Neuromarketing Business Applications: A Systematic Literature Review and Future Research Directions

A Project Report

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DECLARATION

We hereby declare that this report "Neuromarketing Business Applications: A Systematic Literature Review and Future Research Directions' is our own work, to the best of our knowledge and belief. It contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of any other institute, except where due acknowledgement has been made in the text.

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This is to certify that work entitled 'Neuromarketing Business Applications: A Systematic Literature Review and Future Research Directions' is a piece of work done by Kritika Sharma and Muskan Lohia under my guidance and supervision for the partial fulfillment of degree of PGDM at Delhi School of Business.

To the best of my knowledge and belief this study embodies the work of the candidate. This requirement of the rules and regulations relating to the 'Capstone Project' of the institute, is up-to the standard both in respect of content and language for being referred to the examiner.

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Neuromarketing Business Applications: A Systematic Literature Review and Future Research Directions

Table 1: Acronyms

Acronym	Full Meaning
EEG	Electroencephalography
fMRI	Functional Magnetic Resonance Imaging
SPAR-4	Scientific Procedures and Rationales for Systematic Literature Reviews
MEG	Magnetoencephalography
ROI	Return on Investment
SLRs	Systematic Literature Reviews
NeR	Neuro-Enhanced Reality
CNN	Convolutional Neural Network
AR	Augmented Reality
VR	Virtual Reality

Keywords: Neuromarketing, Protocol, Neuroimaging Techniques

ABSTRACT

Neuromarketing is an interdisciplinary field that is emerging in the marketing domain, offers deep insights into consumer behaviour, and helps to make informed marketing strategies across industries. This review of the literature using the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4) method aims to bring together the previous work, spot trends, and show where more research is needed in the business uses of neuromarketing. Peer-reviewed articles are searched for using well-known search criteria and databases. The articles focus on the results from different fields, such as e-tourism, healthcare, cybersecurity, and banking, using neuroscientific methods, such as neuroimaging technologies like EEG and fMRI. Peer-reviewed articles are searched for using well-known search criteria and databases. The articles focus on the results from different fields, such as e-tourism, healthcare, cybersecurity, and banking, using neuroscientific methods, such as neuroimaging technologies like EEG and fMRI. By adopting SPAR-4 protocol, the editors provide consolidated knowledge, scholarly disclosure, and future research directions for neuromarketing business applications.

INTRODUCTION

The marketers now have a different approach to their business because they have the answers to consumer behaviour through the discovery of neuromarketing. It combines cognitive and explanatory concepts of neuroscience with marketing theory, thus better understanding the sensitivity of consumer's unconscious and emotional reactions to any experience. Basically, neuromarketing is the science related to either changing consumer behaviour or greatly improving companies' marketing efforts. The marketing, along with some brain functions, is implemented, which cannot be assessed in traditional ways, but through the use of neuromarketing techniques, the same can be known. Here, eye trackers and GSR sensors are the neuromarketing tools that are used for the purpose of understanding the response generated in the audience towards different promotional content. For companies to keep pace with the increasing intensity of competition within their markets, it is no longer enough to have an understanding of why consumers purchase what they do; businesses must now also be aware of the underlying biology that drives those decisions.

Also known as bio-marketing, neuro-marketing studies such as MRI and electroencephalography show the areas of the brain that react to different stimuli and thus may help marketers design more effective marketing campaigns. Furthermore, digital platforms and social media can use neuromarketing research to understand consumer behaviour in the digital age. By studying Neuromarketing reports on consumer choices for various kinds of products or services, firms can change their approaches based on the predicted reactions of customers towards different marketing strategies. At the same time, unlocking better experiences for customers is one major importance of neuromarketing.

The journey into neuromarketing begins by exploring how this new discipline was developed historically. Marketing used questionnaires, focus groups, or even simple observations. Still, when it comes to the origins of neuromarketing, there has been a shift away from this kind of thinking toward looking more closely at what happens at the source of our decision-making processes—our brains.

The work done by (Ahlfors & Mody, 2016) is a real and long-awaited scientific solution of the neuromarketing field. They exerted the dual effect of MEG to record brain responses to marketing assets. MEG enables scientists to monitor the brain activity directly and the connectivity in the brain in fact time. With such contemporary technologies giving consumers much more power over the marketing landscape, this technology nowadays has greatly empowered our knowledge about consumer behaviour and has opened the door to more pinpoint and effective marketing strategies.

Alarmed, technology developers looked for new opportunities in relation to optics, not just customer services. The research paper carried out by (Meißner & Oll, 2019) played the role of a groundbreaking one within the area of e-performance assessment using eye-tracking. These guys showed the attendees how eye tracking technology can reveal insights into attention,

moods and decisions at work. This route from handling the individual element to organising the whole enterprise just tells how neuromarketing mediations can be effectively used in business organisations.

The line between what consumers desire and what they actually purchase has become increasingly blurred in the tourism and hospitality industry, a phenomenon examined by (Lei et al., 2022) in their exploration of Neuromarketing. They do assess the stand of the authorities on the utilisation of brain-tracking strategies like EEG, fMRI, and skin conductance to assess emotional responses of the audience in this field of technology. The authors propose strengths and flaws of any technique, where they offer views as a strength of a technique while also sighting barriers to such a technique.

As online marketplaces with diverse applied models become more prevalent, the ethical dimension of personalised pricing also comes into consideration. While evaluating the outcome of research, (Rest et al., 2020) argues that the central cause of deceitful pricing is traders' insincerity. However, it would be a side-shoot which is the base for understanding the nuances of personalised pricing, even when it becomes the norm of trade, providing the companies with an opportunity to handle the challenges of a new ethical digital world in which everyone has almost ready set of means to create some really smart pricing tools. The study shows that perception of unfair prices and high prices activate the part of the brain that processes punishment, while the brain's reward system is activated by price reductions.

