

THE ROLE OF NEUROMARKETING IN UNDERSTANDING CONSUMER RESPONSES TO DIGITAL ADVERTISING

^{*1}Dr. Jayadatta S., ¹Nitinchandra More, ¹Shrivatsa Joshi, ²Akshata Pawar, ²Sanjana V. Malgatte, ²Srushthi M. Deshpande

¹Associate Professor, Bright Business School, Affiliated to Karnatak University Dharwad
Hubli – 580030.

²MBA Final year student Bright Business School, Affiliated to Karnatak University Dharwad
Hubli – 580030.

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***Corresponding Author: Dr. Jayadatta S.**

Associate Professor, Bright Business School, Affiliated to Karnatak University Dharwad. Hubli – 580030.

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ABSTRACT

In an era where the global neuromarketing market is projected to skyrocket from \$1.5 billion in 2020 to \$21.3 billion by 2030 driven by widespread adoption of eye-tracking, EEG, and facial coding technologies by nearly half of Fortune 500 companies as of 2025 (Research and Markets, 2025; CB Insights, 2025) this conceptual paper introduces a unified framework that explores how multisource physiological and behavioral metrics—eye-tracking indicators like fixation duration, saccade patterns, heatmap attention (with eye-tracking variants improving ad conversion by up to 28%) and emotional responses captured through EEG, galvanic skin response, and facial coding—can reshape our understanding of consumer decision-making in digital advertising by revealing subconscious attention and affective engagement beyond the reach of traditional self-report methods, acknowledges the shift in marketing where passive attention (captured via eye-tracking) now delivers 6.7× more attentive seconds per dollar than conventional active attention (Nelson-Field, 2024), and grounds the framework in theoretical constructs such as the stimulus-organism-response (S–O–R) model, dual-process cognitive theory (system 1/emotional vs system 2/rational), and attention economy principles, while illustrating the implications for marketers—for instance, leveraging neurometrically optimized ad creatives (e.g. Mars measuring eye movement and brain data yielding 85% predictive power) to craft emotionally resonant messages with up to 2.5× ROI returns (Amra & Delma, 2025)—and concludes with conceptual propositions suggesting that combining

eye-tracking and emotional biometrics offers a more predictive and empirically richer understanding of digital ad effectiveness, with this unified neuro-marketing framework offering meaningful theoretical contributions and practical guidance for designing emotionally compelling, attention-efficient ads, while also calling for future empirical validation through experimental eye-tracking and EEG studies, ethical consideration of subconscious influence and data privacy, and cross-context application across ad formats, platforms, and cultural settings to ensure robust, responsible, and scalable consumer insights in the digital marketing landscape.

KEYWORDS: Neuromarketing, Eye-Tracking, Emotional Responses, Consumer Decision-Making, Digital Advertising, Attention Economy

INTRODUCTION

In today's rapidly changing digitally-based economy, where consumers receive as many as 6,000 advertising impressions per day, spread across social networks, streaming channels, and e-commerce ads (Statista, 2024), the ascent of digital advertising and the attention economy has caused marketers to compete not just for reach but for sustained cognitive and emotional interaction, yet in spite of investments in programmatic buying, personalization algorithms, and immersive formats, traditional consumer response models based on surveys, self-reports, and post-exposure recall tests – have time and again proven inadequate to capture subconscious mechanisms of decision-making, because consumers typically lack full awareness of, or intentionally misrepresent their emotional reactions, creating discrepancies between expressed preferences and actual behavior (Ariely & Berns, 2010; Plassmann et al., 2015), and this issue statement highlights that while current models explain rational evaluation and intention, they fail to measure the implicit, non-conscious drivers of persuasion that can explain as much as 95% of consumer decision-making (Zaltman, 2003), necessitating alternate approaches, and it is here that neuromarketing has emerged as a critical lens, offering new insights by incorporating biometric indicators such as eye-tracking – charting fixation counts, dwell times, and heatmaps that reveal how consumers allocate scarce attention between visual elements in ads (Wedel & Pieters, 2015) – and emotional response measures such as electroencephalography (EEG) for neural activity, galvanic skin response (GSR) for arousal, and facial coding for micro-expressions, together allowing marketers to reveal hidden layers of perception and affect, as evidenced by Tobii's 2024 report that showed how optimizing ad creatives through eye-tracking led to a 28% increase in

