

NEUROMARKETING AND CTA DESIGN IN E-COMMERCE: CONSUMER RESPONSES AND ETHICAL INSIGHTS – A SYSTEMATIC LITERATURE REVIEW

Trisha Mirchandani¹, Dr. N.D. Shah²

¹ Research Scholar, Department of Public Policy and Governance, B.K. School of Professional and Management Studies

² Research Guide, Gujarat University

Abstract

In study on neuromarketing in e-commerce has grown substantially. Although earlier research has used neuroscience approaches to analyse consumer behaviour, there remains not enough of systematic classification of studies that examine how design factors like layout, colour, and call-to-action (CTA) influence online decision-making. In order to fill this gap, 39 peer-reviewed articles were systematically reviewed in the literature. Four research themes emerged from a thorough assessment and thematic analysis: (1) use of neuromarketing as an e-commerce driver; (2) effectiveness of calls to action; (3) consumer reactions; and (4) application and ethical implications. Additionally, a theme framework was created to connect neuromarketing insights with conversion behaviors, psychophysiological reactions, and visual attention in online purchasing environments. The result has showed that the neuromarketing is the revolutionary techniques it understands the consumer behaviour and the preferences but even after identification of the need the consumer behaviour can changed as it's depended on how information is transformed.

Keywords: Neuromarketing, Call to action (CTA), Consumer Response, E-Commerce, Ethical Insight

INTRODUCTION

In the highly competitive environment of e-commerce today, business want to achieve the highest conversion rates and impact customer decision-making by optimizing every element of the online buying experience. Applying psychology and neuroscience to marketing, or neuromarketing, has proven an effective tool for understanding out exactly how customers react to different design and content strategies, always unintentionally. Using techniques like eye tracking, galvanic skin response, and EEG to measure brain activity, emotional reactions, and attention patterns, neuromarketing offers a greater understanding of the factors that actually influence consumer behaviour.

The call to action (CTA) is one of the most Important—yet sometimes overlooked—components of online retail. The design, location, and presentation of CTAs are crucial to sales performance since they are the final cues that direct consumers to complete a transaction. Color schemes, layout designs, and subtle motion effects are examples of elements that have a direct impact on consumer attention, urgency, and trust in addition to being just aesthetic choices. To increase the persuasiveness of CTAs, neuromarketing concepts such as color psychology, visual hierarchy, layouts, and low cognitive load can be carefully implemented

This study is motivated by a visible lack of integration of scientific neuromarketing information into useful e-commerce design. Although a lot of digital marketers use A/B testing, few also use psychophysiological data to determine why some designs are more effective than others. This study aims to close the gap between academic neuroscience results and practical e-commerce applications by investigating the effects of neuromarketing-informed CTA designs, with particular emphasis to colour, layout, and text, on conversion behaviour in e-commerce. The results may ultimately offer e-commerce companies evidence-based tactics to create more captivating, trustworthy, and conversion-optimized online shopping experiences, contributing both theoretically to marketing science and practically to the field of digital commerce.

Neuromarketing has been a popular method for studying consumer behaviour in the past few years, there are still few complete evaluations that group research into distinct areas of study. Assessing how neuromarketing insights might be methodically applied to digital commerce, especially in the context of interface design, is still crucial from a business and management aspect. Many e-commerce decision-makers are still reluctant to fully embrace technologies like eye-tracking, EEG, and galvanic skin response, despite mounting evidence that they can predict consumer attention and emotions. This is frequently because of perceived complexity, ethical concerns, or a lack of clarity regarding the direct benefits of these tools.

Few studies have specifically looked at how Call-to-Action (CTA) design, page layout, and colour choice influence purchase intentions and conversion outcomes, despite the fact that previous research has explored connections between neuromarketing strategies and general consumer behaviour in E-commerce. The current analysis aims to synthesize existing information and elucidate the ways in which neuromarketing-driven cues impact customer attention, trust, and behavioural responses in online

purchasing contexts. This gap serves as the driving force behind the review. The following questions were framed based on the gaps.

RQ1: What are the key themes and trends in neuromarketing research from the perspective of consumer behavior, e-commerce, and business management?

RQ2: What role do e-commerce elements such as layout, aesthetics, color, and call-to-actions (CTAs) play in shaping consumer responses through neuromarketing techniques?

RQ3: What are the ethical considerations and challenges associated with the use of neuromarketing in influencing consumer behavior and decision-making?