It was (Robaina-Calderin & Martin-Santana, 2021) who used neuromarketing from a different angle instead. They conducted content analysis around neuromarketing that has been utilised in the healthcare industry to encourage the consumption of healthful products, particularly among youth and young adults. According to studies, neuromarketing has been successful in pinpointing the mental and emotional cues that influence particular brain regions and motivate consumers to eat healthily. Also, the advertising effectiveness of anti-tobacco commercials has been examined using neuroimaging methods like fMRI.

Scholars (Casado-Aranda & Sanchez-Fernandez, 2021) launched an innovative memory in neuromarketing by looking into physiological approach research to address marketing choices and consumer behaviour. In the same order of thought, they indicate that new neurophysiological tools whose data can be integrated with traditional self-reports are described and that they are proposed to be used together. Their findings imply the efforts to conduct research in the area of new product decisions, pricing, communication, and retail strategies, which will immensely develop the understanding of marketing in the future.

According to (Mostafa, 2014), the functional neuroimaging technique has its epitome in fMRI, and it is, therefore, well equipped to show consumer behaviour. Using the neuroimaging data researchers can therefore cover as far as the subconscious reactions, the emotional and cognitive processes, and most importantly how consumers make decisions and summarise it. This leads to thorough understanding of consumer behaviour, which is above the scope of traditional marketing research which is a mindset of marketers.

(EDLA et al., 2021) enumerate a particular method for misrepresentation identification, which is based on Electroencephalography (EEG). This work took advantage of a novel psychiatric technique that visualised legal brain areas of deceit and is particularly promising as it indicates potential use of true polygraph imaging and truth-telling systems. Thus, it expands traditional marketing domain.

In neuromarketing, you can find something of significance for every field of study that needs more investigations. A key thing to begin with is offering a clear overview of the concept, so that readers can get a general perception of what neuromarketing is all about. This foundation lays the basis for more profound reflections in the field. The mounds of data have shown unexpected paths for new thinking and theory building in this science, which is multidisciplinary. While neuroscience combines forces with marketing, companies will have more insights on how to create interaction and understanding with their future consumers. Therefore, new merits depend on the market environment, which is a matter of constant change.

MOTIVATION AND RESEARCH OBJECTIVES

While neuromarketing continues to gain traction in academic research and industry practices, there is a need to integrate the current studies, identify futuristic trends, and provide a thorough review of research findings on how different marketing applications of neuromarketing are used in businesses. This research endeavours to bridge the gap by employing a distinctive research technique, namely - "Systematic Literature Review Analysis (SLR) to unravel the application of neuromarketing in business".

By organizing a meticulous review of the already published literatures, this study aims to identify prevailing trends, elucidate thematic patterns and theoretical frameworks, and uncover potential research gaps or emerging trajectories warranting further exploration of neuromarketing. The key objectives of this study include:

RO1: The investigation of the development of neuromarketing approach from its origins to its current integration with brain research, assessment of neuroscientific tools effectiveness, and its influence on consumer behaviour and understanding.

RO2: This study takes an in-depth look at the industry-specific applications of e-tourism, healthcare, cybersecurity, and banking, where challenges and opportunities are identified.

RO3: The objective of research is to determine the places where neuromarketing insights are introduced into marketing strategies, and all such gaps are further traced to ensure the continuity of research and development in the field.

RESEARCH QUESTIONS

The division of the research questions into three sub-questions ensures a systematic investigation of the main topic:

RQ1: How have previous and ongoing studies been dispersed throughout the functional themes of neuromarketing?

RQ2: How can we make marketers realise the importance of evolving the marketing domain with neuromarketing to understand consumer behaviour?

RQ3: Identifying how ethical considerations and other research gaps are raising concerns in neuromarketing studies? What can be the future research directions for the neuromarketing environment for the researchers?

RESEARCH CONTRIBUTIONS

RC1: Utilises systematic analysis to comprehensively explore neuromarketing business applications in various fields.

RC2: Crafts a structured framework that unveils present trends, challenges, and innovations, providing a panoramic view of neuromarketing's impact on understanding consumer behaviour for marketing.

RC3: Amplifies insights through systematic analysis, spotlighting and highlighting influential authors, pivotal publications, and scholarly impact within the field of neuromaketing.

RC4: Extended valuable insights for both scholars and stakeholders, informing practitioners, policymakers, and industry leaders about the rapidly evolving neuromarketing ecosystem.

RC5: Enhances understanding of neuromarketing's revolutionary potential and identifies future directions that assists further scholarly research.

RC6: Provides a compelling narrative that underlines the multivariate significance of neuromarketing applications within the marketing domain, taking into consideration the raising awareness of ethical concerns in neuromarketing.

LITERATURE REVIEW

There are various angles from which one could look at neuromarketing, a rising discipline that combines neuroscience with marketing. If we consider it in totality, the study suggests that neuromarketing can be used for different purposes, hence providing insights into numerous related fields. It's about how visual attention and consumer engagement in advertising recall impact the e-tourism industry, according to (Muñoz-Leiva et al., 2018) research. This research explained how fixation counts, visit duration and banner type affected consumers' memorization abilities. As to the effectiveness of online advertisements, this study was a breakthrough in understanding how visual attention works.

Moving into the social media domain, (Zhou & Xue, 2021) study sought to examine how visual branding strategies affect Instagram. By utilising an eye-tracking experiment, they measured participants' eye movements towards brand posts and eventually the evaluation of the brand. In practice, this study offers a practical framework for obtaining brand identities through visual strategies based on David Aaker's "brand identity planning model'This work brought out some specific elements of visual branding as practiced on typical social networking sites since their engagement is principally image-based and has a limited attention span. In the research by Edla et al. (2021), a new method of deception identification was proposed using electroencephalogram (EEG) signals. This current research was focused on developing a reliable method of human behavior identification and analysis based on EEG records. For instance, the results reveal that real-time P300 signal processing has high classification accuracy that can be applied to reliable polygraph tests and lie detection systems. This novel application of neuromarketing techniques goes beyond traditional marketing domains into the cybersecurity realm.