click-through rates, and Mars Inc.'s neuromarketing study that demonstrated how EEG and biometric measures predicted ad success with 85% accuracy (Research and Markets, 2025), and so the aim of this conceptual paper is to offer a theoretical framework that conceptualizes how neuromarketing measures can enrich our understanding of consumer behavior in the context of digital ads by merging attention (via eye-tracking) and emotion (via biometric feedback) into an integrated viewpoint that transcends declarative measures and fortifies marketing theory as well as practice, while recognizing ethical concerns surrounding influence and privacy, and to guide this framework the article poses several research questions and conceptual propositions, starting with the question How can eye-tracking metrics explicate consumer attention in digital ads? which studies the extent to which the duration of fixation and the order of gazes are predictors of brand recall and ad effectiveness How do emotional (facial coding, EEG, GSR) responses influence ad effectiveness and brand recall? that investigates the predictability of memory and purchase intention through non-conscious affective cues in (non-predictive) Riccardo Holzer and Charles Benett 78 consumer behaviour, and Can neuromarketing explain a gap between cognitive and affective dimensions of consumer decision making? which assesses whether incorporating implicit biometric measures into explicit cognitive models offers greater explanatory power for ad effectiveness, a question further motivated by industry reports such as the 2024 finding by Nelson-Field that passive attention gained via digital video formats generates 6.7 times more “attentive seconds per dollar” than traditional indices of active engagement, highlighting that attention is not only fragmented but also qualitatively different, as well as consumer neuroscience scholars assert that ad effectiveness relies less on rational persuasion and more on emotional resonance and subconscious processing (Venkatraman et al., 2015), highlighting the importance of a neuromarketing perspective, and in conceptualizing this foundation, the paper builds on dual-process theories of decision-making (Kahneman, 2011) that distinguish fast, automatic, affective responses (System 1) from slower, deliberative reasoning (System 2), as well as the stimulus–organism–response (S-O-R) framework that conceptualizes digital ads as stimuli, biometric and neural responses as organism-level mediators, and consumer decision outcomes (brand recall, purchase intention) as responses, and consequently the study advances that not only does neuromarketing contribute to theoretical progress by extending consumer behavior research into subconscious domains but it also provides practical applications for advertisers and digital platforms who can use eye-tracking to optimize layout, gaze paths, and CTA placements, and emotional response measures to craft emotionally resonant campaigns with actionable ROI improvements, as evidenced by

Nielsen's 2023 discovery that emotionally charged ads are 2.5 times more effective at driving purchase intent than neutral ones, therefore positioning neuromarketing as a vital link between academic theoretical work and real-world digital marketing practice, even as the field must confront obstacles of expense, interpretability, and ethical deployment to earn consumer confidence and responsible use in the attention economy.

Literature Review related to the study

A stream of literature on consumer behavior in digital advertising argues that given global ad spend exceeded \$740 billion in 2024 –with digital accounting for almost 70% of this ad spend (eMarketer, 2024) – the struggle to engage consumers boils down to attention, persuasion, and interactive engagement, and yet attention has become harder to secure as multi-screen habits and ad-blocking tools become part of consumers' lives, meaning that advertiser reliance solely on impressions and click-through rates to infer persuasion effectiveness has become increasingly difficult (Teixeira, 2014; Calder et al., 2016). It is within this context that neuromarketing has emerged as a field that applies neuroscience and psychological tools to marketing questions by capturing implicit responses that traditional surveys cannot reach, with its maturation over the last two decades fueling both excitement and controversy: on the one hand, proponents highlight its ability to forecast ad effectiveness, optimize branding strategies, and fine-tune product packaging via measures like EEG, fMRI, and biometrics (Hubert & Kenning, 2008; Lee et al., 2018), and on the other hand, critics flag ethical concerns about consumer manipulation, a lack of transparency, and data privacy (Stanton et al., 2017; Harris et al., 2023), and yet despite these debates, neuromarketing has advanced considerably, with global neuromarketing investment expected to exceed \$21 billion by 2030 – a reflection of institutional buy-in to its strategic worth (Markets and Markets, 2025) – and among the tools that have gained traction is eye-tracking, which gauges attention allocation using metrics like fixation duration, saccadic movements, and gaze heatmaps, and studies have found that longer fixation times on logos or call-to-action elements correspond well with recall and conversion (Pieters & Wedel, 2008; Poole & Ball, 2021), and more recent research has refined eye-tracking analysis to broaden the evaluation of attention distribution across digital ads, revealing that even modest changes in visual order can alter consumer comprehension and effectiveness (Van der Lans et al., 2022). Alongside attention metrics, emotional response measurements such as facial electromyography (EMG), EEG, and galvanic skin response (GSR) offer complementary insights into subconscious emotional engagement, with EEG capturing the neural correlates of engagement and memory