These teams were framed from the gaps (1) Neuromarketing in e-commerce, (2) the efficacy of calls to action, (3) customer reactions, and (4) application and ethical issues. These elements are incorporated into a conceptual framework that connects visual attention, trust-building, online purchasing conversion behaviours, and neuromarketing insights. Lastly, the theoretical and managerial implications are emphasized, demonstrating how companies can responsibly use neuromarketing-driven design methods while researchers deepen our understanding of how consumers behave in digital environments.

According to this review, neuromarketing is a key lens through which to evaluate how consumers make decisions in online shopping. The approach, results, and discussion are presented in the following parts, which are followed by propositions for practitioners and representatives. The limits and suggestions for more research are noted in the paper's conclusion.

METHODOLOGY

In order to address the established research questions derived from pertinent peer-reviewed papers, the current study used a methodical approach to data collecting. To guarantee a thorough and exacting analysis of the body of existing literature, this approach used an iterative process of definition, clarification, and improvement. This method enables the consolidation of discoveries into significant themes and the identification of important patterns among various findings. A scoping viewpoint was also included to improve the review's quality and dependability and give a more comprehensive picture of the theoretical, practical, and methodological facets of neuromarketing in e-commerce. The review procedure was organized in this study using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria as a framework. Transparency, reproducibility, and methodological rigor were guaranteed throughout the review process using the PRISMA checklist.

We commenced by examining earlier review-based studies in order to find any gaps in the established study process. The criteria utilized to find pertinent research publications for data collection are outlined in Table 1.

A methodical search approach was used to address RQ1 through RQ3, taking the following actions:

Online database: The main resource for finding pertinent studies was Google Scholar. It was selected due to its broad reach and disciplinary recognition, especially in the domains of business, management, and psychology, which are essential to this study.

Search terms: To find the most pertinent research studies, a number of effective search terms were used. Only pertinent items were extracted thanks to the wide search options and Boolean operators. Both were included to encompass a wider range of studies because words like consumer neuroscience and neuromarketing are frequently used interchangeably.

Journal articles: Only peer-reviewed English-language journal articles were taken into consideration in order to guarantee rigor and dependability. Before being accepted, these publications go through a rigorous review and shortlisting procedure that guarantees the inclusion of high-calibre, methodologically sound research pieces. Based on the study's objectives, an inclusion and exclusion method was established to find and filter the most pertinent research articles. The PRISMA framework supported a three-step methodological process that was used to ensure systematic study identification and selection in order to preserve rigor.

STEPS 1: The first screening was carried out using titles and keywords following the extraction of research articles from Google Scholar. At this point, articles having titles that had nothing to do with neuromarketing or that were not relevant to the topic were disqualified.

2: After that, the abstracts of the papers that made the short list were thoroughly examined. It was made sure that the main idea and goals of every chosen study had a direct connection to neuromarketing during this process, because neuromarketing is the main emphasis of this study, only publications that were completely consistent with this theme were kept.

3: To ensure that no pertinent study was missed, a last reexamination of the excluded publications was conducted. This procedure verified the final pool of 39 peer-reviewed research publications for analysis and validated the inclusion-exclusion approach.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach served as the process's compass, improving the screening and selection procedure's dependability and transparency.

Search Strings for Data Extraction (Table 1)

Search topic	Search string
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Neuromarketing	“Neuro-marketing” OR “Neuromarketing” OR “Consumer neuroscience”
Consumer behavior & CTA	“Consumer behavior” OR “Consumer retention” OR “Consumer motivation” OR “Consumer decision making” OR “Call to Action” OR “Website layout” OR “Color psychology” OR “Visual appeal” OR “Aesthetic design”
E-commerce	“E-commerce” OR “Online shopping” OR “Digital consumer behavior” OR “Online purchasing”

FINAL SELECTION

To make sure the 70 research articles on the shortlist were relevant, a full-text reading was done. Only papers that addressed neuromarketing as a central issue and whose goals coincided with the current investigation were kept. According to the PRISMA analysis, 39 research publications were ultimately included as a result of this method (Fig. 1).

The chosen publications were then examined from a variety of angles, including journal outlets, methodology, and year of publication. The findings show that neuromarketing research has been steadily expanding, underscoring its multidisciplinary character and growing significance in recent years.

