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Neuromarketing and Consumer Behavior: A Comprehensive Bibliometric Review

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ABSTRACT

This study provides a comprehensive bibliometric analysis of neuromarketing research, with a specific emphasis on EEG applications in understanding consumer behavior. The study examines global trends from 2016 to 2025 using data from the Scopus database and analytical tools such as VOS viewer and Bibliometrix. Based on co-authorship networks, citation impact, bibliographic coupling, keyword co-occurrence, and source co-citation patterns, 144 pertinent documents were examined. The results show a notable increase in publications after 2016, reaching a peak in 2022, and then showing a varying pattern in the years that followed. To provide insights into the intellectual and thematic evolution of the field, key contributors, influential publications, and emerging topics—like AI integration and biometric tools—are mapped. The findings point to a developing and multidisciplinary field of study that combines technology, psychology, marketing, and neuroscience to investigate how consumers make decisions. For future researchers hoping to advance neuromarketing using neurophysiological techniques, this work offers a fundamental understanding.

KEYWORDS: *Neuromarketing, Bibliometric Analysis, Consumer Behavior, Neuroscience.*

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INTRODUCTION

In recent years, the integration of neuroscience into marketing research has opened new avenues for understanding consumer behavior beyond the limitations of self-report measures such as surveys, interviews, and focus groups (Jordão et al., 2017; Cherubino et al., 2019). These traditional methods, while widely used, often fall short in capturing consumers' unconscious reactions to marketing stimuli. This gap has spurred the rise of *neuromarketing*, a multidisciplinary field that combines marketing, psychology, and neuroscience to explore the underlying neural mechanisms driving consumer decisions (Stanton et al., 2017; Venkatraman et al., 2015).

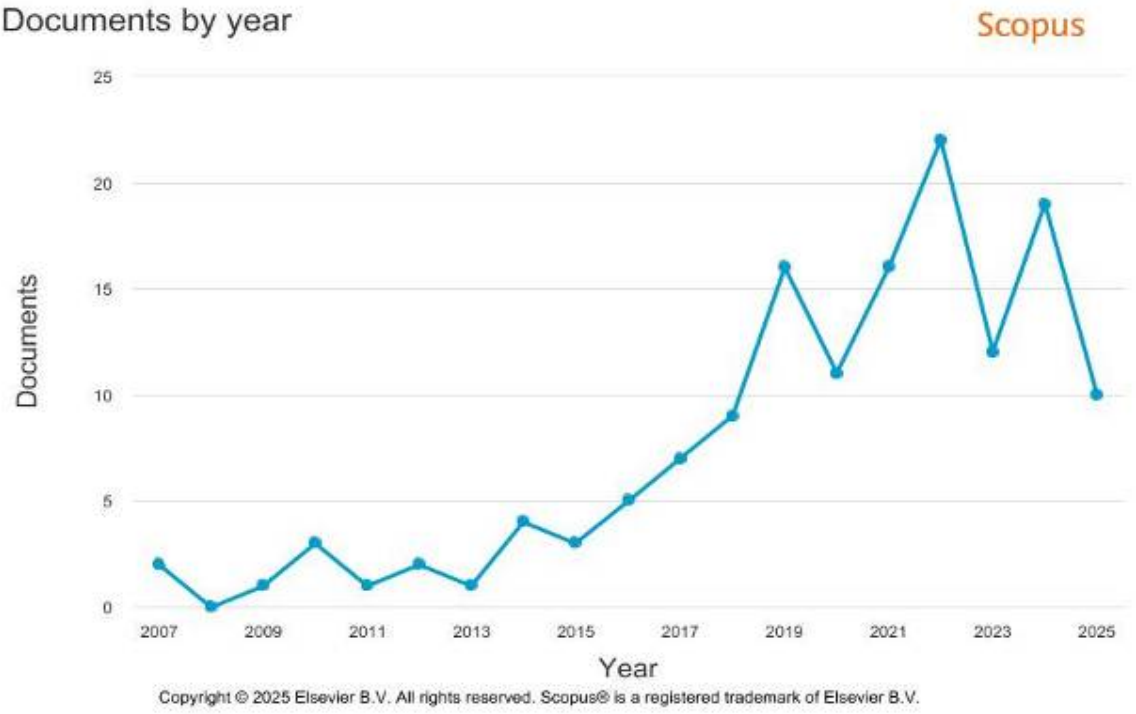
The term "neuromarketing" was first coined by Smidts (2002) and refers to the application of neuroscientific tools to investigate consumer behavior in response to marketing stimuli. These tools are broadly categorized into two groups: (i) neurophysiological methods, such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), positron emission tomography (PET), and magnetoencephalography (MEG); and (ii) physiological techniques including eye-tracking (ET), galvanic skin response (GSR), and electromyography (EMG) (Isabella et al., 2015; Alsharif et al., 2021a).