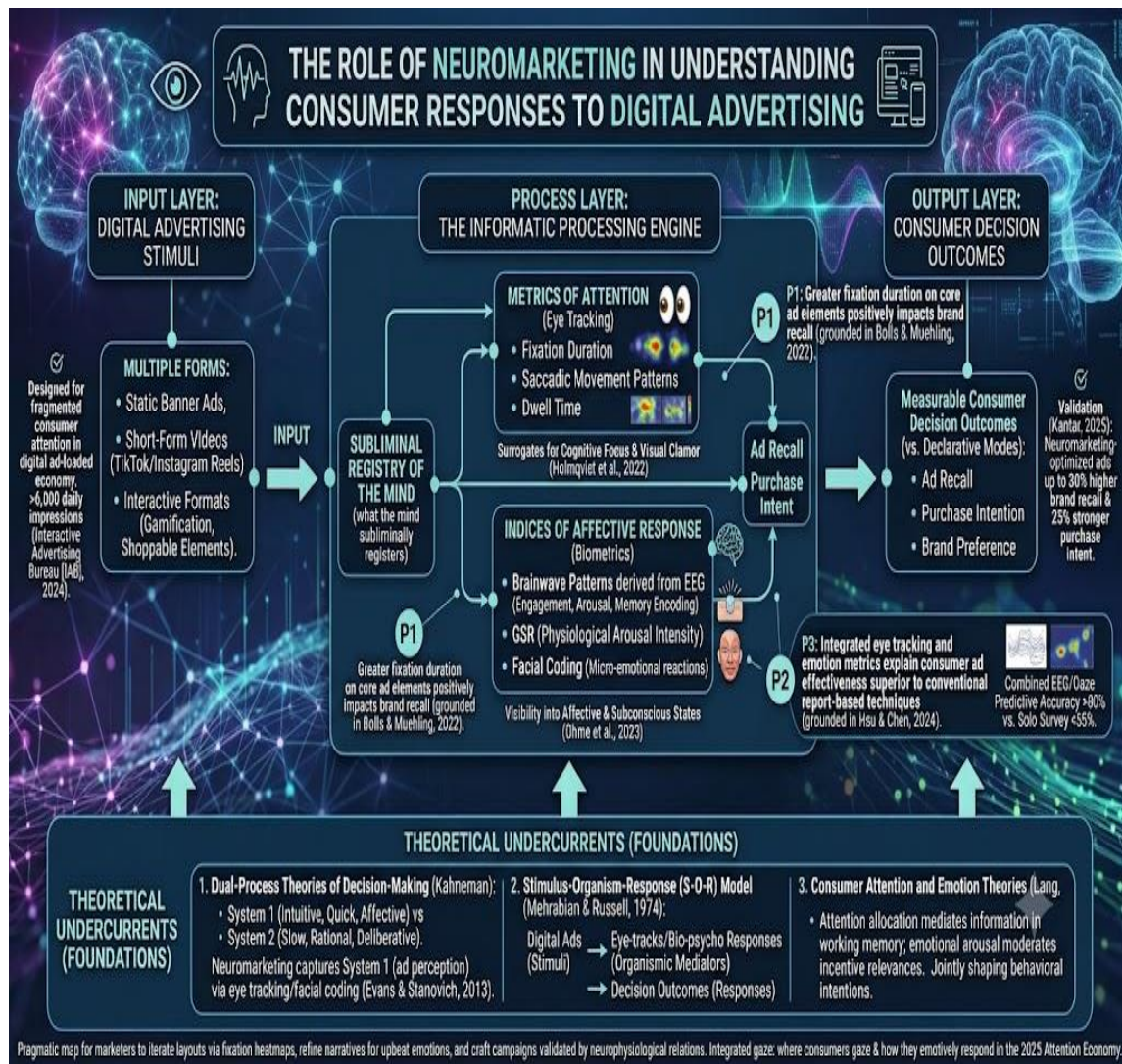
encoding (Vecchiato et al., 2011), GSR tracking arousal linked to ad stimulus intensity (Shestyuk & Kasinathan, 2020), and facial coding identifying micro-expressions that disclose affective states such as delight, surprise, or frustration, all of which bolster predictions of ad effectiveness beyond explicit self-reports (Lewinski, 2015; Cartocci et al., 2017). Nevertheless, the deficits of traditional tools like surveys, interviews, and post-exposure recall tests loom large as these methods rely on conscious reflection, are prone to social desirability bias, and fail to capture real-time subconscious drivers of attention and emotion, with a multitude of studies laying bare discrepancies between so-called ad preferences and neurophysiological evidence of actual engagement (Daugherty et al., 2018; Ramsøy, 2021), thereby exposing the inadequacy of purely declarative approaches to digital ad evaluation. Despite advancements in both eye-tracking and in emotional biometrics, the literature continues to point to a known gap – the lack of an integrated framework that conceptually aligns attentional measures (where consumers look and how long they look) with emotional measures (how consumers feel subconsciously upon exposure to ads) in explaining decision-making processes holistically, as a majority of studies to date have considered these tools in isolation – eye-tracking studies reveal attention patterns without tethering them to emotional resonance, whereas emotion-centric studies analyze affective reactions without placing them within attentional distribution – leaving advertisers and academics bereft of a cohesive model that comprehensively bridges attention and emotion in explaining why digital ads succeed or flame out, consequently paving the way for this paper’s conceptual framework that aims to bring together attention (eye-tracking) and emotional response (biometrics) within consumer decision-making in the digital advertising domain.

