



From Synapse to Sale: Neuromarketing's Impact on Consumer Decision Making

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Abstract

Consumer behaviour is essential to consumer behavior. Companies are in persistent search of new ways to entice consumers and influence their consumer behavior. Neuromarketing is a novel method that has garnered immense attention from researchers as well as companies in the last decade. Since most of the decisions are made unconsciously thus, NM provides a great opportunity for companies to know their consumer in-depth and influence their decisions. This paper reviews the literature to give comprehensive knowledge of tools and techniques used by companies and attempts to present the efficacy of these tools. The study has found that NM is vital in designing the marketing mix of any company. Neuroimaging tool like EEG was found to be used extensively by the companies. However many researchers have suggested a combination of neuromarketing tools with traditional marketing tools to get better results. The increasing popularity of NM also has ethical concerns which have been addressed in the paper. The paper also prescribes future directions for further research.

Keywords: Neuromarketing, consumer behaviour, psychology, marketing research.



Introduction

Human being is complex and so is their brain. The interpretation of brain activity and nervous system responses to stimuli enchants not only science but marketers also. The empowerment of consumers has made them demanding and less loyal. The surge in competitiveness has compelled marketers to find new ways to understand their consumers. The shrinking borders and convergence of markets globally have increased competition thus forcing marketers to find new ways to sustain their less loyal and demanding consumers which explains the neuromarketing boom.

In the words of Laureanti et al. (2022), emotions are the drivers of decision-making and consumer preferences. Neuromarketing offers a great opportunity to gauge consumers' minds to understand their emotions and preferences. Harell (2019) commented that the study of the brain by marketers through the discipline of neuromarketing enables them to forecast customer behaviour and potentially influence consumer choice in their favour. Consumers want more from the products/services than just to satisfy their needs. Companies in their search to gather more knowledge about their consumers and to manipulate their decision-making when making the purchase have employed every tool and technique.

Traditional market research has provided information about consumers gathered by way of surveys, interviews, and observation techniques which is now insufficient given the competition in the marketplace. According to Monin (2011), it paves a pathway to a new market research method Neuromarketing (NM) which is an amalgamation of neuroscience and marketing. Harell (2019) also referred to it as 'consumer neuroscience' which offers great value to marketers. It uses brain scanning to measure neural activity and physiological tracking to gain insights into consumer preferences and its decisions. The high-potential that neuromarketing offer has attracted marketers and researchers alike. The last decade has seen an uprising in the use of neuromarketing methods by companies to understand the concealed behaviour of consumers and a surge in academic research emphasizes the importance of neuromarketing.



Decision making of consumers largely depends on responses to external stimuli. Marketers have started to employ neuroscientific techniques to understand the conscious or unconscious responses of consumers to external stimuli. Harris et al. (2018) reported that the application of methods such as functional magnetic resonance imaging (fMRI), Facial expression recognition (FERS), and Galvanic Skin Response (GSR) in the marketing industry to examine the behavior of consumers and potentially manipulate their decisions is becoming standard practice.

Professor Schmidt invented the term “Neuromarketing” (NM) in 2002. According to the literature ‘Bright House Company’ was the first one to use the NM methods in their advertising company in Atlanta, USA. Researchers like Pereira et al. (2022); Alsharif (2023) mentioned in their scholarly article that this company established the first neuroscience department to conduct marketing research to understand the human spectrum.

Literature Review

Morin (2011) explained Neuromarketing: an emerging field of research as “a combination neuro and marketing...a merging of two fields neuroscience and marketing”. The author further elaborates on the concept of NM as “neuromarketing is to marketing what neuropsychology is to psychology. While neuropsychology studies the relationship between the brain and human cognitive and psychological functions, neuromarketing promotes the value of looking at consumer behavior from a brain perspective”. Harell (2019) cited in his paper, “Neuromarketing loosely refers to the measurement of physiological and neural signals to gain insight into customers’ motivations, preferences, and decisions, which can help inform creative advertising, product development, pricing, and other marketing areas”. Researchers such as Plassmann et al. (2012); Javor et al. (2013) reported NM to be a combination of neuroscience, marketing, and psychology. The intriguing prospect of gaining insights into consumers’ brains has attracted marketers as well as piqued the interest of academicians and researchers to study this rather new field of NM in detail. Companies Coca-Cola and Pepsi, Hyundai have used NM methods to understand the responses of consumer’s brains. Similarly, studies have been conducted to study the impact of neuromarketing on the decision-making process of consumers.