Among these tools, EEG has gained particular prominence due to its high temporal resolution, cost-effectiveness, and non-invasive nature (Burle et al., 2015; Aditya & Sarno, 2018). EEG measures the electrical activity of the brain via electrodes placed on the scalp and is capable of capturing neural signals associated with attention, memory, emotional

valence, and cognitive load (Vecchiato& Babiloni, 2011; Di Flumeri et al., 2016). Despite its lower spatial resolution compared to fMRI, EEG remains the most frequently used tool in empirical neuromarketing studies, largely due to its practicality and sensitivity to real-time brain dynamics (Alsharif et al., 2021b).

Neuromarketing has not been free of controversy, particularly in the academic neuroscience community, where concerns have been raised about ethical implications and potential misuse of brain imaging to manipulate consumer choices (Nature Neuroscience, 2004; The Lancet, 2004). Nevertheless, scholarly interest in neuromarketing has grown significantly, evidenced by an increasing volume of publications, especially in the context of advertising effectiveness, brand preference, and consumer engagement (Braeutigam et al., 2004; McClure et al., 2004; Boksem & Smidts, 2015).

Recent advances in machine learning (ML) and signal processing have also facilitated the use of multiple EEG metrics—such as frequency band powers, hemispheric asymmetry, and inter-subject correlations—to predict consumer preferences more accurately than traditional self-report measures (Barnett & Cerf, 2017; Ramsøy et al., 2018). This capability positions EEG as a valuable tool not only for academic inquiry but also for industry applications where predicting consumer behavior is paramount.



Neuromarketing research has been increasing steadily over the last 20 years, especially with regard to EEG. After 2016, there was a noticeable increase in publications, which peaked in 2022. Despite this expansion, there is still a lack of thorough mapping of worldwide research trends in EEG-based neuromarketing. By providing a bibliometric analysis of the field from 2016 to 2020 and highlighting significant contributors, important publications, top nations, and prestigious journals, this study fills that gap. Additionally, it offers information on citation networks and patterns of academic output, laying the groundwork for future studies and assisting researchers who wish to advance EEG applications in consumer neuroscience.

Research methodology

With a focus on studies using neurophysiological tools like EEG, fMRI, and eye tracking, this study uses bibliometric analysis to examine global research trends in consumer neuroscience and neuromarketing. The Scopus database, which is well known for its extensive coverage of peer-reviewed scientific literature, served as the source of the data. Relevant keywords were used to create a well-structured search string, which included terms like "neuromarketing," "consumer neuroscience," "neuroeconomics," "neuro-marketing" AND "consumer," "buyer," "user," "shopper," AND "behaviour," "decision," "choice," "preference," "perception," "emotion," AND "EEG," "fMRI," "eye-tracking," "neuroimaging," "brain activity," "biometric," "physiological," and "cognitive neuroscience." The specificity and breadth of the search were optimised using boolean operators. Following the application of inclusion and exclusion criteria and manual relevance screening, 144 documents made up the final dataset. Two tools were used to analyse and visualise the data: Bibliometrix (R package)(Aria

& Cuccurullo, 2017) for quantitative analysis and performance indicators, and VOSviewer(Van Eck & Waltman, 2010) for network visualisation (including co-authorship, keyword co-occurrence, and citation mapping). This methodological framework provides a thorough understanding of the intellectual and thematic evolution of EEG-based neuromarketing research by making it possible to identify key journals, influential authors, dominant research themes, and emerging trends.

This bibliometric study's main goal is to conduct a thorough analysis of the collaborative and intellectual environment surrounding consumer neuroscience and neuromarketing research. The methodology specifically seeks to: analyse co-authorship by nation in order to comprehend patterns of international collaboration and the geographic distribution of research productivity; Analyse bibliographic coupling to uncover thematic connections and shared references between documents; evaluate citation documents to determine the most influential publications in the field; examine well-known writers and their academic output; To identify fundamental and developing research topics, examine the frequency and development of author keywords; To map the foundational literature and source journals influencing the field, evaluate the co-citation of cited references and sources; determine the average number of citations annually to gauge the relative influence of publications over time; and monitor yearly scientific output to spot trends in publications and increases in academic output. When taken as a whole, these goals facilitate a systematic comprehension of the evolution, impact, and future direction of neuromarketing studies employing EEG and associated neurophysiological techniques.

