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Neuromarketing: a historical review

Chiemelie Benneth Iloka* and Kenechi John Onyeke

Department of Marketing, Enugu State University of Science and Technology(ESUT), Enugu, Nigeria.
* Corresponding author: ilokaben@gmail.com; Tel.: +2348140766160

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ABSTRACT: Neuroscience, the study of the brain and how humans process their daily activities, has always been part of other fields (such as neuropsychology in the psychological context). However, 2002 is known as the year neuromarketing was first coined by Professor Ale Smidts, describing it as the study of the brain and how it processes activities about consumer context (purchase behavior – how and why they buy). Further reviews showed that before coining the term, companies were already adopting neuromarketing through systems such as functional Magnetic Resonance Imaging (fMRI). To further demonstrate its essence, this review discussed its historical dimension, and findings show that it is a revolutionary area of marketing. Although limited empirical studies have been conducted within the context of neuromarketing, the review shows that it can address the challenges of reliability, validity, and generalizability that come with the conventional approaches in marketing research. However, it is suggested that the field of neuromarketing needs empirically-based works, urgently.

Keywords: neuroscience; neuromarketing; cognition; consumer; marketing; behavior; brain

1.0 INTRODUCTION

The interests in the use of brain imaging techniques have significantly grown in the past years, and these techniques are employed in analyzing how the brain responds in varied contexts. In recent years, the scientific developments featured more of an expansion of how these techniques are applied in diverse and multidisciplinary research areas to address the different questions that have been raised in these scientific fields. However, what stands is that the recent increase in the application of neuroscience (and its neuroscientific methods) to understand human behavior across different contexts is, without a doubt, intriguing and exciting. Tallis & Taylor (2011) are renowned for coining the term "Neuromania," which is used to reference different fields of studies adopting (embracing) neuroimaging to explicate all forms of human behavior concerning brain activities.

The application of neuroscientific approaches is known to enhance the understanding of subconscious factors that influence human behaviors, with particular reference to the actions deemed risky. Interests in these approaches were initially focused on how these human factors (HFs) can be analyzed (Wilson & Eggemeier, 1991). To be precise, this form of application was founded on specific social challenges, like operational settings where the safety of people working within such conditions are based on the nature of work and the efficiency of the operators. A

good example is the transport domain, where the safety of the passengers is deemed dependent on: the performance of the pilots (G. Borghini et al., 2013; Gianluca Borghini et al., 2016, 2015; Dehais et al., 2018; Sciaraffa et al., 2017; Vecchiato et al., 2016); the drivers (Di Flumeri et al., 2018; Di Flumeri, Borghini, et al., 2019; Maglione et al., 2014); or those within the traffic control rooms (P. Aricò et al., 2016; Pietro Arico et al., 2015; Pietro Aricò et al., 2016; Gianluca Borghini et al., 2017; di Flumeri et al., 2015). Under such conditions, any human error will potentially lead to drastic and dramatic consequences.

In essence, these human factors have been highlighted as the main factors responsible for the majority of workplace accidents. Estimation shows that about 90% of the accidents that occur within the workplace can be traced to human factors as the leading cause (Feyer & Williamson, 2011). Due to this, the HFs have been accorded more attention with investigations spanning through a broad range of domains. In numerous operational environments (like the case of industrial process control, aircraft piloting, robot-assisted surgery, and air-traffic control), it is expected that to accomplish the operational activities, the operators are to manage complex machines and systems consistently. Thus, new solutions and innovations are usually proposed to improve such technologies. The fundamental essence of such introductions is to improve the efficiency and security of the human-machine interactions (HMI), with a resulting improvement on the performance of the operators as well as the overall safety of the workers (P. Arico et al., 2018; P. Aricò et al., 2014). Under such conditions, the most studied state of the user is the mental workload; for instance, the extent of cognition necessary to executed designated tasks (Boucsein & Backs, 2000). This is because cognition has a direct influence on the variations in performance among operators (P. Aricò et al., 2016). Another critical area reviewed is the mental state of the operators like their situation awareness, vigilance, cognitive engagement, stress, and drowsiness that they display in the course of undertaken designated tasks (P. Aricò et al., 2014; Gianluca Borghini et al., 2014; Lal & Craig, 2001).