Alsharif et al (2023) stated that the growing use to study consumers' neural and physiological responses toward marketing stimuli demonstrates the rising significance of NM. The traditional marketing ways have their limitations as they heavily rely on consumers' verbal messages however, NM provides a powerful lens to understand the motivations, preferences, and decisions made by consumers. It provides a bridge between consumer decision-making and with neuroscientific method. NM seeks to measure the impact of marketing on the minds of consumers. Kumar and Singh (2015) proclaimed that NM helps in determining where and how consumers' brains react to marketing and advertisements. Kumar and Singh (2015) reported that Gerald Zaltman, a Harvard professor has been attributed to be the pioneer of developing neuromarketing technology in the 1990s and his technique known as the Zaltman Metaphor Elicitation Technique (ZMET) explores the unconscious mind of humans by utilizing various images that trigger positive emotional responses.

NM has widened the scope of research and it is associated with concrete results. Fisher et al. (2010) quoted that NM has been classified as a type of qualitative research that provides quantifiable and graphic results. Fortunato et al. (2014) stressed that the results of NM are more unbiased and more accurate as compared to traditional techniques of marketing. Studies affirm that marketers are energetic and motivated in this new field. Ariely and Berns (2010) expressed dual benefits of this new field. Firstly, it is helpful in revealing the hidden emotions of consumers that they cannot express verbally. Secondly, it provides a new method of marketing research that enables predictions before the products are launched. However, many authors such as Alsharif et al. (2021); Romsoy (2019) have been raised ethical issues from time to time. Researchers like Fugate (2007); Fisher et al. (2010) argued that NM methods render customers transparent and violation of customer's privacy. In the words of Alsharif et al (2023), it is beyond doubt that NM empowers marketers to read customers minds. However, Fugate (2007) cited that the techniques of NM may render consumers as defenseless. Similarly, Fisher et al (2010) mentioned that NM techniques may render consumers vulnerable to irresistible ads and exerting power on purchase decisions of the consumers. Further, Fortunato et al. (2014) underlined the concern for children as they are the most vulnerable group who are fast turning into young consumers.



Objectives of the paper

1. To define and comprehend the theoretical aspects of Neuromarketing
2. To understand the range of techniques of Neuromarketing involved.
3. To comprehend the role of Neuromarketing in consumer decision-making.
4. To outline the practical implications and future research agenda of Neuromarketing.

Materials and methods

The paper draws heavily from existing literature. Though the research on NM and its subfield is attracting researchers it is still in the early stages. It offers unique concepts and avenues yet, the area requires more probing and research (Bharadwaj et al. 2023). The study on NM is claimed to be in the embryonic stage (Morin, 2011, Bharadwaj, 2023).

Qualitative research was conducted utilizing secondary data. The research comprised gathering information regarding NM. Only peer-reviewed articles were selected and analyzed. Journals and articles from *Frontiers in Neuroscience*, *Journal of Consumer Behaviour*, *Journal of Advertising Research*, and SCOPUS data were referred. Keywords like neuromarketing, consumer behaviour, and consumer neuroscience were used to search the databases. The study provides a basic groundwork on the topic and is thus helpful in conceptualizing the NM in future studies.

The paper attempts to understand the various dimensions of NM. It studies the existing literature to comprehensively understand the concept of NM and overviews the range of techniques of NM. The paper assesses the influence NM exerts on consumer decision-making. It synthesizes and reviews the current stock of literature to outline the practical applications of NM and suggest further research agendas for the future.

Tools and Techniques of Neuromarketing

A multitude of neuroscience techniques is applied to anticipate consumer behaviour and decision-making processes. They measure physiological functions like heartbeat, blood pressure, etc., and reflexes like eye fixation, eye tracking, and facial expression to obtain information on consumers' preferences and reveal emotions when exposed to marketing stimuli (Alvino et al., 2020). The knowledge about tools has been reported to be scattered (Alvino, 2020).