Key results

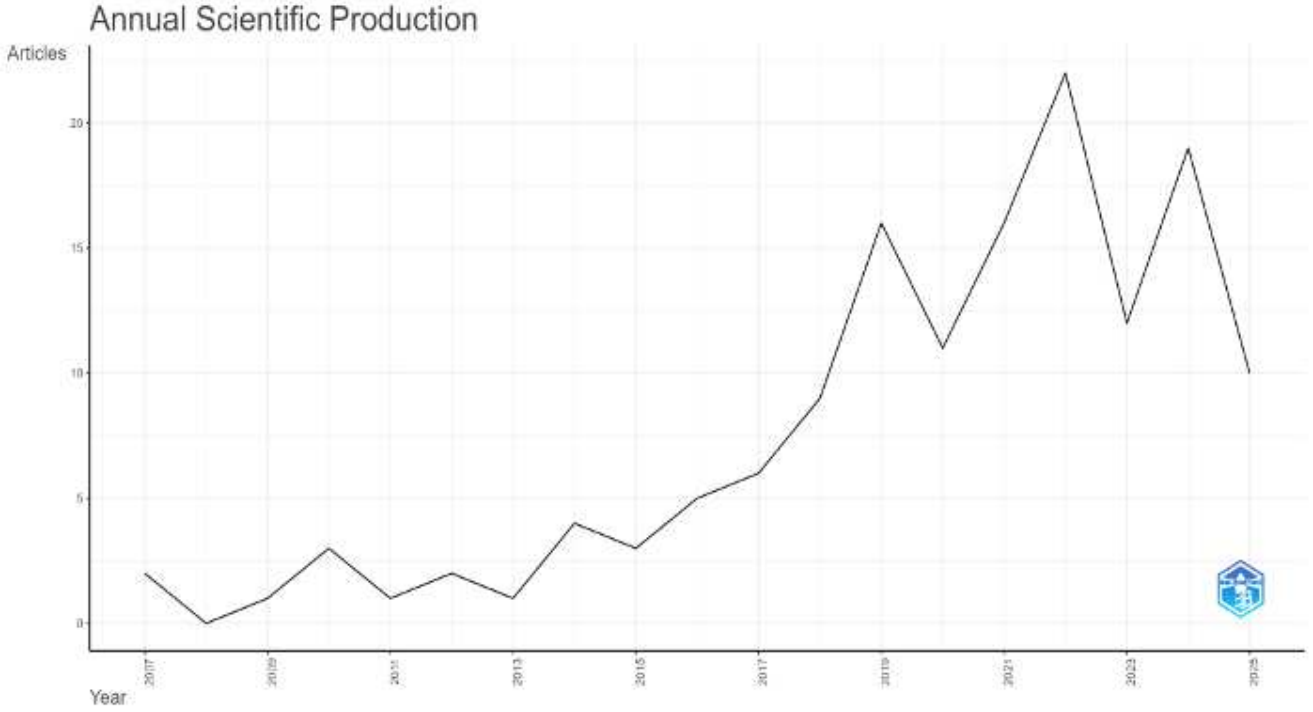


Fig.1 Annual scientific production

The field grew slowly and erratically between 2007 and 2015, with annual publications largely remaining below five articles. This suggests that the field of study is still in its early stages of development, with little scholarly focus and production.

The trend changed dramatically starting around 2016, indicating a consistent increase in scientific output. The most productive year in the dataset, 2022, saw a peak of over 20 articles, up from about 5 in 2016. This increase is indicative of a growing interest in the subject among academics and industry, which may be brought about by interdisciplinary collaborations and technological advancements like EEG, fMRI, and AI.

Although the output is still higher than in previous years, there has been a discernible decline in the last three years (2023–2025). Incomplete data collection for the current year or a brief lull in publication activity could be the cause of the 2025 decline.

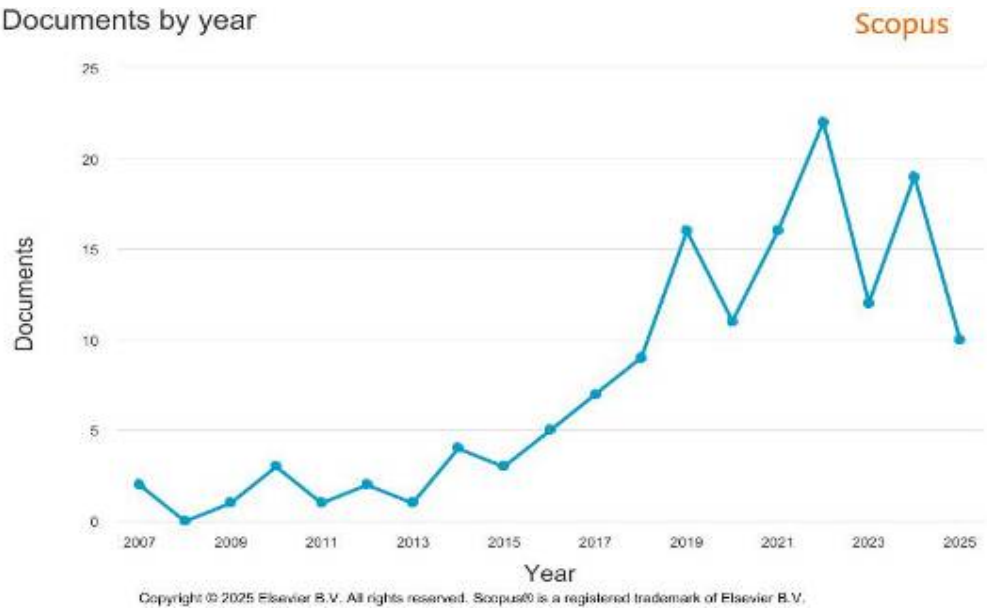


Fig.2 Document by year

Over the previous 20 years, there has been a consistent and noteworthy rise in research publications. Less than five papers were published annually in the field between 2007 and about 2015. There has been a noticeable upward trend since 2016, suggesting that academic interest is increasing. From 2018 onwards, there is a noticeable increase, reaching its highest level of scholarly output in 2022 with 23 documents.