While the interest in this field boomed, these applications were still considered pure research areas until the last decade, and they were deemed hard to be reproduced on a large scale outside the laboratory and be linked to the daily activities as obtainable today. However, the story has changed as a result of the technological advancements that brought about innovative solutions that apply these neuroimaging techniques (such as the wearable and less invasive technologies) (Gianluca Borghini et al., 2019; Di Flumeri, Aricò, et al., 2019). This has made the neuroscientific approach a powerful tool that can be employed in investigating brain functionality and unconscious reactions in the course of man's daily life. It is now possible to investigate how the central stimuli are perceived, processed, evaluated, reacted, and utilized by human beings to reach decisions in their daily interactions and activities (Gluth et al., 2012).

Given that, a newly emerging area of neuroscience is *industrial science*, in which state-of-the-art approaches are employed in real content to assess the consumers' emotional and cognitive state (Gianluca Borghini et al., 2017). In the last decade, these new techniques were approached by the financial world, bringing about neuroscience labs with the central aims of addressing the issues and questions that have been raised concerning economic transactions. Therefore, it is inherently necessary that neuroscience researchers work together with the economists in the course of evaluating the activities of brains based on monetary values and judgment, if they are to understand the underlying mechanisms applied by consumers in decision making (Cherubino et al., 2015). The resulting impact has been a rise in a new area of study that is known as "neuroscience," which utilizes all the modern tools of neuroimaging (Camerer et al., 2004; Glimcher & Rustichini, 2004).

In today's marketing world, one of the most frequently featured questions is: what drives the consumers to choose a given product instead of another or the factors that influence consumers' interaction with a particular brand. Therefore, there has been an increase in interest geared towards understanding how the brain responds to these decision-making processes. To this effect, there have been practical adoption of the neuroscientific neuroimaging tools in the real-life setting to assess real stimuli, and this is the main subject of this article. This process is coined as "***neuromarketing***." It is a term that is used in describing the field of study known as "*the application of neuroscientific methods in analyzing and understanding how humans behave in reference markets and the marketing exchanges*" (Lee et al., 2007). Two main highlights can be gathered from this definition: a) it does shift the consideration of neuromarketing from being centered on the adoption of neuroimaging by commercializing its interest to benefit other users; and b), it does broaden the scope

of neuromarketing from focusing more on consumer behavior to include other areas of interests, like the inter- and intra-organizational research, which is a common domain in the literary works of marketing.

The main objective of neuromarketing is to understand how the different areas of the brain function when consumers are exposed to market stimuli, and to help the marketer highlight and report on the correlation between consumers' behavior and their neurophysiological systems. By basing on the knowledge and known elements of the human brain anatomy, as well as being conscious of the physiological features of the brain areas, it is now possible for the neuromarketing to model neuronal activities that pinpoint specific behavior of the human brain. By applying the techniques in neuroimaging, researchers are now able to compare the varied areas of activities going on in the brain to differentiate specific tasks, to develop a model that can be used to describe the dynamics of human decisions systematically. They are also able to explicate the normal mismatches that the consumers experience concerning their actions and thoughts (P. Aricò et al., 2014; Jordao et al., 2017; Riccio et al., 2015; Schettini et al., 2014).

From the above discussions, it is clear that most of the studies have focused on neuroscience with limited attention to neuromarketing. Thus, the central aim of this paper is to offer a historical review of neuromarketing in the past decades, referencing studies that have been conducted in this area and developing the basis for experiments.

2.0 PAST, PRESENT, AND PROJECTED FUTURE OF NEUROMARKETING

For tens of decades, scholars aimed to understand how humans make –or at least should make – a given decision. This is the central question that kept specific disciplines (such as psychology and philosophy) alive. It can be deduced from these decades of research that the majority of the mental processes humans experience take place at their subconscious level, which also includes the decisions consumers make as to what to purchase or when to purchase. These subconscious processes also offer explanations with regards to humans, often failing to predict their future choices in an accurate way (Vecchiato et al., 2013). It is shown that in most cases, what people think they want shows little or no bearing on the decisions that they eventually make in the future (Boksem & Smidts, 2015).