Considering the banking sector, Monica et al. (2019) investigated the potential of neuromarketing towards studying customer behaviour on banking websites. Their results suggest that ad banners, partnership details, and very bright colours are meant to attract your attention for a long time. The research indicated that the design of a website is simple and helps in improving online communication and service provision significantly. With the change in the marketing landscape, neuroscience's entry into business becomes increasingly relevant. In general terms (Spence, 2019) depicts different ways in which neuroscience is useful to comprehend human behaviour for commercial applications like neurorobotics, neuromarketing, and neurogastronomy. Therefore, it identifies practical problems faced during commercial neuromarketing research while also highlighting the advantages and disadvantages of employing real-life applications based on neuroscience.

The researchers (Yerdon et al., 2021) examine eye-tracking measures as a tool to detect insider threats in organisations. They propose the insertion of "active indication probes" (AIPs) into a simulated workflow to provoke IT-like eye movement behaviour. While their research has potential, they are concerned that it still needs to be validated for ethical considerations. In the paper CNN-based Facial Expression Recognition, (Ramasubbareddy et al., 2019) presented a

facial recognition system through CNN and achieved up to 92% accuracy. They explored its applications in security, lie detection, and human machine interaction, as well as the benefits and technical complexities involved in them.

(Hilken et al., 2022) introduced Neuro-Enhanced Reality (NeR), which is the integration of neuroimaging and neurostimulation with augmented reality (AR) & virtual reality (VR). They aimed at enhancing service communication. Authors discussed opportunities associated with NeR technology or future needs of scientific research using this same particular technology. The ethical issues surrounding neuromarketing are examined in (Ulman et al., 2015), with a focus on informed consent, privacy, manipulation, and exploitation of vulnerable groups. They promoted dialogue about bioethics, public participation, and legislative frameworks to guarantee   ethical   behaviour.

The main applications and emerging trends are improved security systems through eye-tracking and facial recognition which could be used for safety purposes. More natural user experiences can also be achieved through NeR, specifically designed to make users feel immersed in these experiences. Ethical considerations and societal impacts are discussed in the paper for the collection and usage of personal information via neuroimaging or eye-tracking techniques, which triggers concerns about privacy. Full disclosure is important in such studies, where individuals must be made fully aware of the implications of the usage of these technologies.

In summary, this literature review presents a wide range of neuromarketing applications, each offering a distinct outlook on the fusion of neuroscience and marketing. Also, it draws our attention to the ethical concerns and privacy measures to be taken care of. Combining these findings helps in developing neuromarketing to gain better understanding of neural roots behind consumer decision making. In view of the multifaceted nature of customer behaviour, these studies provide some useful advice on what directions can be followed in future studies when it comes to organising prospective studies that will ensure that the interdisciplinary field of neuromarketing never stops revealing new shades in the dynamic business and marketing environment.

While the studies shed light on emerging technologies, and their applications, there are several gaps that need to be addressed for further studies:

- Many studies rely on controlled laboratory settings for investigation of eye-tracking for insider threat detection. In addition, studies such as one by CNN based facial expression recognition technology showed its inability to operate in uncontrolled conditions. The truth is that these technologies tend to fail when they are used to recognize facial expressions since there are different lightings and backgrounds that can affect their accuracy and strength in real life situations.

- Further, the study admits that there is a need to find out how NER can be incorporated into service communication policies and organisational cultures in relation to the possible effects on employee trust and compliance. At the same time, ethical aspects of

neuromarketing should be taken into consideration for further investigation. In (Ulman et al., 2015) work, ethical issues in neuromarketing are discussed but more research is required for a comprehensive framework for responsible development and use of different technologies. The latter involves such issues as user privacy concerns, informed consent requirements, potential manipulation concerns, and long-term societal implications, among others.

● A considerable research gap is showcased by (Pagan et al., 2020) in their study regarding neuromarketing and sustainability. By using eye tracking and electroencephalography (EEG), the authors demonstrate how this may be done to evaluate aspects of sustainable consumption, such as responses to waste recycling and the impact of sustainable design; however, analysis showed that very few studies employed these methods for studying the topic area. This implies that more studies are needed to investigate how neuromarketing tools can help in understanding buyer behaviour and decision making within a framework of sustainability.

● Another research gap exists in analysing user experience and long-term societal impacts of neuromarketing. The instance of this (Hilken et al., 2022) emphasises the need for research that deal with customer satisfaction in terms of communication enhancement through NeR technology and its effectiveness as well. As a matter of fact, there is little understanding about long-term societal/psychological effects of NeR or other emerging technologies at large. In order to understand potential consequences on human behaviour, cognition, social interactions, studies in this area are needed as well. Also, according to (Ulman et al., 2015), it is important to know how the public will perceive evolving technologies since it may be useful while developing open practices towards citizens' fears and worries.

RESEARCH METHODOLOGY

IDENTIFICATION

Topic Selection
On latest developments in neuromarketing research, neuromarketing strategies, and business practices in neuromarketing

↓

Formulation of Research Questions
Formulating research questions to guide the systematic literature review (SLR)

↓

Selection of Database
Scopus is selected as the main research database for reasons related to its large and global coverage of scholarly papers

↓

Keywords Selection

"Neuromarketing" AND "Applications"

↓

SCREENING

First Level Screening
N1 = 301 (Keywords "Neuromarketing" AND "Applications")

↓

Data Collection and Filtering
Criterion for inclusion – articles only, publication stage is final, source type is peer-reviewed journal, English language articles, and exact-word selection

↓

Studies after exclusions

N2 = 143 (Keywords and Articles Only)
N3 = 142 (Keywords, Articles, and Publication Stage "Final")
N4 = 141 (Keywords, Articles, Publication Stage "Final", and Source Type "Journal")
N5 = 121 (Keywords, Articles, Publication Stage "Final", Source Type "Journal", and Language "English")

FINAL SELECTION

Refinement

N6 = 81 (Keywords, Articles, Publication Stage "Final", Source Type "Journal", Language "English", and Exact-Keyword "Neuromarketing")

↓

Final Selection

Records included in SLR after quantitative synthesis and after reading the abstracts.
N7 = 66

↓

DOCUMENTATION

Data Analysis
Key articles are analysed in detail to extract the most important takeaways

↓

Data Synthesis
Results were summarised to answer the set research questions and thereby complete the picture of the research landscape

↓

Report and Documentation
The research findings include evidence of key findings, methodologies and approaches observed, and possible areas for future research.