A cyclical pattern appears after 2022, with a decrease in 2023, a rebound in 2024 (with 19 documents), and another decline in 2025 (10 documents). This variation may indicate a temporary saturation, a recent data lag, or a change in the focus of the study.

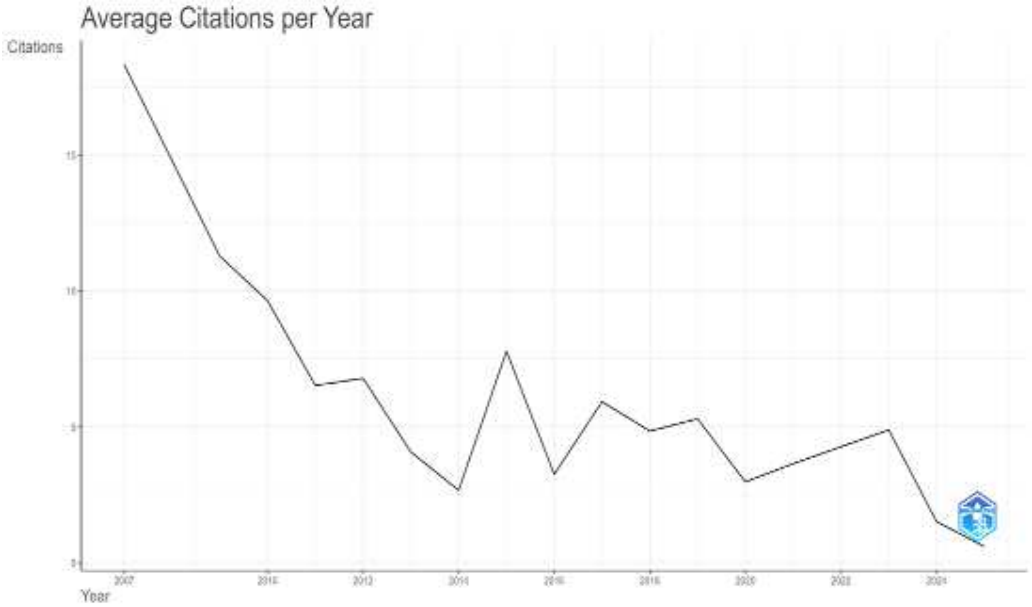


Fig.3 Average citations per year

The field had a significant impact on citations between 2007 and 2010, with an average of over 17 citations annually beginning in 2007 and progressively dropping to about 10 by 2010. The strong influence and foundational role of early publications in the field is reflected in this early high average, which is probably the result of fewer but more significant papers.

The average number of citations decreased gradually between 2011 and 2016, ranging from 3 to 7 annually. There was a slight uptick in high-impact publications in 2015.

Average citations have been low since 2017, averaging between three and five citations before plummeting to almost zero in 2024 and 2025. Since newer publications haven't had enough time to accrue citations, this final decline is anticipated as a result of citation lag.

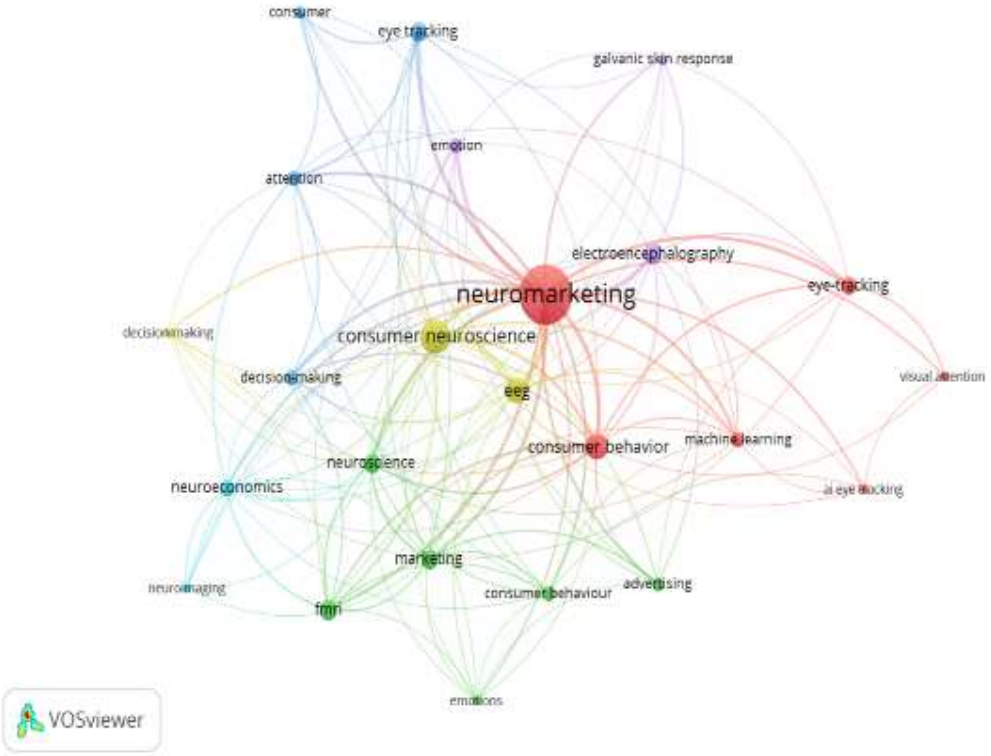


Fig.4 Author keywords

With strong connections to keywords like "consumer neuroscience," "consumer behaviour," and "EEG," the co-occurrence network identifies "neuromarketing" as the field's main theme. The primary research focus on studying consumer decision-making with brain-based tools is reflected in these terms.

