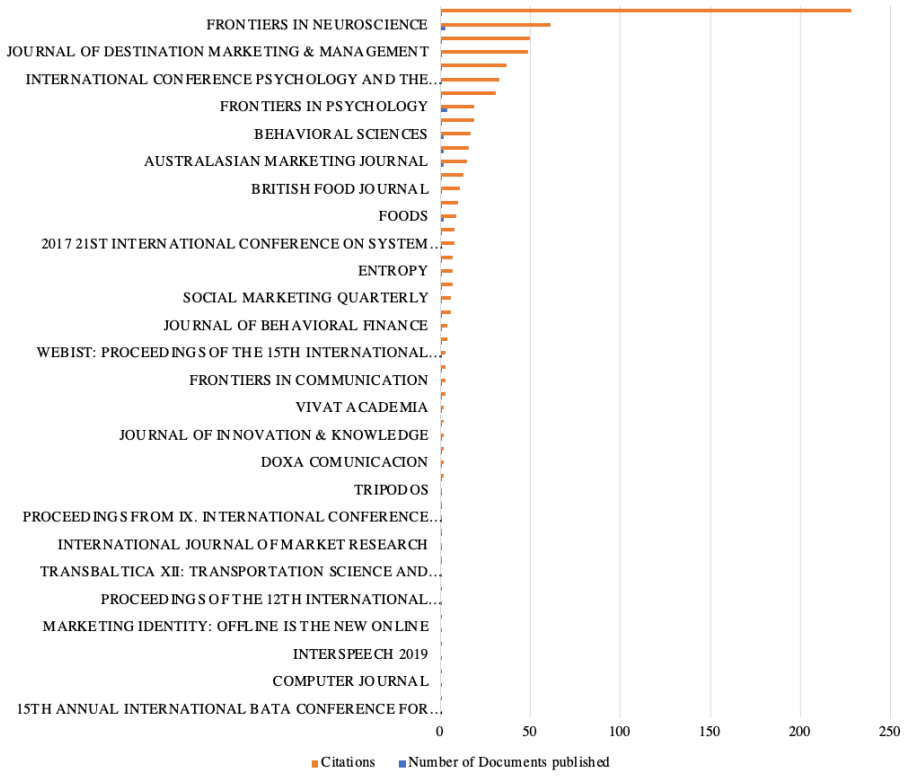
# 6 Appendix

## *Appendix I - Descriptive Analysis*

### *Appendix I.I - Number of Publications per Year*




### *Appendix I.II - Number of publications and citations per journal*



***Appendix I.III -*** *Top 10 cited papers*

| Authors | Title | Journal | Citations | Rank |
|---|---|---|---|---|
| Khushaba, RN<br>Wise, C<br>Kodagoda, S<br>Louviere, J<br>Kahn, BE,<br>Townsend, C | Consumer neuroscience: Assessing the brain response to marketing stimuli using electroencephalogram (EEG) and eye tracking | Expert Systems with Applications | 228 | 1 |
| Stasi, A<br>Songa, G<br>Mauri, M<br>Ciceri, A<br>Diotallevi, F<br>Nardone, G<br>Russo, V | Neuromarketing empirical approaches and food choice: A systematic review | Food Research International | 50 | 2 |
| Lin, YP<br>Yang, YH<br>Jung, TP | Fusion of electroencephalographic dynamics and musical contents for estimating emotional responses in music listening | Frontiers in Neuromarketing | 50 | 3 |
| Bastiaansen, M<br>Straatman, S<br>Driessen, E<br>Mitas, O<br>Stekelenburg, J<br>Wang, L | My destination in your brain: A novel neuromarketing approach for evaluating the effectiveness of destination marketing | Journal of Destination Marketing & Managementt | 49 | 4 |
| Goto, N<br>Mushtaq, F<br>Shee, D<br>Lim, XL<br>Martazavi, M<br>Watabe, M<br>Schaefer, A | Neural signals of selective attention are modulated by subjective preferences and buying decisions in a virtual shopping task | Biological Psychology | 37 | 5 |
| Sebastian, V | Neuromarketing and evaluation of cognitive and emotional responses of consumer to marketing stimuli | 4th International Conference on Psychology and the Realities of the Contemporary World | 33 | 6 |
| Vecchiato, G<br>Kong, WZ<br>Maglione, AG<br>Wei, DM | Understanding the Impact of TV Commercials Electrical Neuroimaging | IEEE Pulse | 31 | 7 |
| Bercik, J<br>Horska, E<br>Wang, RWY<br>Chen, YC | The impact of parameters of store illumination on food shopper response | Appetite | 19 | 8 |
| Hsu, LW<br>Chen, YJ | Music and wine tasting: an experimental neuromarketing study | British Food Journal | 15 | 9 |
| Sung, B<br>Wilson, NJ<br>Yun, JH<br>Lee, EJ | What can neuroscience offer marketing research? | Asia Pacific Journal of Marketing and Logistics | 14 | 10 |