Primary goal is to provide researchers and professionals with an evidence-based resource that will enable them to build upon the existing body of knowledge in neuromarketing and ensure that the field is up to date.
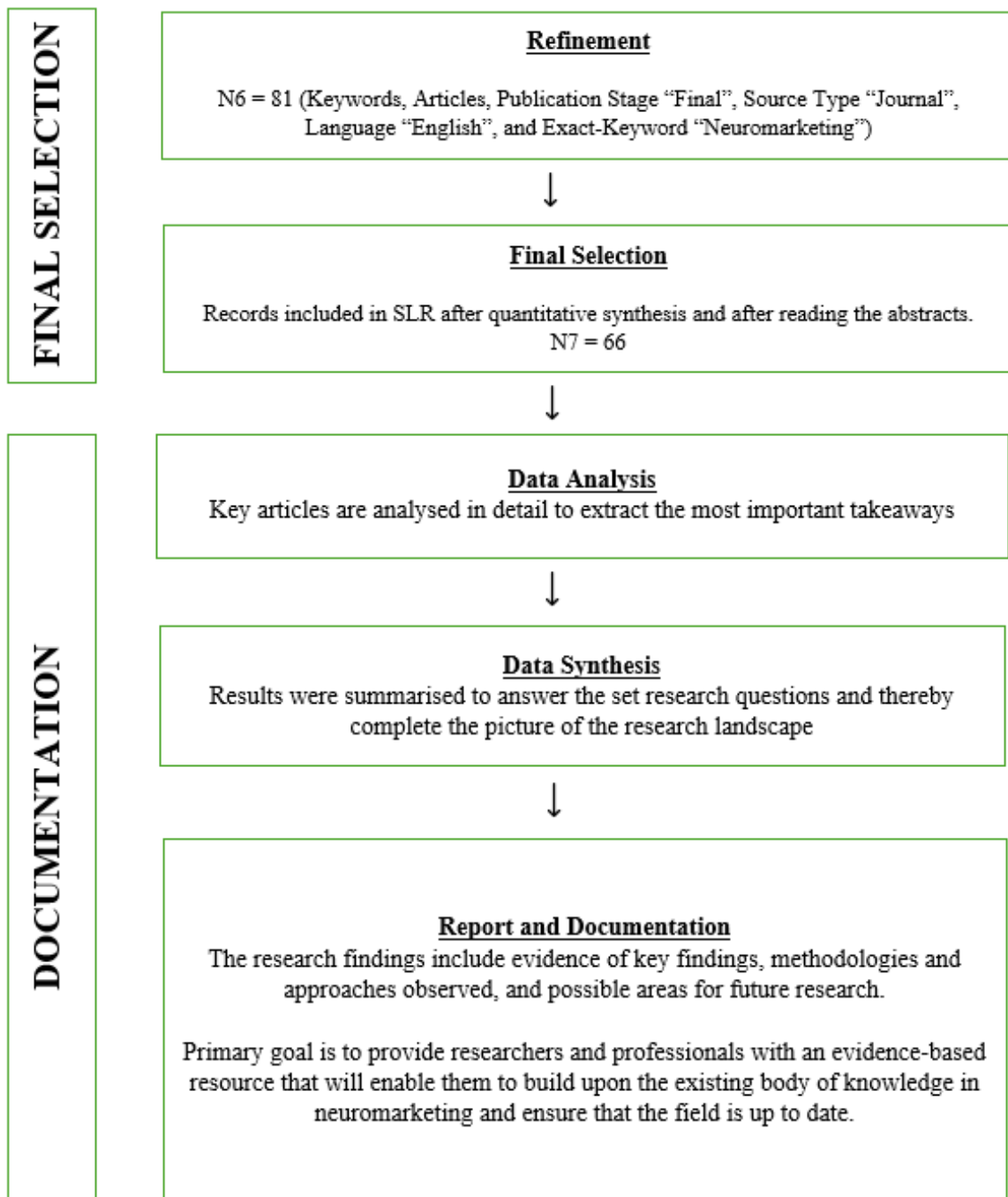
Figure 1: Research Methodology

Building on the insights shared by (Paul et al., 2021) and (Bhardwaj et al., 2023) regarding the systematic literature review (SLR) methodology, this study employs an approach to represent the intersections of neuromarketing, branding, consumer behaviour, and advertising in different fields. The goal is to address existing research gaps and identify avenues for future exploration in these domains. This methodology unfolds in several key stages:

Topic Selection: The paper topic, "Neuromarketing Business Applications" was carefully selected following a comprehensive examination of the latest developments in marketing research, marketing strategies, and business practice. However, it was viewed as one of the most booming areas and, at the same time, the area that was crucial to examine in order to develop better marketing.

Formulation of Research Questions: The initial step involves formulating research questions to guide the systematic literature review. These questions will probe not only the academic research papers and neuromarketing case studies but also:

      a. the methodologies used in systematic literature reviews,
      b. the neuroscientific devices used in the research, and
      c. the identification of research gaps in advertising, branding, and consumer behaviour.

Selection of Database: The Scopus global research database is selected as the main search engine for reasons related to its large coverage of scholarly papers. The search provides a holistic coverage of the field of neuromarketing and allied fields where technology evolution and human mind-shift are extremely fast.

Keywords Selection: The most comprehensive keywords and phrases were handpicked as they have the purpose of defining the multifaceted characteristics of neuromarketing in the business world. These will consist of neuroscientific concepts (e.g., EEG, fMRI), marketing concepts (e.g., branding, advertising), behavioural concepts (e.g., decision-making, emotions), and business implications (e.g., ROI, market segmentation). The selection process will be iterative, trying to perfect the pilot searches by involving subject matter experts.