Search terms like "fMRI," "eye tracking," "GSR," and "machine learning" highlight the significance of cutting-edge neurotechnologies in contemporary research. New research directions are indicated by the growing popularity of emerging topics like "visual attention" and "AI eye tracking."

Various research strands are connected by psychological concepts such as "emotion," "attention," and "decision making." All things considered, the network represents an expanding, interdisciplinary field that combines technology, marketing, and neuroscience to better understand consumer behaviour.

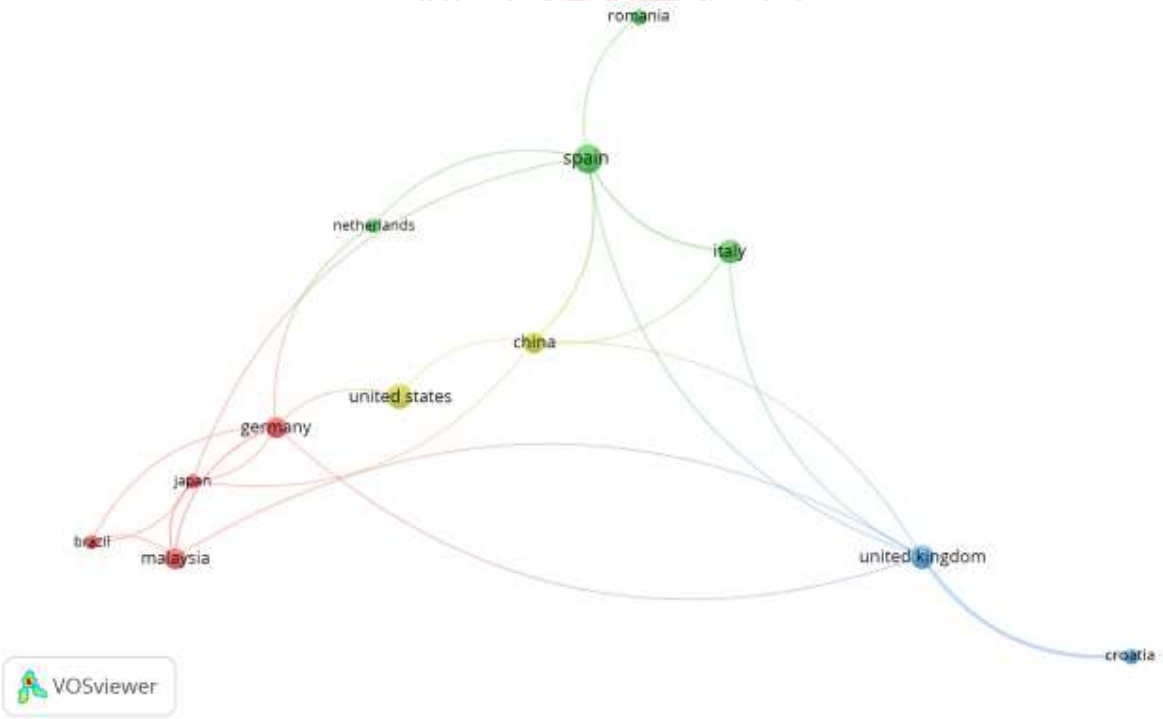


Fig. 5 Co-authorship country

Four major international clusters are revealed by the country collaboration analysis in neuromarketing. Although it exhibits little cooperation, the United States has the greatest impact, with the most citations (1,143) and publications (15). The UK is a key participant in the network due to its robust research output (14 documents) and wide-ranging collaboration (11 links). Significant contributions are also made by Germany, Spain, and Malaysia, with Malaysia demonstrating excellent research quality (normalised citation score: 1.15) and Spain demonstrating close regional ties in Europe.

Although cooperation is still scarce, emerging nations like China and Croatia have recently stepped up their efforts. All things considered, the network is a reflection of expanding global collaboration and the expansion of neuromarketing research worldwide.