DATA EXTRACTION

Every research paper was thoroughly analyzed to extract important details, including the journal, abstract, research aims, methods, topics, sub-themes, major findings, and bibliographic information (title, year, author, affiliation) (Table 2).

Each of the 39 research articles that made the short list underwent a methodical, impartial examination. The first step in the analysis was to determine each study's primary emphasis, which was recorded using beginning codes. Based on commonalities found throughout the articles, these codes were subsequently categorized into sub-themes. For example, the concept of interrelated factors (including neuro characteristics, psychological reactions, evolving consumer behavior, and interdisciplinary features) was used to group together factors pertaining to behavioral and psychological aspects (Table 3).

The research was arranged into a number of more general topic groups as a result of this procedure, offering a systematic comprehension of the literature.

Fig: 1: Prisma Flowchart

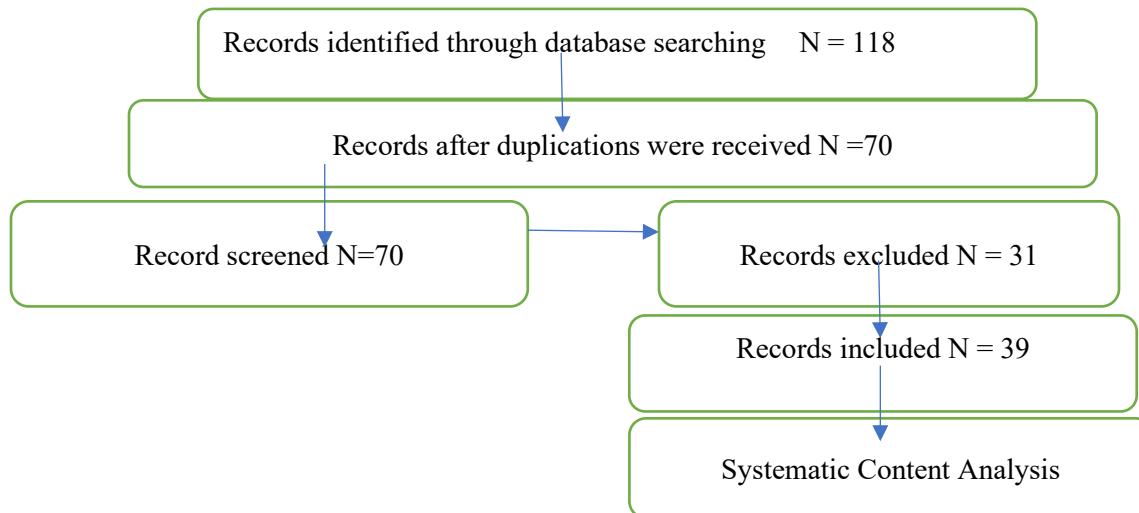


Table 2: Thematic Extraction Process for Neuromarketing

Stage 1	Stage 2	Stage 3	Final Themes
Open Coding	Axial Coding	Ancillary Analysis	
Broad Topics (n=30)	Sub-Themes (n=15)	Central Themes (n=4)	
			1. Neuromarketing and e commerce 2. Call to Action effectiveness 3. Consumer response 4. Applications of ethical considerations

Table 3: Themes, Sub-Themes, and Broad Topics in Neuromarketing & E-commerce

Theme	Sub-themes	Broad Topics
1. Neuromarketing as a driver in e-commerce	Concepts	Eye-tracking, EEG, Emotional arousal, Attention mapping
	Theory	Consumer neuroscience models,
	Approaches	Biometrics, Implicit association tests, Galvanic skin response
2. Call-to-Action (CTA) effectiveness	Strategy	CTA placement strategy, Sensory branding in online platforms,
	Visual design factors	Colour psychology, Typography, Animation/motion effects,
	Layout & structure	CTA positioning, White space use
	Messaging strategies	Urgency cues, Personalisation,
	Contextual placement	Above/below fold, Timing triggers, Adaptive CTAs
	Emotional responses	Positive affect, Trust building,
	Cognitive processing	Cognitive load, Decision clarity,
	Behavioural outcomes	Cart addition, Purchase completion,
4. Application & ethical considerations	Marketing application	Neuromarketing-based ad creative, Behavioral targeting,
	Retention strategies	Post-purchase engagement, Neuro-personalised suggestions,
	Prediction & analytics	AI-driven purchase prediction, User path modelling,
	Ethics in neuromarketing	Transparency, Informed persuasion, Privacy concerns