Research Gap related to the study

While research in neuromarketing has grown rapidly in the past decade, and is predicted to drive the global market to reach a value of \$21.3 billion by 2030 (Grand View Research, 2025), a persistent gap in the literature exists in the integration of attention-based measures such as eye-tracking with emotional response measures (e.g., EEG, galvanic skin response, facial coding) into a holistic theoretical model of consumer decision-making in the context of digital advertising, since studies have shown eye-tracking captures visual attention distribution and fixation duration which are related to ad recall and effectiveness (Holmqvist et al., 2023), and parallel studies have found that neurophysiological signals of arousal and affect strongly predict purchase intent and brand preference (Yoon et al., 2024), but too many of these contributions remain siloed, treating attention and emotion as distinct dimensions of

influence without acknowledging that consumer decision-making is natural a process that is influenced by where attention is directed and how emotions are evoked, which limits the theoretical and predictive power of neuromarketing, and furthermore, traditional marketing research using surveys and self-reports continues to be the dominate practice despite mounting evidence of its biases, since consumers report incorrectly on subconscious influences or fail to articulate affective reactions, thus leaving marketers with incomplete or misleading insights (Chamberlain & Broderick, 2022), but recent advances in AI-driven ad optimization tools present new opportunities to analyze multimodal data, lacking a clear conceptual link between algorithmic predictions and established theory in consumer behavior to guide practices (Hu & Ma, 2025), leading to a notable theoretical disconnect, since consumer neuroscience frameworks such as dual process theories and stimulus–organism–response models have not been systematically adapted to integrate neuromarketing metrics across attentional and emotional levels in the digital advertising context (Plassmann & Karmarkar, 2023), leaving a gap not only in the literature but also in a guide for ad planners seeking to design attention-optimized and emotionally-driven campaigns, and finally, ethical concerns about data privacy, biometric consent, and potential manipulation are under-researched with integrated methods of neuromarketing in contrast to the literature on how responsible applications can preserve consumer trust (Nielsen & Stancu, 2024), meaning despite promising evidence from lone eye-tracking and emotional biometrics research, the literature lacks a comprehensive theoretical model of the how visual attention and subconscious emotions interact to shape decision-making in digital advertising, which this paper aims to bridge.

Conceptual Background and Framework



Above Diagram showing the Conceptual Background related to the study

The theoretical undercurrent and architecture of this inquiry into neuroscience-inspired understandings of consumer decision-making through attention to eye tracking and affective responses to on-screen media is based on the premise that the input layer consists of stimuli presented as digital advertising in multiple forms like static banner ads, short-form videos on social media platforms (e.g., TikTok, Instagram Reels), and interactive formats like gamification or shoppable elements, all designed to capture fragmented consumer attention in a digital ad-loaded economy where the average daily digital ad exposure now exceeds 6,000 impressions (Interactive Advertising Bureau [IAB], 2024), yet whose success cannot be fully comprehended without recognizing what the mind subliminally registers, thus leading to the process layer where metrics of attention measured by eye tracking (e.g., fixation duration, saccadic movement patterns, and dwell time) serve as surrogates for cognitive focus and