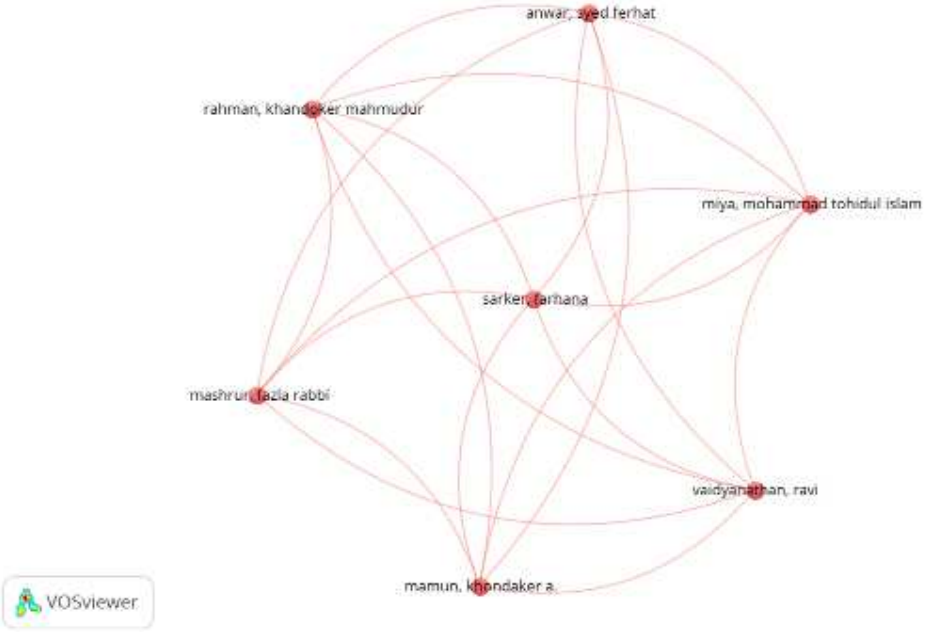


Fig. 6 Author

The seven core authors—Anwar, Mamun, Mashrur, Miya, Rahman, Sarker, and Vaidyanathan—who have worked together on several high-impact neuromarketing studies are depicted in the co-authorship network as a closely knit research team. Their work, which was primarily published in 2022, has drawn a lot of citations (57 total; norm. score: 1.67), suggesting that their academic influence is increasing.

Particularly in fields like EEG-based consumer behaviour and brain–computer interface applications, the network's symmetry and balance demonstrate equal contributions and robust interdisciplinary collaboration. This team structure demonstrates a cohesive unit that is actively influencing the course of future neuromarketing research.

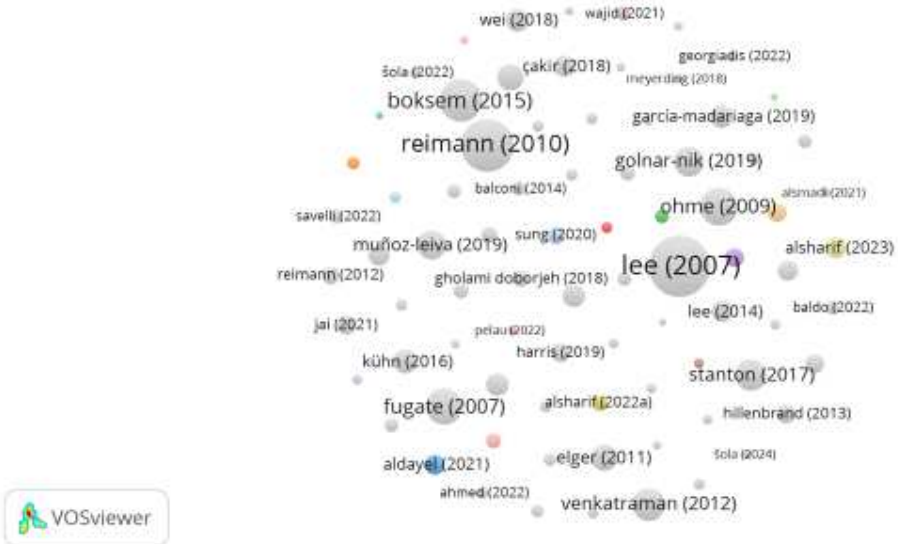


Fig. 7 Citation document

According to the author co-citation analysis, Lee (2007) is the most significant contributor, having formed the theoretical foundation of neuromarketing and receiving the most citations (512). Numerous cited studies on branding and consumer decision-making have been produced by other important authors, including Reimann, Boksem, Venkatraman, and Ohme.

Particularly in fields like EEG, bibliometric reviews, and AI integration, recent writers like Alsharif and Hakim are becoming significant voices. Cartocci, Kühn, and Stanton are among the authors who add to the field's methodological diversity and ethical debates.

Overall, the network demonstrates a move away from conceptual underpinnings and towards empirical, data-driven research, which reflects the increasing sophistication and complexity of neuromarketing studies.

