



Neuro-Marketing in Understanding Consumer Behavior: Systematic Literature Review

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Abstract – Neuromarketing and its implicit and automated processes influence customer decision-making and expose any concealed understanding of consumer behavior. There is a rising interest in studying how consumers' brain responses affect their decision-making process because one of the most important questions in today's market is what motivates consumers to choose one product over another. Although neuromarketing positions itself as one of the key fields of research targeted at accomplishing this objective, it is still a young and rapidly evolving discipline. The study's research proposal was to examine how advertising influences consumers' purchasing decisions when shopping online. Examining the role of customers' gaze spots, fixation counts, heat maps, and emotions in reaction to stimuli or marketing efforts is another goal. The consumer provides the stimulus, and the advertising effort gauges the response. Authors used the systematic literature review of latest studies. Inclusion and exclusion of scanned literature was conducted with help of PRISMA. For check effect size of used literature authors employed the Forest Plot based on partial correlation. Publication bias of SLR was viewed with the Funnel plot. Bibliometrics analysis and content analysis was conducted to support the reviewed literature strength.

Keywords: Neuromarketing, PRISMA, Forest and Funnel Plot.

1. INTRODUCTION

Although there is a lot of research on consumer perception and attitude, it is difficult and extensive to examine neuroscience. The decision-making process's hidden components are better understood thanks to neuroscience (Pereira et. al, 2022). Both consumers and marketers benefit from the expanded use of neuromarketing approaches for the analysis of consumer preferences and decision-making processes (Oikonomou et. al., 2023). The human brain subconsciously processes more than 50% of the information (Ala et. al., 2022, Kant, 2020). Compared to traditional techniques of analysis based on questionnaires and interviews, neuromarketing and consumer neuroscience research more accurately depicts reality (Aldayel, et al., 2020). Ali Gaafar & Al-Romeedy (2022) conducted research on a few domains where neuroscience helps advance theory-building by offering chances and directions. The work contributed to new empirical tests of prevalent unsupported claims.

This also clarified the differences between consumer groups and the impact of physiological features and biological factors, such as hormones and DNA, on consumer preferences and decisions. Since its inception in 2002, neuromarketing has become increasingly important (Gurguet. Al., 2020). There is a tremendous spread of the same among businesses, marketers, and advertisements (Alsharif et. al, 2021). Traditional methods cannot be replaced by neuromarketing, but cutting-edge instruments like fMRI (functional



magnetic resonance imaging) will increase the effectiveness of marketing campaigns (Adula et. al., 2023). Since it has the capacity to identify implicit and automatic processes that influence consumer decision-making and because it will disclose hidden information about consumer behavior, neuromarketing will have a huge impact on businesses and society. Using conventional techniques would not have enabled this (Bhardwaj et. al., 2023). The retail sector has undergone significant upheaval, and as a result, all online sellers now have a wealth of opportunities. Consumer neuroscience helps online companies understand the changing buying habits (Kant et. al., 2022).

To take advantage of the advantages and disadvantages of the contemporary consumer experience, the function of emotions in online retail environments is examined. The executives of major brands researched the most recent changes in the retail industry (Wakjira & Kant, 2022). The researcher looked at how to alter the purchasing process and human brain problems. With the developing, complex e-commerce and traditional brick and mortar environments, the shops may be able to equip themselves to better fulfill consumer needs (Mansor & Isa, 2020). In response to pricing changes made by competitors, internet shops adjust their prices. Representation, Attention, Predicted Value, Experienced Value, Remembered Importance, and Learning are the steps in the Consumer Neuroscience Model of Branding (Nilashi & Abumalloh, 2023).

Emotional involvement and personal relevance are crucial. Retailers take into account the entire purchasing process and are aware of the finest ways to influence customers as they shop. In order to promote consumer repurchase, it is essential to develop an experience for customers that elicits emotional reactions and facilitates the rewards process (Spence, 2020). The researcher has identified three key stages in the purchasing process. Retailers may engage with customers and elicit an emotional response from them that is then kept for use in the future thanks to marketing communications and word-of-mouth experiences. In retail, the customer's purchase develops a lasting memory (Paramashivaiah et. Al., 2021). Consumers form an emotional connection to the product during the post-tail phase. Buyers also serve as advocates during the post-tail experience, positioning potential buyers and buyers also play the role of brand ambassadors during the post-tail experience, positioning themselves for future purchases and strengthening their bond with the company, goods, or service.