As the desire to answer the question of why and how people buy increased, *consumer neuroscience* was developed as a new approach within the consumer research, and it has since risen rapidly in scope and essence, with the main aim of advancing the understanding of consumer behavior based on the methods and insights from neuroscience.

Following the conceptualization of consumer neuroscience, there have been broadened, ongoing debates about the benefits that come with this hybrid field, from its foundational disciplines to consumer psychology and neuroscience (Ariely & Berns, 2010; Kenning & Plassmann, 2008; Plassmann et al., 2007). To appreciate neuroscience within the context of consumer psychology, it is pivotal to highlight the vast area of insight available through cognitive neuroscience.

Cognitive neuroscience is used to represent the study of the nervous system, which is aimed at understanding the biological foundations of human behavior. Cognitive neuroscience represents the main difference between clinical and non-clinical research. The clinical aspect of the study, which is also known as neurology, is focused on studying the patients and how disorders influence their emotions, behavior, and cognition in their nervous systems, tumors, trauma, and injuries compared to the healthy subjects within a population. The non-clinical aspects of the research are focused on assessing the responses of consumers compared to the healthy subjects within a population. The distinction between these two is that consumer neuroscience focuses on academic research, which is the intersection between consumer psychology and neuroscience. Neuromarketing is a branch of study that was previously communicated to focus on the application of consumer neuroscience in the marketplace by employing neurophysiological tools (such as functional magnetic resonance imaging, eye tracking, and electroencephalography) to conduct specific researches with particular focuses on the market. Essentially, neuromarketing can be viewed as the field of study which applies the techniques of neuroscience to assess and understand the behavior of humans about the market and economic exchanges (Lee et al., 2007). Therefore, the subject of neuromarketing is related to marketing,just the same way neuropsychology is related to psychology. On the same note, neuromarketing assesses the behavior of the consumers from the perspective of their brains, just as the same way neuropsychology investigates the

relationship between human cognition and brand, and psychological attributes (Morin, 2011).

While many have stated that the term "neuromarketing" cannot be attributed to anybody, it is widely agreed that Professor Ale Smidts, from the Rotterdam School of Management of the Erasmus University, was the first person to use the term neuromarketing in 2002. It was used to describe the adoption of neuroscientific techniques by those in the marketing field (Smidts, 2002). Following this conceptualization, two US companies (BrightHouse and SalesBrain) were the first to offer neuromarketing consulting and research services; they promoted the adoption of technology and knowledge from the cognitive neuroscience field within the business context. Specific reference can also be made to the Atlanta-based BrightHouse, which moved with the creation of a department that is entirely dedicated to the adoption of fMRI for marketing research purposes (Fisher et al., 2010; Fortunato et al., 2014). What this goes to show is that even before the coining of "neuro" to this scientific approach, there were companies already adopting the neurophysiological techniques, like the EEG, to address problems within the marketing context (Alwitt, 1985; Olson & Ray, 1983; Rothschild et al., 1986, 1988).

The advantages of neuroscientific methods have been highlighted within the marketing context by researches that focus on the study of human behavior. In recent years, there has been an increase in the abilities of neuroscientists to investigate the activities of the brain. In the field of marketing, the contributions made by the concept of neuromarketing has significantly helped in addressing numerous questions about the neural processes of the consumers as it partakes to their behavioral performance, and such importance can be seen from different levels of consumer research. On a similar note, another issue of interest to the researchers is how to overcome their dependence on verbal answers that are frequently being employed in today's methods to assess the response of subjects within conventional marketing researches. The indicators and insights offered by the approach might be dependent on the accuracy and good faith of the respondents according to their personal views and sensations related to the reports being made by the experimenters. That is to say, the methods employed in collecting traditional data come with their limitations and have been criticized for their inability to produce accurate results. In some studies, the failure rate of new products is set at 90% (Gourville, 2006; Pradeep & Patel, 2010; Schlossberg, 1990). This serves as a piece of validating evidence that traditional marketing researches conducted before the launch of new products might not have offered valid, reliable, and generalizable results.

Through the traditional approaches in marketing research, scientists can measure the emotional and cognitive variables of the consumers only as they verbally express them at their conscious level in the course of data gathering. However, with the adoption of the brain imaging techniques, it is now possible for the scientists to distinguish the subconscious states of the consumer from the processes that critically influence their behavior, and on the same note, be able to merge and comprehend the discoveries that can be made through written and verbal declarations.