***Appendix I.VI -*** *Top 10 published authors*

| Author | Documents | Citations | Rank |
|---|---|---|---|
| Manas Viniegra, L | 4 | 21 | 1 |
| Nunez-Gomez, P | 3 | 14 | 2 |
| Tur-Vines, V | 3 | 31 | 3 |
| Bercik, J | 2 | 20 | 4 |
| Sung, B | 2 | 15 | 5 |
| Goto, N | 2 | 45 | 6 |
| Lim, XL | 2 | 45 | 7 |
| Schaefer, A | 2 | 45 | 8 |
| Shee, D | 2 | 45 | 9 |
| Watabe, M | 2 | 45 | 10 |

***Appendix I.V -*** *Country ranking regarding published documents and citations*

| Country | Documents | Rank | Country | Citations | Rank |
|---|---|---|---|---|---|
| Spain | 15 | 1 | United States | 290 | 1 |
| Slovakia | 7 | 2 | Australia | 257 | 2 |
| Australia | 5 | 3 | Taiwan | 101 | 3 |
| United Stated | 5 | 4 | China | 91 | 4 |
| Taiwan | 5 | 5 | Italy | 87 | 5 |
| Italy | 5 | 6 | Malaysia | 62 | 6 |
| Malaysia | 4 | 7 | Spain | 55 | 7 |
| Germany | 4 | 8 | Netherlands | 452 | 8 |
| China | 4 | 9 | Germany | 48 | 9 |
| Japan | 3 | 10 | England | 42 | 10 |

***Appendix I.VI -*** *Top 7 Journals regarding publications*

| Journal | Documents | Rank |
|---|---|---|
| Frontiers in Psychology | 4 | 1 |
| Frontiers in Neuroscience | 3 | 2 |
| Australasian Marketing Journal | 2 | 3 |
| Asia Pacific Journal of Marketing and Logistics | 2 | 4 |
| Foods | 2 | 5 |
| Behavioral Sciences | 2 | 6 |
| Food Research International | 3 | 7 |

***Appendix I.VII*** *- Top 10 Journals regarding citations*

| Journal | Citations | Rank |
|---|---|---|
| Expert Systems with Applications | 228 | 1 |
| Frontiers in Neuroscience | 61 | 2 |
| Food Research International | 50 | 3 |
| Journal of Destination Marketing & Management | 49 | 4 |
| Biological Psychology | 37 | 5 |
| International Conference Psychology and Realities of the Contemporary World | 33 | 6 |
| Ieee Pulse | 31 | 7 |
| Frontiers in Psychology | 19 | 8 |
| Appetite | 19 | 9 |
| Behavioral Sciences | 19 | 10 |

***Appendix I.VIII -*** *Top 10 Organizations regarding publications*

| Organization | Documents | Rank |
|---|---|---|
| Universidad Complutense de Madrid | 8 | 1 |
| Slovak University of Agriculture | 4 | 2 |
| Universidad de Alicante | 3 | 3 |
| Universitat Politéchnica de Valência | 3 | 4 |
| BrainSigns SRL | 2 | 5 |
| National Kaohsiung University of Hospitality and Tourism | 2 | 6 |
| Curtin University | 2 | 7 |
| Ningbo University | 2 | 8 |
| Zhejiang University | 2 | 9 |
| Universidad Politécnica de Madrid | 2 | 10 |