[Keywords and Boolean Operators: EEG, emotion classification, affective brain-computer interface, neuromarketing, neuroscience, facial expression, computer vision, machine learning, expression-specific features, innovation, neuroeconomics, social neuroscience, marketing, neuroimaging, neuroergonomics, neurogastronomy, neuroscience-inspired design, apparel attractiveness, emotion, frontal asymmetry, eye tracking, blink detection]

Data Collection and Filtering: The initial screening process consists of systematically going through the obtained results and picking those articles which are more related to the research questions. One of the criteria for inclusion is peer-reviewed journals, publication in English language, and works published after 2011. Secondary and questionable data are cut out to select top-notch papers that will be used for the write-up.

Journal Selection: A strict selection criterion will come into force to pinpoint impactful journals known for their presence as an outlet for multidisciplinary research in neuromarketing, neuroscience, consumer psychology, and related fields. Given that first and foremost journals with rigorous double blinded peer-review processes, high citation impact factors, and relevance to the research topic will be prioritised.

Refinement and Final Selection: A comprehensive assessment phase involves a deeper screening of the initially identified relevant documents. The final selection is refined based on adherence to inclusion criteria, specifically focusing on the context of neuromarketing in advertising communication and consumer behaviour.

Data Analysis and Synthesis: The key articles are analysed in detail to extract the most important takeaways. The results were summarised to answer the set research questions and thereby complete the picture of the research landscape in neuromarketing, branding, advertising, and consumer behaviour.

Report and Documentation: The research findings are reported in a systematic way, which includes evidence of key findings, methodologies and approaches observed, and possible areas for future research. Our primary goal is to provide researchers and professionals with an evidence-based resource that will enable them to build upon the existing body of knowledge in neuromarketing and ensure that the field is up to date.

DISCUSSION AND IMPLICATIONS

The basic science behind the use of neuromarketing concepts is to know how consumers are interacting with the brand or products. Sometime even the consumers do not know what they want, here neuromarketing fills the gap for marketers. This fulfilment of gap can help the companies to formulate targeted strategies, redesigning of products or even development of new products.

One of the premium examples of this of Pepsi. The company ran an experiment to know the neuro response of consumer who drank Pepsi and those who drank coca cola. Response showed that people who drank Pepsi showed major neuro pleasing response in their brain in comparison to coca cola. With this the company came out with their campaign of "The choice of new generation" (Kucun, 2022)

Through this systematic literature review that encompass various domains, this study throw light on the various applications of neuromarketing in different industries like Consumer goods, e-tourism, healthcare, cybersecurity, and banking. By using neuroscientific techniques like EEG, fMRI, and eye-tracking researchers can study workings of the human brain and find the link between cognitive and emotional responses that shape consumer preferences.

However, alongside its growing potential, neuromarketing also raises questions on its ethical considerations that requires careful use of the technique. Issues like consumer privacy, informed consent, and the potential for manipulation require thoughtful deliberation to ensure responsible research practices and protect consumer rights.

Theoretical Implications:

Neuromarketing acts as a bridge between neuroscience and marketing. Many underlying cognitive and emotional processes drive consumer behaviour. This integration expands the theoretical frameworks of both fields and fosters a deeper understanding of neurological

mechanisms' influence on marketing phenomena. It helps to find answers for the neural basis of decision-making and contributes to the development of models that hold up for both rational and emotional aspects of consumer behaviour.

Furthermore, practicing advanced neuroimaging techniques in marketing such as EEG and fMRI, can assist researchers to measure the neural responses of consumers to marketing stimuli. This provides empirical support for theoretical constructs in marketing theory. This scientific validation of research enhances the credibility of marketing research and offers empirical evidence for theoretical propositions and hypotheses.

However, this review also highlights the need to incorporate cultural sensitivity in neuromarketing research. By acknowledging and highlighting the cultural differences in neural responses, researchers can develop culturally sensitive theories and models stating the influence of cultural factors on consumer behaviour. These can account for variations in consumer behaviour across different cultural contexts and thus, fostering a deeper understanding of consumer behaviour in diverse cultural settings.

Practical Implications:

Beyond theory neuromarketing insights offer practical implications for optimising and forming marketing strategies across various industries. By using neuroscientific findings, marketers can tailor their strategies to match consumers' subconscious desires and motivations. This may include refining and upgrading advertising messages, product designs, and pricing strategies to align with consumers' neural responses. Thus, eventually enhancing the effectiveness of marketing campaigns and driving business success along with the personalisation of marketing strategies.

Understanding the neural mechanisms of consumer engagement enables marketers to create more engaging brand experiences. By drawing attention into consumers emotions through neuromarketing techniques, companies can design interactive marketing initiatives that can captivate audiences and foster their brand loyalty. This enhanced consumer engagement helps businesses improve brand affinity and advocacy, driving a long-term customer relationships and sustainable growth in business.

Neuromarketing insights also stimulate innovation and differentiation in product development and marketing strategies. By studying consumers' subconscious preferences, desires and motivations, companies can identify untapped market opportunities and develop innovative products and services that resonate with the consumers on a deeper level. This helps companies to focus on consumer-centric innovation while differentiating themselves in competitive markets and maintain a competitive edge.

Furthermore, the dynamic nature of neuromarketing leads to continuous learning and adaptation of marketing practices in businesses. By staying ahead of advancements in neuro research and emerging trends, companies can remain agile and responsive to evolving consumer preferences, ensuring long-term sustainable business success.

CONCLUSION

In conclusion, this systematic literature review provides a comprehensive view of varied applications and implications of neuromarketing in the businesses. It also highlights, how neuromarketing outputs can be used by the marketers to understand consumer behaviour, and form strategies accordingly. Neuromarketing, as an interdisciplinary field, helps to bridge the gap between neuroscience and marketing, imparting useful insights into consumer buying behaviour and decision making. With the evolving neuroscientific techniques such as EEG and fMRI, marketers gain a deeper understanding of the consumer's subconscious and emotional responses to the marketing stimuli, helping them craft effective marketing strategies and ultimately improving consumer satisfaction. From e-tourism to healthcare cyber security to banking, from evaluating the effectiveness of online ads to detecting eye- tracking measures, neuromarketing has diverse business applications. Overall, this research paper serves as a valuable source of insights for scholars, practitioners, and industry leaders who are interested in the field of neuromarketing. Yet there are certain gaps in the earlier research that need to be fulfilled to delve deeper into the neuromarketing domain and its applications. These existing gaps and unexplored emerging trends are yet to be addressed which can help in shaping the future of marketing practices and learning the consumer behaviour in decision making.