The exciting part is that it is suggested in some experimental evidence that brain imaging features will be fully integrated and applicable in the near future, in such a way that it could be placed side by side with the classical tests that the marketing scientists are employing today (Boksem & Smidts, 2015). Thus, from the marketing point of view, *neuromarketing is a revolutionary and significant field in marketing research*, and can also be defined in the form of a "*third dimension*" of the said field. The reason is that neuromarketing has attracted a considerable amount of attention within the corporate world, and there has been an impressive growth in the number of neuromarketing companies in recent times (Plassmann et al., 2012). Also, there has been a tremendous increase in such publications across marketing journals and Google's referencing about the topic, as well as the number of neuromarketing companies being created. Hubert & Kenning (2008) reported that in 2008, the term "neuromarketing" had 800,000 hits, and this increased to 1.4 million hits in 2012, with a subsequent increase to 3 million in 2018.

3.0 EVIDENCE-BASED NEUROMARKETING RESEARCH

Although neuromarketing is described as being in its introductory stage, there are significant empirical and literary works dedicated to this new field of marketing. One of the recent works was done by Constantinescu et al. (2019) and is focused on attitude evaluation on the use of neuromarketing approaches in social medial, matching corporate purpose, and the benefits of the customer for sustainable business growth. The goal of this research was attained through two pieces of research that focused on models where these purposes were matched with the corresponding

benefits, illustrating the extent to which neuromarketing principles can be integrated into social media. Findings from the research indicate that it is not easy to integrate neuromarketing in social media as a result of two significant reasons. The first reason is that neuromarketing requires special software and equipment, which implies that companies willing to integrate this into their business process will have to make significant investments in that direction. On the second note, such companies will also need to consider the reluctance of users when it comes to gathering data in relation to their behavior and characteristics. In line with these limitations, the model developed by the authors is believed to be capable of assisting companies in integrating neuromarketing features in their business process. However, the authors recommended that the model needs to be further tested in the real market setting.

The work of Solomon (2018) focused on the applications, challenges, and promises of neuromarketing. It was pointed out in this study that the application of neuromarketing tools is bound to yield a profound impact in the emerging economies, especially as their populations and consumer purchasing potentials are rapidly increasing.

Arthmann & Li (2017) focused on neuromarketing as the art and science of marketing and neuroscience enabled by the Internet of Things (IoT) technologies, predominantly focused on the application of neuromarketing in the internet age, as well as the benefits that come with such applications. The researchers concluded by stating that neuromarketing has the potential to influence brand association and consumer loyalty proactively as it measures the behavior of customers in real-time, and also come with the capability of testing the verbal and non-verbal responses of customers to new products, pricing, and advertisement promotions. Thus, on the long-run, whether the individual is viewing neuromarketing as the art of measuring consumer emotions or science that is used to measure marketing effectiveness, there is little doubt that all the retailers will want access to the unbeatable truth of consumers' subconscious mind irrespective of what emotions, engagement, or sentiments they might be feeling.

Hensel et al. (2017) looked at conducting neuromarketing studies from the perspective of ethical practitioners. The study was aimed at checking the validity of additionally developed ethical aspects that are supplementary to the Neuromarketing Science and Business Association (NMSBA) code of ethics, as contained in the Ethical Guidelines in Neuromarketing (EGNM) guideline used to determine the extent of consensus with the answers that were provided by the neuromarketing practitioners. Additionally, the study aimed to refine the ethical guidelines with different aspects that are considered relevant for the practitioners. Based on interview data that was gathered from 10 neuromarketing practitioners, it was found in this study that all seven aspects of ethicality in neuromarketing are crucial when conducting neuromarketing studies. On the same note, the study also highlighted five extra ethical measures that need to be considered.

Nemorin & Gandy (2017) focused on exploring neuromarketing and its relevance to remote sensing, social and ethical concerns. The key objective was to evaluate the consequences of neuromarketer's reliance on direct and indirect forms of remote sensing. Findings from the study indicate that there are ethical implications with neuromarketing, and they are closely related to remote sensing, invasion of privacy, and statistical discrimination. Most of the concerns raised concerning the subject are based on what the neuromarketers understand as expectations of fairness, encompassing the reasonableness of the expectation that life chances of individuals are not being shaped by the stereotype they apply to groups which the individual in question might have been assigned as a result of statistical, political, or social processes.