With the expansion of platforms and information, the digital world has never been more distracting. Every digital environment has its own set of challenges, from website design to product display to adding recommendations and reviews. Emotion is a constant factor. Examining various neuromarketing tactics for online buying is the study's goal.

2. OBJECTIVE OF THE STUDY

Educating the audience on the subject of neuromarketing is one of the study's objectives. Nonetheless, the main objective is to assess how neuromarketing affects various marketing inputs, including advertising and consumer purchasing behavior. It is anticipated that this novel technique would result in more workable customer enticement strategies thanks to its objective research of the brain.

3. META ANALYSIS OF CONCEPT OF NEUROMARKETING

Several publications have provided definitions of neuromarketing, some of which are included here;

Table -1: Meta Analysis of Concept of Neuromarketing

	Study	Concept of Neuromarketing
1	Collins Dictionary	When creating new advertising campaigns and branding strategies, neuromarketing involves analyzing customer brain patterns to see how they react to specific adverts and products
2	Smidts, 2002	Neuromarketing is the study of the brain's mechanisms to comprehend consumer behavior and enhance marketing tactics.
3	Lee et al, 2002	By using "neuroscientific tools to evaluate and comprehend human behavior in connection to markets and marketing exchanges," neuromarketing seeks to understand how consumers think and why they choose the items
4	Kenning & Hubert, 2006	The use of research from neuroscientific consumer studies in the context of managerial practice is known as neuromarketing
5	Zaltman&Zaltman, 2006; Boricean, 2005; Zurawicki, 2010; Dooley, 2010	Most commonly, neuromarketing is described as a recent area of marketing research that examines customers' cognitive and affective reactions to various marketing stimuli
6	Georges &Badoc, 2010	The method of neuromarketing enables knowledge and comprehension of the information–processing mechanisms used by the human brain

Source: Authors own Meta analysis (2023)

4. MATERIAL AND METHOD

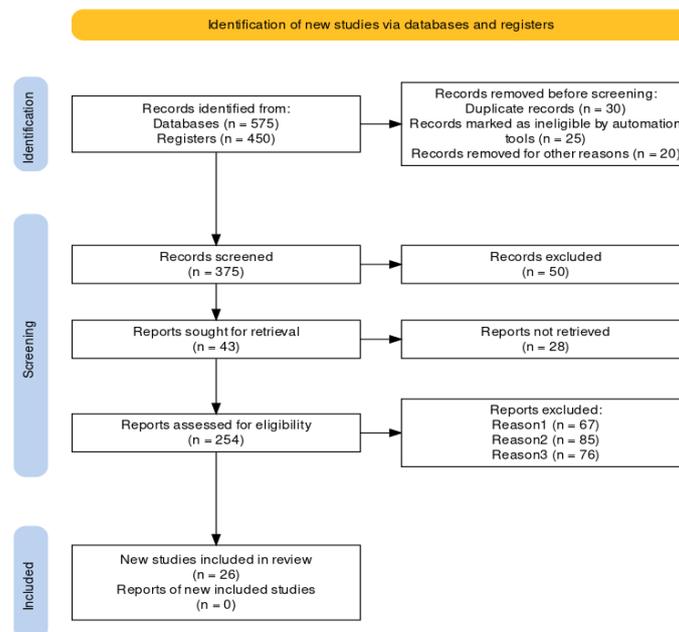


Fig -1: PRISMA Construct

5. SYSTEMATIC LITERATURE REVIEW

From 2006 and 2022, 525 documents were published in total. 26 items in all were chosen. The PRISMA framework, which has four stages, is depicted in Figure 1. These are (i) identification as records found through database searching, (ii) screening the record publications, (iii) eligibility as determination of the publications that qualify for this review, and (iv) choosing and including studies.

A recent area of marketing research is neuromarketing. The field is built on the investigation of how consumers react to marketing stimuli on a sensory, cognitive, and emotive level. One hundred billion neurons make up the network in the human brain. The study of neuromarketing is becoming increasingly popular in both the academic and corporate worlds. Companies with global aspirations must forecast consumer behavior. They make investments in their research facilities, science people, and academic collaborations.