FUTURE RESEARCH DIRECTIONS

The differences in neuromarketing findings between cultures and societies are intriguing. This would be useful in designing marketing plans for certain segments of the target audience because it shows how culture affects buying patterns. Monitoring customer preferences over a long period of time helps to understand the dynamics of their preferences and reactions to different marketing strategies. It may also enable marketers to assess if they have succeeded or not by applying these neuro-marketing ideas over time and plan marketing strategies accordingly. The researchers can delve deep into how neuromarketing techniques can be applied to real world business situations, such as environments and channels, to understand consumer buyer behaviour within a framework of sustainability. Trying these methods outside the controlled conditions may provide more accurately refined evidence that indeed targeting consumers is possible through them. There is also a critical need to set up guidelines on the use of neuromarketing methods in advertisements and consumer studies. Thus, this area of neuromarketing can be ethically improved through considerations such as privacy, consent, and manipulation, which requires transparency to be incorporated among practitioners. As a result, understanding data privacy, consent, and fairness issues in neuromarketing involves engaging stakeholders with diverse backgrounds and creating ethical frameworks that prioritise consumer well-being and welfare of the society. Keeping track of advancements in neuroimaging technology to improve the accuracy and reliability of neuromarketing measurements. It could, however, be less difficult to conduct real life neuromarketing studies by applying technologies such as EEG devices or wearable sensors. A study on encouraging collaboration between neuroscientists and marketers to deepen our knowledge of the brain

mechanisms that influence consumer behaviour. This can give insights from neuroscience as to how people make decisions and respond emotionally to marketing stimuli. Neural underpinnings of trust; impact on brand loyalty & customer engagement. It is possible that this will entail studying neural responses to trust-based marketing signals and communications, as well as their impact on consumer attitudes and behaviours. Development of consumer behaviour predictive metrics and algorithms based on neurons. This would integrate machine learning techniques that use artificial intelligence for developing predictive models for consumers' preferences or choices. Studying the emergence of neuro-commerce platforms and neuro-marketplaces that integrate neuroimaging technologies into online shopping experiences. This could involve studying the impact of personalised recommendations and neuro-adaptive interfaces on consumer satisfaction and purchase behaviour.

LIMITATIONS

Neuromarketing has been described in a very wide range of applications and perspectives within this research paper. Nonetheless, the extensive topics covered might not allow for deeper analysis on some of them. As such, it might be too shallow to sufficiently explain some concepts and may not offer enough insights into particular aspects of neuromarketing. The literature review is heavily reliant on published research articles, which could make it

susceptible to publication bias. It's possible that studies with significant findings are more likely to be published, while studies with null results or inconclusive findings may not be represented in the review. Hence, this can lead to distorted overall conclusions from the literature. The methodological heterogeneity used in the papers employed for the literature review may range from experimental studies to qualitative analysis. Different methods are used, which could make it hard to compare results or draw conclusions from these different investigations. This could be because of a confounding variable that changes the validity results and makes it harder to make sure that samples, participant demographics, and experimental design are all the same. Limitations of generalisation may restrict the findings of most studies in this literature review, which may be conducted in controlled laboratory settings or specific industries. The paper may not properly address how various consumer populations or cultural contexts can benefit from neuromarketing insights. Even though ethical issues pertaining to neuromarketing are fleetingly discussed, the paper may fail to comprehensively analyse the ethical implications of using neuroscientific techniques in marketing. Topics like privacy concerns, informed consent, potential manipulation, and societal impacts should have a more thoroughgoing treatment through discussion and analysis. While potential future research directions are outlined in the research paper, there are no definite recommendations or strategies on how to fill these gaps identified by the literature. The paper would benefit from a more thorough exploration of difficult areas such as the coming methodological challenges for researchers and practitioners, improving generalisation, and managing ethical dilemmas within neuromarketing research.

REFERENCES

Ahlfors, Seppo P., and Maria Mody. "Overview of MEG." Organisational research methods 22.1 (2019): 95-115.

Casado-Aranda, L. A., & Sanchez-Fernandez, J. (2022). Advances in neuroscience and marketing: analysing tool possibilities and research opportunities. Spanish Journal of Marketing-ESIC, 26(1), 3-22.

Edla, Damodar Reddy, et al. "An efficient deep learning paradigm for deceit identification test on EEG signals." ACM Transactions on Management Information Systems (TMIS) 12.3 (2021): 1-20.

Cavalari, R. N., & Romanczyk, R. G. (2015). Quantifying Supervisory Decision Making: Eye-Tracking Technology Applications for the Promotion of Child Safety. *Journal of Behavioural Decision Making*, *28*(4), 360-368.

Daugherty, T., Hoffman, E., & Kennedy, K. (2016). Research in reverse: Ad testing using an inductive consumer neuroscience approach. Journal of Business Research, 69(8), 3168-3176.

Baldo, D., Parikh, H., Piu, Y., & Müller, K. M. (2015). Brain waves predict success of new fashion products: a practical application for the footwear retailing industry. *Journal of Creating Value*, *1*(1), 61-71.

Spence, C. (2019). Neuroscience-inspired design: From academic neuromarketing to commercially relevant research. *Organisational Research Methods*, *22*(1), 275-298.

Royo, M., Chulvi, V., Mulet, E., & Galán, J. (2018). Users' reactions captured by means of an EEG headset on viewing the presentation of sustainable designs using verbal narrative. *European Journal of Marketing*, *52*(1/2), 159-181.

Meißner, M., & Oll, J. (2019). The promise of eye-tracking methodology in organisational research: A taxonomy, review, and future avenues. *Organisational Research Methods*, *22*(2), 590-617.

Cakir, M. P., Çakar, T., Girisken, Y., & Yurdakul, D. (2018). An investigation of the neural correlates of purchase behaviour through fNIRS. *European Journal of Marketing*, *52*(1/2), 224-243.