Glaenzer (2016) looked at whether the brain and mind are one concerning neuromarketing and how the consumers make decisions. The study was designed to demonstrate how neuromarketing connects to the history of subliminal messaging and the present neuro-obsessed culture (neuroculture). It was found in this study that neuromarketing can be effectively used in supporting claims made in traditional marketing and also assisting marketers to understand how products can be marketed more effectively. In any case, it was stated that neuromarketing is not going to replace the conventional marketing mix. Still, it will offer valid supports to the marketing mix in the area of discovering the right audience for a product. This is based on the understanding that neuromarketing helps marketers to understand what happens when the consumer chooses a product, provides necessary assistance for brain-mapping initiatives and increases overall knowledge of the consumers' bodily and brain responses.

Kumar's (2015) study focused on neuromarketing as the new science of advertising. The work focused on investigating how the attention levels influence users from the neuromarketing perspective, and the research was conceptual. It was found that by combining culture and neuroscience, one will be able to make advertising more engaging and effective.

Roth (2013) discussed the potentials of neuromarketing as a marketing tool in a thesis. The paper was centered on evaluating the influence of neuromarketing tools on conventional marketing approaches in terms of understanding consumer behavior. It was revealed in this work that neuromarketing yields a high impact on the purchase behavior of consumers, pricing, advertising, branding, product distribution, and decision making within the marketing dimensions. Thus, the study considers neuromarketing to be a remarkable extension in research about human behavior, and it has highly practical applicability in the real-world setting.

The work of Krajnovic et al. (2012) focused on neuromarketing and customers' free will. The research focused on the possibility of applying neuroscience in marketing and branding, and it also looked at the limitations that come with understanding the human brain in the marketing context. It was concluded in this study that neuromarketing relies on the fact that numerous decisions, about 70% of them, are made within the sub-conscious level, and the majority of the consumers are not able to explain the reasons being their decision logically. Therefore, neuromarketing offers the possibility of detecting the data about purchase decisions of customers and well as their preferences that were not known till now.

Morin (2011) presented a paper that discussed the promises of the burgeoning field of neuromarketing with suggestions about its potential to significantly enhance the overall effectiveness of both commercial and cause-related advertising messages across the globe. In this paper, it was pointed out that neuromarketing offers cutting edge approaches that can be employed to directly probe the minds of customers without demanding their conscious or cognitive participation. The essence of this is based on the limitations that come with the conventional approaches used for testing and predicting the effectiveness of advertising investments being made by brands globally.

Murphy et al. (2008) conducted one of the earliest researches on neuromarketing, and it focused on the neuroethics of neuromarketing. The main objective was to assess the ethical issues concerning neuromarketing. Based on literature review and personal opinions, they categorized these ethical issues into two; 1) protection of various parties that might be harmed or exploited via neuromarketing research or deployment of neuromarketing tools; and 2) protection of consumer autonomy if neuromarketing reaches a critical level of effectiveness. It was highlighted in this study that companies intending to utilize neuromarketing techniques should adopt a code of ethics to ensure that the technology is both beneficial and non-harmful with respect to the two categories of ethical concerns stated above.

Lee et al. (2007) focused on defining neuromarketing and discussing the agenda for future research in the field. It was found that neuromarketing is continuously evolving both in the area of technology and insight. The future direction was focused on the challenges that come from neuromarketing and how companies can successfully integrate this principle in their business process. A summary of the reviews conducted is presented in Supplementary Table S1.

4.0 CONCLUSION

Essentially, neuromarketing is a revolutionary and new area of marketing with limited empirical discus. The majority of the discussions have also been based on literature review and personal views. Therefore, it is concluded in this study that there is an urgent need for empirical works within the Neuromarketing context. Thus, further studies should look at solving marketing issues with real data to appreciate the essence of Neuromarketing better.

Supplementary Materials: Supplementary Table S1 (Summary of Reviews) is available online at https://neuroscirn.org/ojs/index.php/nrnotes/article/view/54/87.

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