The review of the literature has revealed several tools of NM utilized in tapping the brains of consumers. Alvino et al. (2020) have identified seven tools of NM which have been classified into three categories.

1. Behavioral (observations, self-reports, survey)
2. Physiological (electrocardiogram, ECG; Eye tracking, ET; Facial expression recognition fERS, and Galvanic Skin Response, GSR)
3. Neurophysiological. (Electroencephalogram, EEG; Functional Magnetic Resonance Imaging; fMRI and Functional near-infrared spectroscopy, fMRI).

Ramsay (2015) has divided tools into four categories, as follows:

1. neuroimaging tools (fMRI, PET, fNIRS, EEG, MEG, SST, SPET)
2. physiological tools (ECG, ET, EMG, GSR)
3. behavioral measurements (implicit association test, IAT)
4. self-report methods (Surveys, interviews, focus groups).

Alsharif et al., (2023) have identified seven tools of NM in measuring the neural activities of the consumers. They are:

1. Neuroimaging such as fMRI, EEG, and fNIRS,
2. Physiological tools such as ET, EMG, GSR, and ECG.

Studies have cited the use of physiological like ECG, eye tracking, facial expressions and GSR tools to measure consumers' emotional responses to external stimuli (Ramsay(2015);Baraybar-Fernández et al. (2017); Mena et al., (2022). The use of neurophysiological tools like fMRI, EEG, PET, etc. to understand the consumers' unconscious behavior to predict the cognitive responses (Alvino,2020) and reactions to advertisements (Fortunato,2014).There are numerous tools available to quantify the emotions of the consumer however studies have revealed that two tools EEG and fMRI have been frequently used and are quite popular in mapping and measuring the consumer's brain(Alsharif et al., 2023; Mashrur et al,2022; Harell,2019). These tools help in correlating emotional processes and cognitive processes with neural aspects (Alsharif et al., 2021). These two neuroimaging methods are expensive and are unable to exactly pinpoint where



the activity occurs in the brain (Harell, 2019). However, EEG has been recommended to be more popular, efficient, and practical to use (Alsharif et al., 2021).

The physiological methods of measuring are comparatively cheaper and easier to use. They are non-invasive and non-neural methods to measure the cognitive response of the consumers. Methods like eye tracking, GSR, or facial expressions can measure attention or arousal. Eye fixation and pupil dilation are found to be effective in studying behavioral responses from the external environment (Chen et al., 2022). The “scan path” as they are commonly called analyses for how long and what the consumers are looking at. The changes in movements and pupil dilations are primary sources of information on visual perceptions of stimuli (Kalaganis, 2021; Chen et al., 2022).

GSR measures changes in sweat gland activity. It measures emotional arousal by way of skin conductance level (SCL) and short-duration skin conductance responses (SCRs). However, it does not inform the type of emotion whether it is happy or sad thus limiting its use as a sole physiological instrument (Kalaganis, 2021). Facial expressions on the other hand measure the changes in the movement of facial muscles. It is a form of non-verbal communication and is used by human beings to communicate socially. Facial electromyography and computer vision-based decoding techniques are leading in measuring facial expressions. Facial expressions have evolved a lot and they face similar challenges as eye tracking (Kalaganis, 2021).

The growth of neuromarketing has been phenomenal. The advances in technology has propelled this growth and companies are using it to track consumer and even modify their decisions regarding purchase. The aim of NM is to comprehend the neural relation of emotions, attention, memory, and decision-making of consumers (Alsharif et al., 2021). We have identified five tools that are popular and referred to extensively in the literature they are fMRI, EEG, Eye tracking, GSR, and Facial expressions. The following table highlights these tools and their strengths and weaknesses in a nutshell.