Muñoz-Leiva, F., Liébana-Cabanillas, F., & Hernández-Méndez, J. (2018). Etourism advertising effectiveness: banner type and engagement as moderators. *Journal of Services Marketing*, *32*(4), 462-475.

AOKI, H., & SUZUKI, S. (2019). Eye Tracking-Based Reverse Inference Approach for Customers' Behavior Analysis at Japanese Udon Restaurant—Preliminary Application of Reverse Inference Procedure for Detection of Problematic In-Store Display—. *Journal of Japan Industrial Management Association*, *69*(4E), 207-219.

Sung, B., Wilson, N. J., Yun, J. H., & Lee, E. J. (2020). What can neuroscience offer marketing research? *Asia Pacific Journal of Marketing and Logistics*, *32*(5), 1089-1111.

Alonso Dos Santos, M., Calabuig Moreno, F., & Crespo-Hervás, J. (2019). Influence of perceived and effective congruence on recall and purchase intention in sponsored printed sports advertising: an eye-tracking application. *International Journal of Sports Marketing and Sponsorship*, *20*(4), 617-633.

Monica, Ţ. B., Iuliana, C., & Mihai, Ţ. (2019). Studying the user experience in online banking services: an eye-tracking application. *Studies in Business and Economics*, *14*(2), 193-208.

Constantinescu, M., Orindaru, A., Pachitanu, A., Rosca, L., Caescu, S. C., & Orzan, M. C. (2019). Attitude evaluation on using the neuromarketing approach in social media: Matching company's purposes and consumer's benefits for sustainable business growth. *Sustainability*, *11*(24), 7094.

van der Rest, J. P. I., Sears, A. M., Miao, L., & Wang, L. (2020). A note on the future of personalised pricing: Cause for concern. *Journal of Revenue and Pricing Management*, *19*, 113-118.

Pagan, N. M., Pagan, K. M., Teixeira, A. A., de Moura Engracia Giraldi, J., Stefanelli, N. O., & de Oliveira, J. H. C. (2020). Application of neuroscience in the area of sustainability: mapping the territory. *Global Journal of Flexible Systems Management*, *21*(Suppl 1), 61-77.

Zhao, M. (2022). The impact of cognitive conflict on product-service system value co creation: an event-related potential perspective. *Journal of Cleaner Production*, *331*, 129987.

Zhou, L., & Xue, F. (2021). Show products or show people: An eye-tracking study of visual branding strategy on Instagram. *Journal of Research in Interactive Marketing*, *15*(4), 729-749.

Casado-Aranda, L. A., & Sanchez-Fernandez, J. (2022). Advances in neuroscience and marketing: analysing tool possibilities and research opportunities. *Spanish Journal of Marketing-ESIC*, *26*(1), 3-22.

Muñoz Leiva, F., Rodríguez López, M. E., & García Martí, B. (2022). Discovering prominent themes of the application of eye tracking technology in marketing research.

Edla, D. R., Dodia, S., Bablani, A., & Kuppili, V. (2021). An efficient deep learning paradigm for deceit identification test on EEG signals. *ACM Transactions on Management Information Systems (TMIS)*, *12*(3), 1-20.

Robaina-Calderín, L., & Martín-Santana, J. D. (2021). A review of research on neuromarketing using content analysis: key approaches and new avenues. *Cognitive Neurodynamics*, *15*(6), 923-938.

Bhardwaj, S., Rana, G. A., Behl, A., & de Caceres, S. J. G. (2023). Exploring the boundaries of Neuromarketing through systematic investigation. *Journal of Business Research*, *154*, 113371.

Penrod, J. M. (2023). A history of theories of decision-making and technologies for observation in the service of marketing. *Journal of Historical Research in Marketing*, *15*(1), 52-75.

Lei, M., Chen, W., Wu, J., Zhang, Y., & Lv, Y. (2024). Neurophysiological measures in hospitality and tourism: Review, critique, and research agenda. *Journal of Hospitality & Tourism Research*, *48*(1), 3-31.

Alsharif, A., Salleh, N. Z. M., Pilelienė, L., Abbas, A. F., & Ali, J. (2022). Current Trends in the Application of EEG in Neuromarketing: A Bibliometric Analysis. *Scientific Annals of Economics and Business*, *69*(3), 393-415.

M. Mostafa, M. (2014). Functional neuroimaging applications in marketing: Some methodological and statistical considerations. *Qualitative Market Research: An International Journal*, *17*(4), 343-372.

Xiong, R. R., Liu, C. Z., & Choo, K. K. R. (2023). Synthesising knowledge through a data analytics-based systematic literature review protocol. *Information Systems Frontiers*, 1-24.

Fugate, D. L. (2007). Neuromarketing: a layman's look at neuroscience and its potential application to marketing practice. *Journal of consumer marketing*, *24*(7), 385-394.

Menezes, R. G., Gonçalves, C. A., & de Muylder, C. F. (2016). Sensorial marketing and neuroscience: Neuroscience contributions to the marketing field. *International Business Management (Medwell Journals)*.

Li, S., Lyu, T., Chen, M., & Zhang, P. (2022). The prospects of using EEG in tourism and hospitality research. *Journal of Hospitality & Tourism Research*, *46*(1), 189-211.

Reimann, M., Schilke, O., Weber, B., Neuhaus, C., & Zaichkowsky, J. (2011). Functional magnetic resonance imaging in consumer research: A review and application. Psychology & Marketing, 28(6), 608-637.

Lin, Y. P., Yang, Y. H., & Jung, T. P. (2014). Fusion of electroencephalographic dynamics and musical contents for estimating emotional responses in music listening. Frontiers in neuroscience, 8, 83280.

Ulman, Y. I., Cakar, T., & Yildiz, G. (2015). Ethical issues in neuromarketing: "I consume; therefore, I am!". Science and engineering ethics, 21, 1271-1284.

Lopes, A. T., De Aguiar, E., & Oliveira-Santos, T. (2015, August). A facial expression recognition system using convolutional networks. In *2015 28th SIBGRAPI conference on graphics, patterns and images* (pp. 273-280). IEEE.