Table -2: Systematic Literature Review

Nemorin's (2012)	consumers react to stimuli from advertising. At the moment, it lacks a complete understanding of how the brain functions and how a brain's intricate operation results in highly specific human behavior
Donoghue, 2015	A comprehensive authority in comprehending human mental behavior is still being sought after. The convergence of the biological and social sciences is the result of this. Significant advancements in social, behavioral, physiological, and other fields have resulted from the natural and social sciences' joint research efforts.
Shiv & Yoon, 2012)	The measuring of particular regional spectra of the brain is done using electroencephalography and steady-state topography. Responses and sensors are used to track changes in a person's biometrics or physiological status. Additionally, they investigate the heart and respiration rates, the galvanic skin reaction, the reasons behind consumer decisions, and the brain regions involved.
Nyoni and Bonga, 2012	The paper examined the perceptions of a human decision that results in personal decisions (. The researchers used functional magnetic resonance imaging to track variations in activity in various brain regions.
Salatiet al., 2016	Consumer researchers undoubtedly need more information on how our senses influence the judgments we make when selecting products. For instance, what is the best perfume to be sprayed in a retail setting that caters to elderly customers? How can the flavor of food being served in an aircraft that is flying at a height of 20,000 feet be processed by the consumer's brain?
Donoghue, 2015	In the developing field of neuromarketing, consumer responses to marketing stimuli are investigated. There is little research on the in-depth understanding of how the brain functions and how a brain's complicated operation results in the highly specific human behavior despite the fact that the human brain is a well-developed network of 100 billion neurons



Shiv & Yoon, 2012	The information caused a convergence of the biological and social sciences. Significant advancements in the social, behavioral, physiological, and managerial sciences have been facilitated by the coordinated research efforts of natural and social scientists. Theoretical advances in neuro-economics and decision neurosciences about human decision making now take into account both individual choices and the neurological mechanisms behind such choices.
Levallois et. al., 2015	Studies in neuro-marketing focus on the emotions that influence human decision-making and apply this information to improve marketing. The culture is used to improve pricing, store design, promotions, advertising, and product design, as well as the overall consumer experience. The actions, functions, and perceptions of the brain cannot be accurately modeled or replicated by standard methodologies.

Source: Authors own SLR (2023)

By watching and analyzing human emotions, neuromarketing seeks to understand marketing stimuli. The theory underlying neuromarketing holds that the bulk of economic theories are out-of-date and that rational decision making is not primarily a conscious activity. Conversely, there is mounting evidence that purchasing decisions are influenced by emotions and that the brain takes several shortcuts to hasten the decision-making process. Studies on neuromarketing explore how emotions affect human decision-making and apply the knowledge to improve marketing. The principle is put into practice while designing products, enhancing promotions and advertising, pricing, designing stores, and generally enhancing the customer experience.

It is feasible to compress the experiences and discoveries of other researchers and merge newly discovered information from earlier study in order to address the issue. Neuromarketing does not have a study cap because it involves a significant time and financial investment.

6. THEMATIC AND CONTENT ANALYSIS

Table -3: Thematic and Content Analysis

Study	Method	Viewpoint	Theme
Adeola et. al, (2022)	Quantitative	Cognitive Neuro-imaging	Neuro-imaging methods to item for consumption
Ala et. al.(2023)	Qualitative	Cognitive Neuro-coding	Behavioral-organizational dynamics universal view on neuro-marketing
Alsharif et. al. (2023)	Qualitative	Cognitive Neuro-imaging	Brain images and customer behavior
Alsharif et al. (2023)	Quantitative	Cognitive Neuro-mapping	Advertising non-invasive techniques
Bhardwaj et al. (2023)	Qualitative	Cognitive Neuro-sensing	Physiological dimension in psychological processes
Halkiopoulos et. al., (2022)	Qualitative	Cognitive Neuro-imaging	Neuro-imaging of consumer neuroscience

Nilashi & Abumalloh (2023)	Qualitative	Cognitive Neuro-mapping	Primary dialogue in the natives text implanted in neuro-marketing
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Source: Researchers Own TCA (2023)