	fMRI	EEG	Eye Tracking	GSR	Facial expressions
Concept	Tracks brain activity signals by measuring blood flow in the brain.	Records neural brain signals from scalp through bands or helmets	Records eye movement. Eye fixation and pupil dilation are used to measure attitude towards marketing stimuli	Measures skin conductance like sweat level, heartbeat, and perspiration to analyze the emotional responses	Records facial muscle movements
Findings	Measures neural responses to marketing stimuli like branding, pricing, choices, etc. More detailed responses	Measures emotional style Level of engagement Recall level	analyzes visual perception and cognitive purpose towards marketing stimuli. Measures the attention of the subjects	Measures internal emotional status	elucidates emotion, alertness, cognitive processes, and physical effort like happiness, fear, sadness etc.
Uses	To set price. To make effective branding strategies To make better ads	Greater validity in emotional type. Improves advertisements and branding strategy	Improve web designs Better advertisements helpful in packaging	Better ad content Improve visual content	Improve website designs Helpful in product designing and visual content
Strengths	Detailed and more accurate	excellent temporal accuracy, , less expensive hence widely available Less invasive and noisy	Relatively inexpensive Equipment is portable	Measures whether the response is negative or positive	high spatial resolution, growing credibility, reactions of taste, smell, and hearing
Weaknesses	Expensive and invasive. The equipment is not portable	Poor spatial accuracy Cannot measure deeper brain structures Measures only superficial electrical signals	Cannot measure emotion as accurately as fMRI and EEG. Cannot be used independently	Can be used in combination with other tools	Cannot detect double meaning of certain expressions

Extracted from various sources: Morin (2011); Fortunato (2014); Harell (2019); (Alvinoet al., (2020); Mena et al. (2022); Alsharif et al. (2023).



Implications of NM in Anticipating Consumer Decision-making

The progressions in NM are significant for marketing companies as it allows them to have insights into the brain of consumers while making a decision. Consumer behavior comprises decision-making and NM enables the company to track the process involved, and the emotions aroused during the process from inside the brain. This makes the implications far-reaching and significant both for marketers and academicians. By using NM tools, researchers and practitioners can explore, comprehend, analyze, and forecast purchase behavior (Alsharif et al., 2021). Many hybrid approaches have evolved to overcome the shortcomings of single tools (Kalaganis, 2021). A combination of tools has been proposed to get better and more accurate results. The extant literature has outlined many implications of neuromarketing.

The predicting power of NM is better than traditional methods of marketing. They are helpful in understanding the consumers' minds towards products and services, hence improving product design (Plassman et al, 2012). Pricing is another aspect that consumers consider while making decisions. Neuroimaging and physiological tools can be used to capture the response of consumers to different levels of pricing (Alsharif et al.2021). Promotional strategies can be designed effectively when analyzed utilizing NM tools. Previous literature has reported discounts and gifts. Coupons, and free shipping play a significant role in consumer decisions (Alsharif et al.2021).

Advertisements have been widely reported to be benefitting from tools of neuromarketing. Alvino (2020) reports three areas where the NM tools are effective, advertisement effectiveness, target Audience, and advertising salient features. Both neuroimaging and physiological methods were reported to be used to improve the effectiveness of advertisements. In a study of advertisement effectiveness facial expressions of happiness was found to be correlated with attitudes toward amusing advertisements disgusting expression towards disgusting ads and display of fear toward scary ads (Lewinski et al., 2014). Neuroscience can equip marketers as to how consumers process advertisements. They help measure behavioral as well as cognitive



aspects. They measure consumers' preferences, satisfaction, desires, etc. as well as memory, attention, recall, etc. (Alvino et al., 2020).

Neuromarketing contributes to a better understanding of branding, and pricing, in designing and developing desirable products, better product experience, and an overall effective marketing mix (Alvino et al., 2020). The studies have reported the contribution of neuromarketing in the field of web designing and improving the digital presence of companies. The design of a website is crucial to attract consumers and eventually create positive emotions towards a company and its brand. Physiological tools such as eye tracking and facial expressions are critical in measuring customer sentiments in the virtual realm. They have been associated with impacting creative content (Harell, 2019). The study of two website designs has found that website designs directly affect the emotions of the consumers. Five of the basic emotions i.e. joy, anger, surprise, fear, and disgust were found elevated in response to marketing stimuli on one of the new website designs. This certainly proves that neuroscience is useful in designing websites that can provide a better user experience and enhance the trust in the brand of the company (Mena et al., 2022).