De Oliveira, J. H. C., Giraldi, J. D. M. E., Jabbour, C. J. C., Netto, C. F., & Betti, K. C. M. (2015). Improving business innovation and research through the application of neuromarketing with ethics: a framework. International Journal of Business Innovation and Research, 9(1), 52-64.

Mileti, A., Guido, G., & Prete, M. I. (2016). Nanomarketing: a new frontier for neuromarketing. Psychology & Marketing, 33(8), 664-674.

Touchette, B., & Lee, S. E. (2017). Measuring neural responses to apparel product attractiveness: an application of frontal asymmetry theory. Clothing and Textiles Research Journal, 35(1), 3-15.

Lim, W. M. (2018). What will business-to-business marketers learn from neuro-marketing? Insights for business marketing practice. *Journal of Business-to-Business Marketing*, *25*(3), 251-259.

Jukić, S., ĐšĐμčo, D., & Kevrić, J. (2018). Majority Vote of Ensemble Machine Learning Methods for Real-Time Epilepsy Prediction Applied on EEG Pediatric Data. *TEM Journal*, *7*(2).

Taban, R. A., & Crook, M. S. (2018). Eye tracking based directional control system using mobile applications. *International Journal of Computing and Digital Systems*, *7*(06), 365-374.

Krampe, C., Gier, N. R., & Kenning, P. (2018). The application of mobile fNIRS in marketing research—detecting the "first choice-brand" effect. *Frontiers in Human Neuroscience*, *12*, 433.

Brenninkmeijer, J., Schneider, T., & Woolgar, S. (2020). Witness and silence in neuromarketing: managing the gap between science and its application. *Science, Technology, & Human Values*, *45*(1), 62-86.

Monica, Ț. B., Iuliana, C., & Mihai, Ț. (2019). Studying the user experience in online banking services: an eye-tracking application. *Studies in Business and Economics*, *14*(2), 193-208.

Oliveira, J. H. C. D., & Giraldi, J. D. M. E. (2019). Neuromarketing and its implications for operations management: an experiment with two brands of beer. *Gestão & Produção*, *26*, e3512.

Somula Ramasubbareddy, K. Govinda, E. Swetha (2019). Facial Expression Recognition System Using Convolutional Neural Networks.International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-2S4,

Moya, I., García-Madariaga, J., & Blasco, M. F. (2020). What can neuromarketing tell us about food packaging? *Foods*, *9*(12), 1856.

Eijlers, E., Boksem, M. A., & Smidts, A. (2020). Measuring neural arousal for advertisements and its relationship with advertising success. *Frontiers in neuroscience*, *14*, 514113.

Karmarkar, U. R., Carroll, A. L., Burke, M., & Hijikata, S. (2021). Category congruence of display-only products influences attention and purchase decisions. *Frontiers in neuroscience*, *15*, 610060.

Zdarsky, N., Treue, S., & Esghaei, M. (2021). A deep learning-based approach to video-based eye tracking for human psychophysics. *Frontiers in human neuroscience*, *15*, 685830.

Delvigne, V., Tits, N., La Fisca, L., Hubens, N., Maiorca, A., Wannous, H., ... & Vandeborre, J. P. (2022, March). Where is my mind (Looking at)? A study of the EEG–visual attention relationship. In *Informatics* (Vol. 9, No. 1, p. 26). MDPI.

Ahmed, R. R., Streimikiene, D., Channar, Z. A., Soomro, H. A., Streimikis, J., & Kyriakopoulos, G. L. (2022). The neuromarketing concept in artificial neural networks: A case of forecasting and simulation from the advertising industry. *Sustainability*, *14*(14), 8546.

Savelli, E., Gregory-Smith, D., Murmura, F., & Pencarelli, T. (2022). How to communicate typical–local foods to improve food tourism attractiveness. *Psychology & Marketing*, *39*(7), 1350-1369.

Baldo, D., Viswanathan, V. S., Timpone, R. J., & Venkatraman, V. (2022). The heart, brain, and body of marketing: complementary roles of neurophysiological measures in tracking emotions, memory, and ad effectiveness. *Psychology & Marketing*, *39*(10), 1979-1991.

Cenizo, C. (2022). Neuromarketing: concepto, evolución histórica y retos. *Icono14*, *20*(1), 11.

Crespo-Pereira, V., Sánchez-Amboage, E., & Membiela-Pollán, M. (2023). Facing the challenges of metaverse: a systematic literature review from Social Sciences and Marketing and Communication. *Profesional de la información/Information Professional*, *32*(1).

Yerdon, V. A., Lin, J., Wohleber, R. W., Matthews, G., Reinerman-Jones, L., & Hancock, P. A. (2021). Eye-tracking active indicators of insider threats: Detecting illicit activity during normal workflow. *IEEE Transactions on Engineering Management*, *69*(6), 3838-3847.

Hilken, T., Chylinski, M., de Ruyter, K., Heller, J., & Keeling, D. I. (2022). Exploring the frontiers in reality-enhanced service communication: from augmented and virtual reality to neuro-enhanced reality. *Journal of Service Management*, *33*(4/5), 657-674.

Meng, M. (2023). Using Eye Tracking to Study Information Selection and Use in Procedures. *IEEE Transactions on Professional Communication*, *66*(1), 7-25.

Paul, J., Lim, W. M., O'Cass, A., Hao, A. W., & Bresciani, S. (2021). Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR). *International Journal of Consumer Studies*, *45*(4), O1-O16.

Crespo, V., Martínez, V. A., & Campos, F. (2017). La Neurociencia para la innovación de contenidos en la televisión pública europea= Neuroscience for Content Innovation on European Public Service Broadcasters. *Comunicar: Revista Científica Iberoamericana de Comunicación y Educación= Scientific Journal of Media Education: 52, 3, 2017*, 9-18.

Zeng, L., Lin, M., Xiao, K., Wang, J., & Zhou, H. (2022). Like/dislike prediction for sport shoes with electroencephalography: An application of neuromarketing. Frontiers in Human Neuroscience, 15, 793952.