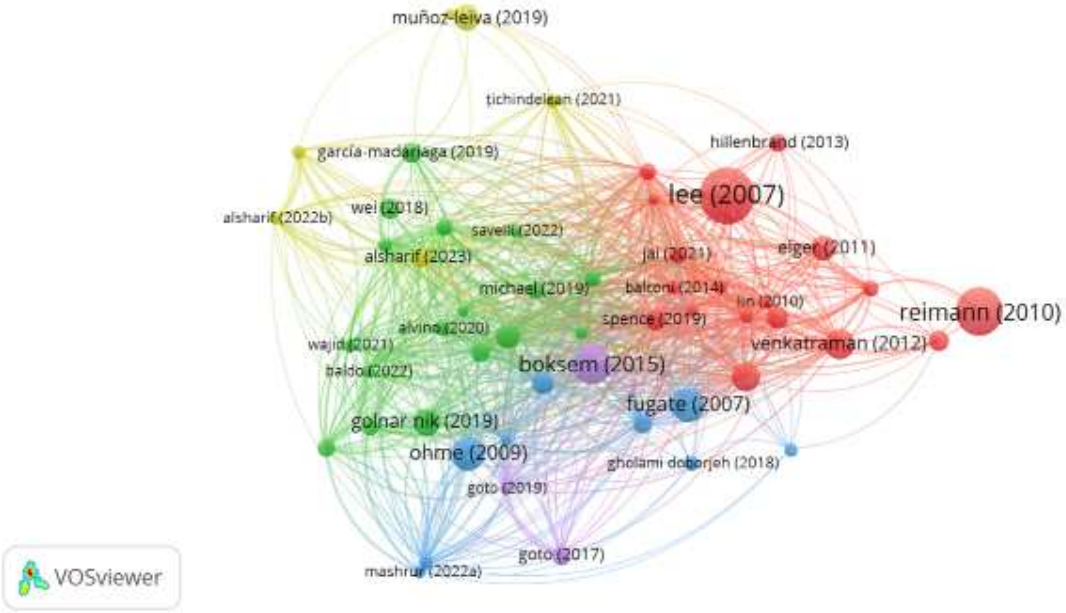


Fig. 8 Bibliographic coupling document

This analysis shows that the field of neuromarketing research is organised and changing. Core authors like Lee (2007), Reimann (2010), and Venkatraman (2012) form the foundation of the field with high citation impact. Recent studies by authors like García-Madariaga (2019) and Alsharif (2022–2023) demonstrate the field's technological advancement by highlighting the increasing use of EEG, fMRI, and AI tools.

According to studies like Boksem (2015) and Fugate (2007), the clusters show a move away from early conceptual frameworks and towards empirical and application-based research. Newer studies' high normalised citation scores attest to their growing scholarly significance.

Overall, the analysis demonstrates that neuromarketing is growing with significant academic relevance and becoming more interdisciplinary, integrating marketing, neuroscience, and behavioural science.

Fig. 9 Co-citation cited reference

According to the co-citation network, neuromarketing research is organised into three primary clusters: methodological studies that concentrate on analytical tools and neurophysiological measures (e.g., EEGlab, Khushaba); conceptual and theoretical works that bridge neuroscience and marketing (e.g., Ariely & Berns, Bartra); and foundational empirical studies that use tools like fMRI and EEG (e.g., Plassmann, Knutson). The integration of theory and application is highlighted in highly cited central works such as Plassmann et al. (2015) and Boksem (2015). All things considered, the network represents an interdisciplinary and cooperative field that blends marketing, psychology, and neuroscience.

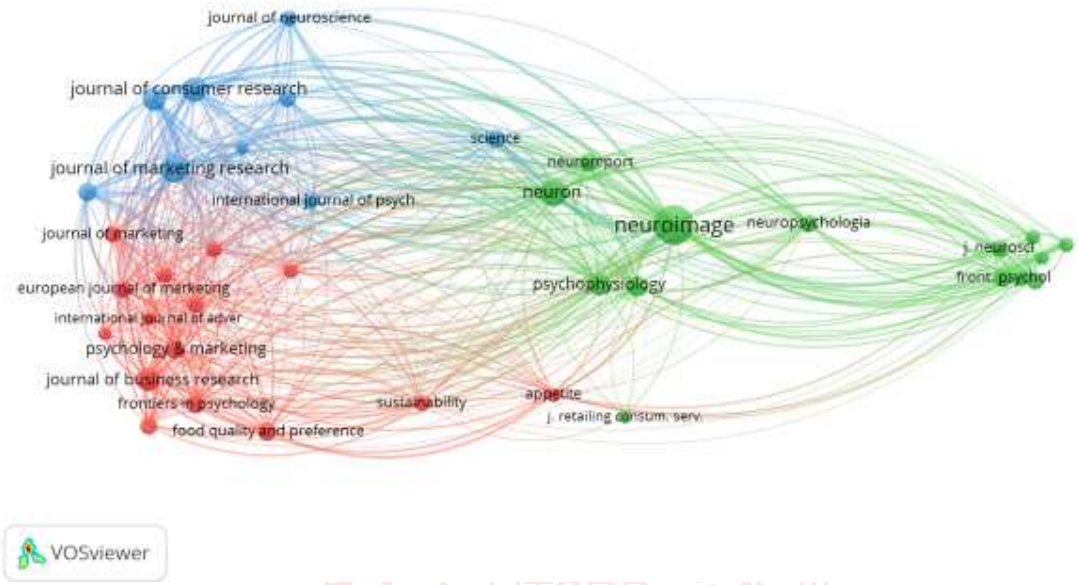


Fig. 10 Co-citation sources

Journal co-citation analysis reveals that three major clusters influence neuromarketing research: (1) marketing and consumer behaviour journals, such as Journal of Consumer Research and Journal of Marketing, which offer fundamental insights; (2) neuroscience journals, such as NeuroImage and Neurone, which provide methodological support using tools like fMRI and EEG; and (3) interdisciplinary journals, such as Science and Nature Reviews Neuroscience, which link core neuroscience to consumer research. This framework emphasises the multidisciplinary nature of neuromarketing, which advances our understanding of consumer behaviour by combining marketing, psychology, and neuroscience.