7. REVIEWED LITERATURE CONTRIBUTION

Table -4: Effect Size

#	Study name	Partial Correlation	CI Lower limit	CI Upper limit	Weight
1	Adeola et. al, (2022)	0.36	0.16	0.56	6.93%
2	Ala et. al.(2023)	0.78	0.63	0.94	9.66%
3	Alsharif et. al. (2023)	0.64	0.24	1.03	2.07%
4	Bhardwaj et al. (2023)	0.68	0.60	0.75	20.71%
5	Halkiopoulos et. al., (2022)	0.65	0.57	0.73	19.77%
6	Alsharif et al. (2023)	0.65	0.57	0.73	19.81%
7	Nilashi & Abumalloh (2023)	0.69	0.61	0.76	21.05%

Source: Meta Essentials (2023)

The predictive ability of a neuromarketing strategy is represented by a new effect size from a multiple regression model. The semi partial correlation between the predictor and the desired outcome is the index, abbreviated as *rsp*. This partial effect size in the correlation family of effect sizes was calculated from neuromarketing studies when multiple predictor variables were included in the regression model. The effect magnitude and its variance were provided by the derivations used in neuromarketing studies. For specific numbers, standard errors and confidence intervals can be generated. Moreover, weighted analyses of neuromarketing studies can be utilized to study heterogeneity and to determine central tendency and variance in the effects. This is how the meta-analysis of the semi partial correlations was conducted.

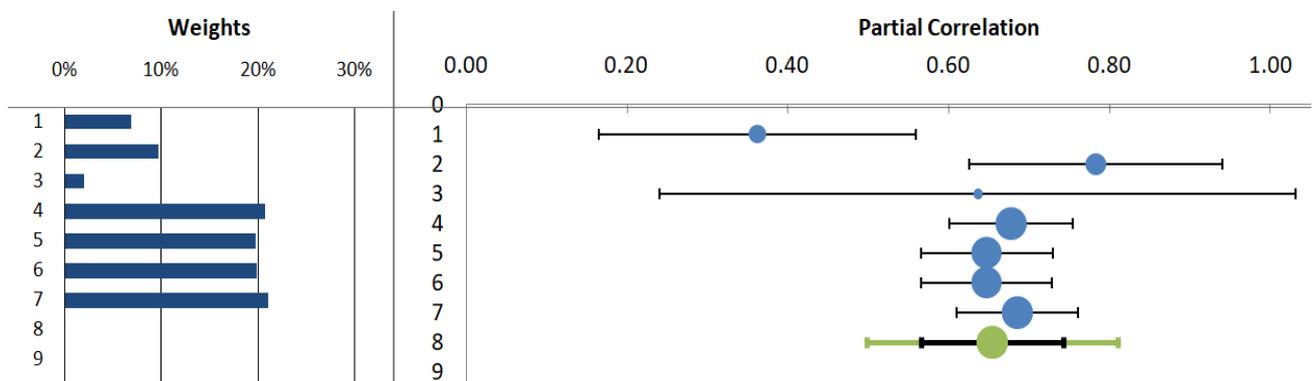


Fig -2: Forest Plot

Source: Meta Essentials (2023)

The green circle in the centre of each horizontal line (confidence interval, CI) reflects the point estimate of the effect for a particular study in a forest plot that shows the effect size of neuromarketing research. The size of the box reflects the study's weight in terms of the combined estimate of all neuromarketing studies.

Table –5: Meta-Analysis Model

Meta-Analysis Model	
Model	Random effects model
Combined Effect Size	
Partial Correlation	0.65
Z-value	18.08
One-tailed p-value	0.000
Two-tailed p-value	0.000
Number of incl. studies	7
Heterogeneity	
Q	12.07
p _Q	0.060
I ²	50.31%

Source: Meta Essentials (2023)

Publication Bias:

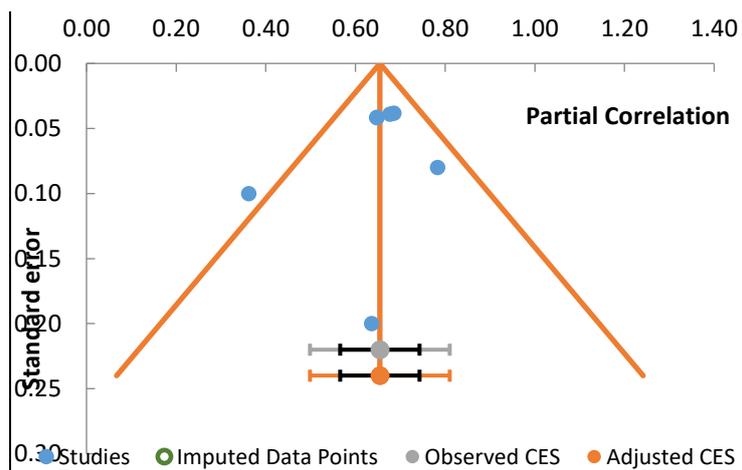


Fig -3: Funnel Plot

Source: Meta Essentials (2023)

For determining the presence of publication bias, neuromarketing research can be constructed as a funnel plot. Smaller (less precise) studies that failed to demonstrate statistical significance will be less likely to be published if there is publication bias among neuromarketing studies. The funnel plot's asymmetry illustrates this. A visual tool for examining publication and other bias in meta-analysis is the funnel plot. Simple scatterplots of estimated treatment effects from individual studies (horizontal axis) versus a measure of study size are displayed (vertical axis).

Table -6: Heterogeneity

Heterogeneity	
Q	12.07
p_Q	0.060
I^2	50.31%
T^2	0.00
Trim and Fill	On
Estimator for missing studies	Linear
Search from mean	Left
Number of imputed studies	0

Source: Meta Essentials (2023)

8. BIBLIOMETRIC ANALYSIS

This algorithm's first network, which allows for the viewing of the first network-linked density map and the keywords associated with the term "neuromarketing," is shown. The most frequent phrases and SLR object of this investigation are items known as nodes or vertices, depicted in each circle. The relationships of co-occurrence are represented by the edges that connect these items; their measurement provides an indication of how strong they are among peers or edge weight, and their correlation may be determined by keeping track of publications where two terms co-occur.

Table -7: Apex keywords by the occurrence of their incidence

Keyword	Frequency	Total Link Strength
Neuromarketing	26	205
Functional Magnetic Resonance	16	222
ECG	12	266
Decision-making	12	165
Neuro-science	12	155
Memory	10	121

Marketing Reserach	12	125
Neural Corelation	11	122
Eeg signal	10	112
Observation	6	51
Brain Activity	6	25