There is no doubt that NM has a huge possibility of a new field of research method yet it is difficult to consider the techniques as standard marketing tool kit. Firstly it has been found to be expensive and difficult to administer technically. The equipments of fMRI are not portable. Secondly, some of the techniques cannot be administered independently. They can be effective when used in combination with traditional methods like surveys or focus interviews. However, the benefits of NM fill the gaps of traditional research methods thus, quick adoption of less expensive methods like eye tracking or facial decoding. (Harell, 2019). They can be used in conjunction with conventional techniques of marketing research and are less expensive, easier to adapt, and less technically complex to administer. NM offers a huge opportunity to measure, explore, study, and change the minds of consumers toward favorable decision-making (as cited by Harell, 2019).



Alsharif et al.,(2021) have reported in their review that EEG as the most popular method of NM used in the marketing research domain. The following figure 1 shows the popularity of the tools of neuromarketing.

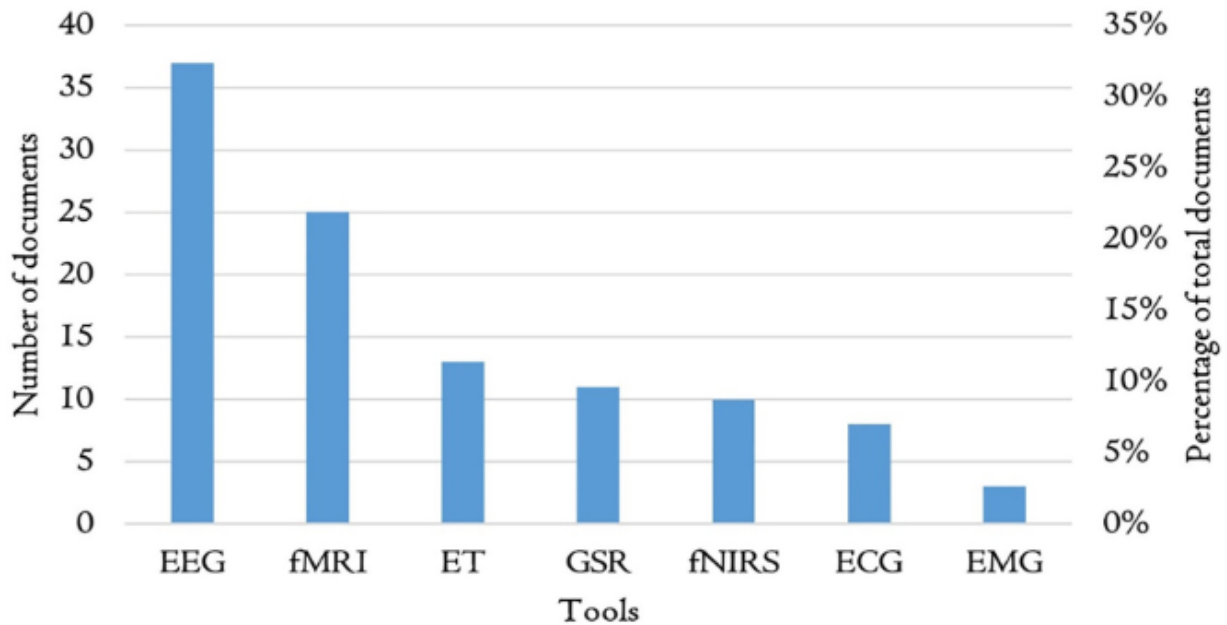


Figure 1. The number and percentage of studies used neural recording tools.

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

Ways to influence consumer behavior in the future

Authors have predicted many ways in which can be used to influence consumer behavior. Harell (2019) has predicted four ways in which NM can be used to influence consumer behavior.

Better segmentation- explores new segments of consumers using neural correlates.