***Appendix I.IX*** *- Top 10 Organizations regarding citations*

| Organization | Citations | Rank |
|---|---|---|
| University of Miami | 228 | 1 |
| University of Pennsylvania | 288 | 2 |
| University of Technology Sydney | 228 | 3 |
| IULM University | 50 | 4 |
| Università degli Studi di Foggia | 50 | 5 |
| Università degli Studi di Perugias | 50 | 6 |
| Academia Sinica | 50 | 7 |
| University of California San Diego | 50 | 8 |
| Chinese Academy of Sciences | 49 | 9 |
| Breda University of Applied Sciences | 49 | 10 |

# ***Appendix II –*** *Cluster Analysis*

## ***Appendix II.I –*** *Cluster Overview (Authors)*

**Cluster Author Overview**

**Cluster 1 (n = 18)**
Bercik et al. (2017)
Filipovic et al. (2019)
Gani et al. (2018)
Gonzalez-Mena et al. (2022)
Hsu et al. (2020b)
Juarez et al. (2020)
Kral'ovicova et al. (2019)
Libert et al. (2019)
Lin et al. (2014)
Manas-Viniegra et al. (2020)
Manas-Viniegra et al. (2020)
Manas-Viniegra et al. (2020)
Mengual-Recuerda et al. (2020)
Mesly et al. (2014)
Nunez-Gomez et al. (2020)
Sebastian (2014)
Yang et al. (2018)
Zamith et al. (2018)

**Cluster 2 (n = 16)**
Aguado-Guadalupe et al. (2018)
Balconi et al. (2022)
Baldo et al. (2022)
Calvert et al. (2020)
De-Frutos-Arranz et al (2022)
Garczarek-Bak et al. (2021)
Harris et al. (2019)
Levrini et al. (2020)
Martinez-Levy et al. (2022)
Mcinnes et al. (2022)
Moya et al. (2020)
Qanawah et al. (2022)
Stasi et al. (2018)
Sung et al: (2020)
Vecchiato et al. (2012)
Zhang et al. (2022)

**Cluster 3 (n = 14)**
Alsharif et al. (2021)
Bastiaansen et al. (2018)
Gill et al. (2022)
Gomez-Carmona et al. (2021)
Hernandez-Garcia et al. (2017)
Horska et al. (2015)
Kleinlein et al. (2019)
Ma et al. (2018)
Marinez Herrador et al. (2020)
Nomura et al. (2015)
Russo et al. (2021)
Sola et al. (2022)
Ungureanu et al (2017)
Yu et al. (2018)

**Cluster 4 (n = 4)**
Hsu et al. (2020a)
Khushaba et al. (2013)
Montazeribarforoushi et al. (2017)
Tichindelean et al. (2018)

**Cluster 5 (n = 3)**
Bercik et al. (2016)
Gkaintatzis et al. (2019)
Nagyova et al. (2019)

**Cluster 6 (n = 2)**
Kolar et al. (2021)
Shenderivska et al. (2022)

**Cluster 7 (n = 2)**
Goto et al. (2017)
Goto et al. (2019)

***Appendix II.II –*** *Suggestions for Future Research*

| Cluster | Suggestions for Future Research |
|---|---|
| **(1) Leverage of Neuromarketing Tools to improve Emotions and Attention** | • All studies use small sample sizes, future research should conduct those experiments with larger sample sizes to get more accurate results.<br>• Include minority groups, as it has been done for Asperger groups.<br>• Conduct more experiments in non-laboratory settings. |
| **(2) Neuromarketing Technologies** | • Combination of different neuromarketing tools in one experiment.<br>• Address gender differences more specifically. |
| **(3) Influence of Visual Stimuli** | • Conduct studies on the influence of other stimuli on consumer attention and emotions, such as scent and taste.<br>• Conduct studies that analyze the effect of the combination of different stimuli. |
| **(4) Emotions and Attention in Decision-Making Process** | • Deeper and more thorough analysis of the methodology on how to influence emotions and attention in the consumer decision-making process |
| **(5) Impact of External Influences on Emotions and Attention** | • Analyze and measure the influence of further external influences. |
| **(6) Traditional and Neuromarketing Research Methods** | • Compare further neuromarketing tools with different traditional methods, such as fMRI vs. survey measures.<br>• Conduct studies with larger sample sizes where neuromarketing and traditional methods are used in a complementary way. |
| **(7) Predicting Consumer Behavior** | • Conduct studies that predict consumer behavior using ERPs with larger sample sizes. |