Source: VOSviewer 2023

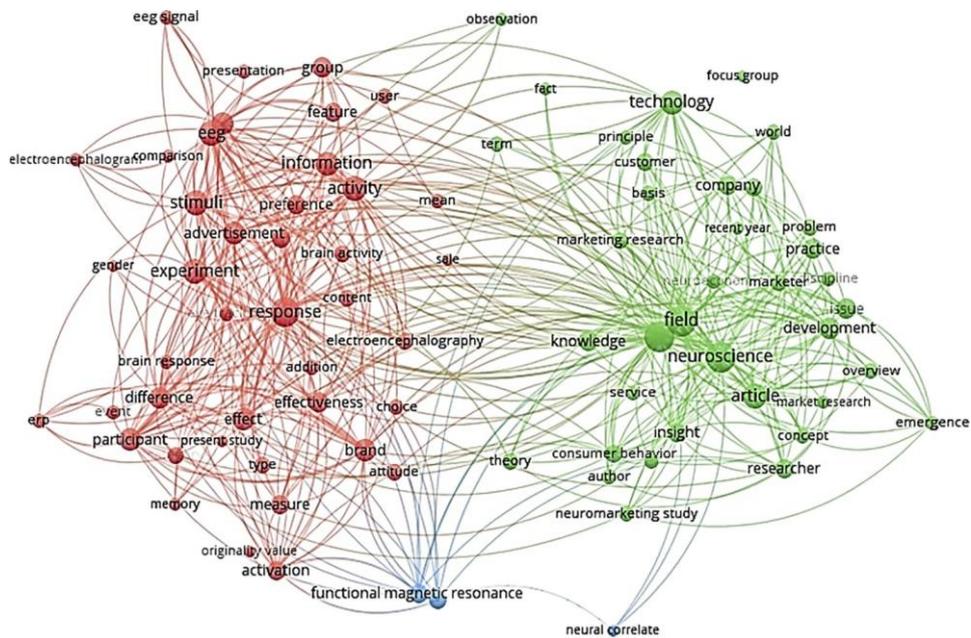


Fig -4: Bibliometrics

Source: VOSviewer 2023

Table -8: Systematic Literature Review

Method	Thought Processes	Whenever it's being utilized?	Functionalism
EEG	Mood and arousal, excitement or boredom, engagement or memory, cognition and recognition, and mental workload.	Testing ads, ads, apps, and social media, as well as website design and usability, packaging design, pricing, sensory studies, print and picture design, and pinpointing an ad's critical moments are all examples of advertising practices.	Temporal precision, cheap cost, non-invasive method, simple data analysis, appropriate for assessing cognitive information processing, ability to compare the left and right hemispheres.



FMRI	Attention, reward, engagement, emotional valence, sensory perception, and memory.	Assessing commercials, brands, pricing, packaging designs, celebrity endorsements, online experiences, product quality, promotion, and attributes, as well as forecasting consumer decisions and determining their requirements.	Capable of detecting modifications to chemical composition or changes in the flow of fluids in the brain, localizing neural activity during consumer choices and purchasing behaviors, and evaluating cognitive processes.
MEG	Vigilance, memory, and perception	Identifying needs and testing commercials, brands, new products, packaging designs, and sensory investigations.	capable of recognizing alterations in active compounds.

Source: Authors own Systematic Literature Review (2023)

9. OVERVIEW OF REVIEWED LITERATURE ON NEURO MARKETING

The study of people's emotional and cognitive reactions to media or marketing stimuli is known as neuromarketing. To learn how people physically react to marketing messages, researchers use technologies that detect brain activity and biometrics (such as heart rate, eye movement, galvanic skin response, facial coding, etc.). It's no secret that neuromarketing has become extremely popular. It's used in various ways by lots of people, businesses, educational organizations, and government agencies. While being used frequently in the marketing industry, the term is not always unambiguous. In essence, the word refers to the use of contemporary brain science to assess the effects of marketing and advertising on customers. This study is crucial for understanding the effects of neuromarketing on consumer purchase decisions as well as the different elements that affect those decisions.

The area resides at the nexus of cognitive psychology, consumer neuroscience, neuroeconomics, and neuroscience. Neuromarketing is a marketing application of behavioural neurosciences. The tools of neuromarketing identify stimuli and cues revealing customer behaviour not detected by careful visual observatio. Neuromarketing techniques help in product design, brand creation and effective advertisements. They help to understand the overall shopping experience of a customer from the moment they step into a market and until they leave, apart from the neural response at the time of purchase. An interesting application is virtual store that has 3D and 4D retail products that creates a real store shopping experience. Test customers are given real marketing experience and their purchase making decisions analysed effectively.

Moreover, neuromarketing has significant obstacles and constraints. Different processing of the marketing stimuli can also be caused by the timing and environment in which a person is exposed to them. The idea of emotions and their connection to certain brain regions is up for debate. The difficulty of creating new tests, the high expense, and the time factor are major drawbacks of neuromarketing.



10. CONCLUSION

The method of qualitative research According to earlier studies, neuromarketing has a variety of advantages over conventional marketing strategies. The discipline of neuromarketing suggests a value addition to marketing research and encourages businesses to use marketing inputs that are focused on achieving specific business goals. Higher quality and a deeper comprehension of consumers are benefits of the scientific advancement of neuromarketing. The study sheds light on how neuromarketing is used in online retail advertising to target customers. The study might allow the researchers to continue their investigation into how neuromarketing affects customer attitudes. A successful marketer needs to have enhanced consumer perception and a growing brand image, according to the report. In the area of marketing, neuromarketing offers intriguing possibilities and fresh directions to explore. Neuromarketing tactics are still in their infancy but show great promise for the future. Neuromarketing researchers generally agree that the area has to advance and overcome a number of challenges before it can become a well-known instrument in the field of market research. Nonetheless, neuromarketing generates greater interest and is anticipated to be crucial in the fiercely competitive field of international marketing. Neuromarketing is certain to benefit more in the long run as high end technology and gadgets become more widely available.

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