FINDING AND THE SUGGESTIONS

Four major themes that individually reflect the contributions of the examined research papers were found as a result of the thematic analysis. When taken as a whole, these topics offer proof and a thorough comprehension of neuromarketing. By providing a more comprehensive viewpoint based on a substantial number of studies, the first theme, neuromarketing, serves as an argument synthesis. In order to direct future research and strategic initiatives, the second theme, Call to Action, emphasizes the overall arrangement, structure, and intellectual placements. The third subject, "Consumer Response," explains how consumers interpret and process marketing stimuli by concentrating on their emotional and cognitive responses. The fourth theme, Ethical Considerations, discusses privacy, retention, and the moral ramifications of employing neuromarketing strategies. In order to provide definitive results, thematic synthesis incorporates neuromarketing research.

Theme 1: Neuromarketing in the E- Commerce

By addressing the shortcomings of conventional techniques and exposing erroneous customer replies, EEG signals improve analysis [34] Sit solves marketing problems by providing useful information beyond self-reports [14]. Neuromarketing lowers the risk of failure and saves money by examining preferences before to launch [26]. It generates new opportunities with societal benefits and offers first-mover advantages [33] Neuroscience Offers Company's advice regarding which products have to be

launched [8]. By tracking brain activity through modern techniques, neuromarketing enhances product feedback and proposals, increasing sales and revenue in E-Commerce [24]. Quality, brain reward systems, and product and brand judgment—all important components of customer satisfaction—are used to explain how consumers make decisions [4]. Product design, promotion, and brand development are all aided by neuromarketing[32]. It forecasts the success or failure of advertising campaigns prior to their launch [2]. Although better than conventional marketing, there isn't always a direct link between ad efficacy and particular brain region [5]. Different neural patterns are linked to product preferences by right-brain EEG activity[39].

Theme 2: Call to Action effectiveness: CTAs (text, images, or screen areas) encourage interaction and have an impact on customer behaviour on all digital platforms [35]. Clear text and engaging counterparts are the keys to successful CTAs; usability and visibility come second to matching design to customer expectations [36]. It's concise, clickable, and urgent calls to action (CTAs) have a good impact on attitudes, encourage impulsive purchases, and increase purchase intentions [37]. Non-monetary, practical incentives work best for direct mail CTAs, especially for devoted and recently engaged clients [38].

Theme 3: Consumer Response: Neuromarketing defines the direct subconscious reactions to stimuli [28].

it captures emotions, subconscious reactions, and brain activity to uncover hidden preferences[6]. Demonstrates that the subconscious is responsible for over 70% of consumer decisions [22]. Unconscious preferences, which frequently influence behavior, may clash with conscious choices [16]. Businesses may take advantage of subconscious dominance to sway consumer decisions [23]. Makes it possible for marketers to create more specialized ads and have a deeper understanding of consumers [11]. Offers pertinent, but occasionally broad, observations [30]. Even after needs have been identified, the way information is presented still affects consumer choices [18]. Emotions are important; in the future, marketing may focus more on brain functions than on sentiment or reasoning [27].

Theme 4: Ethical Considerations Although there are similarities with traditional marketing, it raises concerns about privacy, autonomy, and manipulation and [10] consumer protection and neurological effects [8]. Despite increasing turnover, there is a risk that customers will become less logical and make more automated decisions [20]. Loss of control, privacy, and autonomy as well as the possibility of treating customers like programmed machines are ethical dangers [31]. It must be used Constructively to improve lives by tying together consumer behavior, feelings, and thought processes [1]. Women are more ethically conscious, observing societal impact and product color [29] should put the welfare of society first by developing authentic goods that satisfy actual customer demands [3].

CONCLUSION

A powerful and revolutionary strategy, neuromarketing combines neuroscience with marketing to better understand consumer behavior, preferences, and decision-making in e-commerce, it do lower the risk on the failure and generate the better opportunity with the help of the CTA on the digital platforms .Neuromarketing do capture the subconscious behavior of customer, the hidden reactions and preferences of the customers and make the customer avail more specialized and customized products but raises the concerns for the privacy, autonomy and manipulations issues. Despite the increase in revenues there risk that the customer will become less logical and will opt for the automated decisions. The biggest limitations is that even after the need identified the presentations of the information's do affect the decisions of the consumer.

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