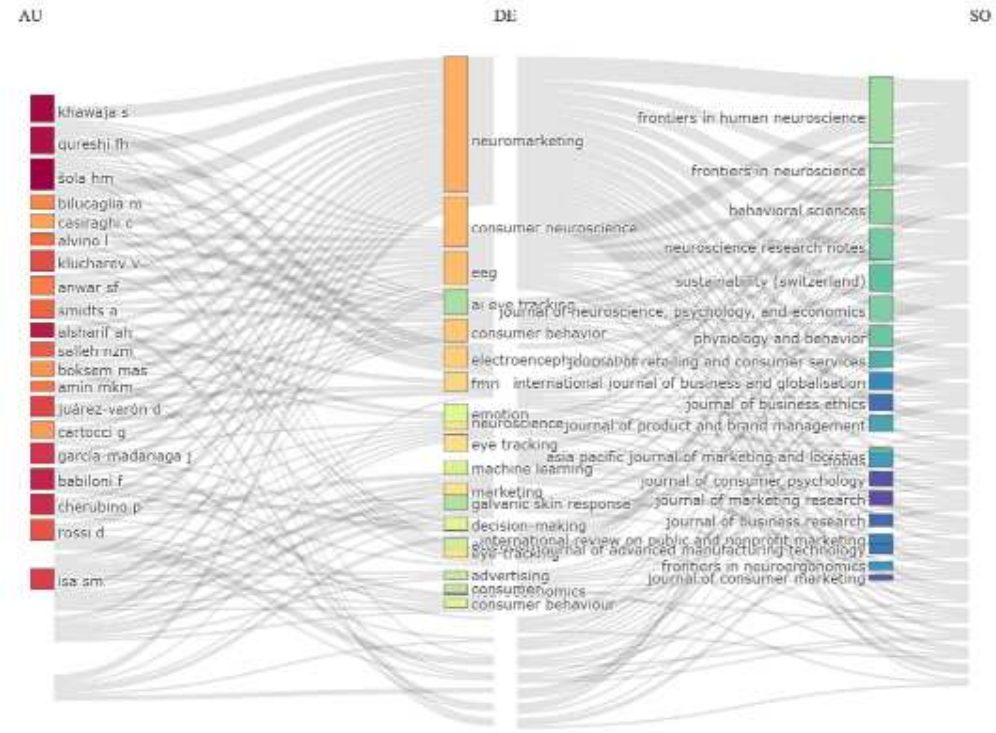


Fig. 11 Three-Field Plot

The three-field plot shows that significant writers like Khawaja S, Qureshi FH, and Bilucaglia M are at the forefront of neuromarketing research, which focusses on fundamental concepts like "neuromarketing," "consumer neuroscience," and "EEG." These studies frequently investigate consumer behaviour and decision-making using neuroscientific techniques like eye tracking, fMRI, and EEG. The interdisciplinary nature of the field is highlighted by the work's publication in journals related to both marketing and neuroscience, such as Frontiers in Human Neuroscience and Journal of Consumer Psychology. Emerging concepts like "sustainability" and "AI" suggest that neuromarketing is increasingly focussing on ethics and technology.

Findings

The bibliometric analysis reveals several significant findings that underscore the growth and diversification of neuromarketing research. Publication output has been steadily increasing since 2016, reaching a peak of 23 documents in 2022. There have been subsequent fluctuations in 2023 and 2025, which could be a sign of either data lag or a brief saturation of research focus. While emerging contributors like Malaysia and Spain exhibit high normalised citation scores and active international cooperation, nations like the United States and the United Kingdom lead the world in both productivity and citation impact. The co-authorship analysis reveals a close-knit community of fundamental researchers who have made substantial contributions to EEG-based consumer behaviour research and co-authored renowned publications. The most common keywords, according to thematic analysis, are "neuromarketing," "EEG," and "consumer behaviour," which reflect the field's primary focus. Meanwhile, more recent themes, such as "AI," "eye-tracking," and "visual attention," indicate evolving research frontiers. Prominent writers like Lee, Reimann, and Venkatraman are still frequently cited, demonstrating their enduring impact on the field's intellectual framework. Core knowledge sources include high-impact journals such as NeuroImage, Journal of Consumer Psychology, and Neurone. In order to better understand consumer decision-making, the field is generally moving away from conceptual discussions and towards more empirical, technologically driven studies that integrate tools like EEG, fMRI, and machine learning.

Conclusion

According to the bibliometric analysis, neuromarketing is a rapidly evolving, multidisciplinary field that combines marketing and neuroscience to gain a deeper understanding of consumer behaviour. EEG's ability to measure responses in real time has made it a dominant tool. New directions involving AI and machine learning are becoming more well-known, even though foundational works continue to have an impact. The field's shift from emerging theory to complex, application-focused research is highlighted by the expanding global collaboration and thematic diversity. Future researchers hoping to navigate and contribute to the changing field of neuromarketing can use this study as a guide.

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