Sleep nudging-consumers can be influenced during windows in our sleep

Hormonemanipulation-researchers are trying to manipulate hormones (testosterone, cortisol and oxytocin)

Temporary neural inhibition-usage of Transcranial magnetic stimulation (TMS) machines to temporarily stimulate or depress nerve cells in the brain to aggravate emotions or suppress emotion.

In addition to this Alvino et al.,(2020) have reported two new methods of neuroscience tools viz. iMotions Platform (iMotions platform iMotions A/S, Kobenhavn V, Denmark) and GRAIL (Gait Real-time Analysis Interactive Lab) system. The GRAIL system (Motek Medical BV, the Netherlands) can be used by marketers to understand the neural correlates of consumer decision-making. iMotions uses different sensors to study consumer behavior by exposing subjects to images, videos, games, apps, or software. It is a ready-to-use platform that can be integrated with other NM tools like ET, GSR, EEG, etc., and can be studied in various setups like shops, labs, etc.

GRAIL computes various gait parameters such as posture, muscle activation, and ground reaction forces in real-time using a speed-matched and synchronized virtual reality (VR) environment and a motion-capture system (VICON system, Vicon Motion Systems Ltd UK). This method also has the ability to integrate other tools of neuromarketing. This has certainly created excitement in marketers but also increased ethical concerns about neural manipulation.

Discussion and Conclusion

The growth of NM as concept is immense and its usage in the marketing field has grown exponentially. The companies are keen to know the needs and wants of the consumers and NM assisted in quantitatively assessing the emotional response thus augmenting the inclusion of NM research methods among companies. In this paper, we give an overview of Neuro marketing, tools and techniques of Neuro marketing and their application in the marketing mix.



Companies like coca cola, Pepsi, Hyundai, and Yahoo have already adopted the NM methods. The results indicated that the procedures of NM have been widely accepted and are crucial in predicting consumer behavioral and cognitive perspectives related to decision-making. Neurological images like fMRI, EEG, etc. measure neural signals whereas physiological tools like ET, Facial expressions, and GSR measure bodily changes –heat, eye movements, perspiration, etc. to accurately interpret the mental processes of the consumer.

Many studies have been conducted by many authors (Morin (2011); Plassman et al., (2012); Fortunato (2014); Harell (2019); Alvino et al., (2020); Mena et al. (2022); Alsharif et al. (2021, 2022, 2023); Kalaganis, (2021); Bharadwaj, (2023) defining neuromarketing, providing an overview of neuromarketing tools and techniques, outlining their pros and cons and finally, predicting the global academic trends of neuromarketing.

The market perspectives of neuromarketing are still in the early stages of positive evolution (Baños-González, 2020), highlighting the reasons for the scarce use of neuromarketing by companies. Ignorant of opportunities NM offers; Companies are hesitant to employ NM because of the technical nature of the tools, the lack of industry standards, and difficulties with data simplification. The costs involved in conducting these have also restricted the use of NM methods by big companies. However, the silver lining in this is the advancements in technology which make it possible for techniques to be applied outside the labs in natural environments for subjects eliciting more natural and accurate responses.

To sum up, neuromarketing methods will help in identifying shopping buttons which will expand the business scope of the marketers by increasing the efficacy of the marketing mix as well as web design. The researchers will find new avenues of research in the context of consumer behaviour which will require looking forward as well as looking backward. Neuromarketing promises a holistic view of the consumer decision-making process, the responses, reactions, attention, preferences, and memory of consumers.



Limitations and Future Directions

The first limitation is the nature of the papers used. The paper exclusively focussed on empirical papers that were in English which may be a limitation. Time constraints and lack of extensive research in the field are other limitations. Further validation is required as this study is qualitative. Since studies and practices are primarily from developed countries (Biswas et al., 2022), the present study may be biased as most of the papers considered for review were from developed countries. Cultural and regional diversity and economic differences are evident which makes a strong case for authors to publish from developing countries on this topic.

The findings have revealed the integration of NM tools to get a better understanding of neural correlates of the brain to consumer behaviour which gives future research opportunities to researchers. The findings have revealed that the market viability of NM methods is still in the early stages which posit for future probe. The challenges regarding the application of NM methods are immense which warrants further research. The research from the perspective of companies employing techniques should also be conducted.

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