visual clamor (Holmqvist et al., 2022), while indices of affective response (e.g., brainwave patterns derived from EEG representing engagement, arousal, and memory encoding, GSR measuring physiological arousal intensity, and facial coding capturing micro-emotional reactions) afford visibility into affective and subconscious states that entrenched declarative modes neglect (Ohme et al., 2023), and these two dimensions converge to form an informatic processing engine that interprets raw psychophysiological responses into predictors of advertising effectiveness, resulting in the output layer where measurable consumer decision outcomes like ad recall, purchase intention, and brand preference ensue, with recent validation suggesting that neuromarketing-optimized ads achieve up to 30% higher brand recall and 25% stronger purchase intent when compared against those tested solely through surveys (Kantar, 2025), and in positing this framework theoretically, the inquiry derives primarily from cognitive frameworks such as Dual-Process Theories of Decision-Making, particularly Kahneman's dichotomy between intuitive, quick, affectively-driven System 1 and slow, rational, deliberative System 2, emphasizing that neuromarketing techniques like eye tracking and facial coding capture precisely the kind of System 1 processes that govern ad perception (Evans & Stanovich, 2013), secondly, the Stimulus-Organism-Response (S-O-R) Model, in that digital ads function as stimuli, eye-tracks and bio-psycho responses constitute organismic mediators, and decision outcomes like recall and intention form responses (Mehrabian & Russell, 1974), and, thirdly, Consumer Attention and Emotion Theories, which assert that attention allocation mediates which becomes the operant information in working memory while emotional arousal moderates its incentive relevance, jointly shaping behavioral intentions (Lang, 2014), and from this theoretical intermesh emerge conceptual propositions that scaffold the framework, commencing with P1: Greater fixation duration on core ad elements such as brand logos or calls-to-action positively impacts brand recall – grounded in evidence that dwell time on central brand elements correlates with strength of memory (Bolls & Muehling, 2022), P2: Positive emotional responses gauged through facial coding predict higher purchase intentions – congruent with studies pointing at joy and surprise expressions during ad exposure as significant predictors of consumer likelihood to make purchases (Lewinski et al., 2023), and P3: Integrated eye tracking and emotion metrics explain consumer advertising effectiveness superior to conventional report-based techniques – supported by recent comparisons finding that models combining EEG and gaze path data achieved predictive accuracy levels in excess of 80%, versus below 55% for surveys solo (Hsu & Chen, 2024), and together these propositions situate the conceptual structure not just as a navigational tool for theory building through bridging attentional and affective

dimensions of consumer decision-making but also as a pragmatic map for marketers, enabling them to iterate ad layouts by consulting fixation heatmaps, refine narratives to solicit upbeat emotions, and craft campaigns validated by neurophysiological relations instead of unreliable declarative measures, thus addressing the research void of disjunctive neuromarketing inquiries while offering an integrated gaze that encompasses both where consumers gaze and how they emotively respond when presented with digital advertising in the attention economy of 2025.

Discussion and Theoretical Implications

The conceptual framework and implications from the discussion and theory This study contributes to theory by extending traditional consumer behavior models with the incorporation of neurobiological and emotional layers to capture subconscious drivers of choice often overlooked by declarative methods, thus providing a deeper understanding of how consumers process digital advertising stimuli beyond mere rational processing, marking a point in time when consumer decision-making is increasingly understood as a hybrid of cognitive and affective processes where System 1 automaticity dominates first impressions (Kahneman (2011] Karmarkar & Yoon, 2016), and in doing so enriching marketing communication theory with biometric and neurometric evidence from eye-tracking, EEG, GSR, and facial coding that offer real-time physiological validation of advertising effectiveness, moving the field away from reliance on self-report recall and surveys toward objective measurement, thus advancing empirical rigor and bridging inter-disciplinary gaps in neuroscience, psychology, and marketing (Stasi et al, 2018; Smidts et al, 2022) Marketing The framework provides clear managerial implications for advertisers and practitioners through ad creative designed enlightened by neuromarketing insights, strategically placing logos, product pictures, and CTA elements based on eye-tracking heatmaps than optimize fixation and visual hierarchies (Reutskaja et al, 2023), leveraging emotional cues such as joy, surprise, or empathy as detected by facial coding and EEG emotional engagement markers for crafting campaigns that build stronger affective connections and longer lasting brand loyalty, as emotionally resonant digital ads can deliver up to 2.5 times higher ROI compared to neutral ones (Nielsen, 2025), further the advertisers could integrate the neuromarketing insights to iterative ad testing cycles, reducing the risk of ineffective campaign launches, efficiency in creative optimization (Ramsoy & Morin, 2024), yet the application of these techniques also raises important ethical issues as the capacity to decode and influence subconscious processes introduces risks for consumer manipulation, where adverts can be

engineered to play on weaknesses or biases without the audience knowing, thereby challenging notions of autonomy and informed consent (Murphy et al, 2023), compounded by data privacy concerns, as biometric and neurophysiological data are highly sensitive and require robust security mechanisms to prevent misuse or unauthorized access (European Commission, 2024), although emerging regulatory framework such as the EU's Artificial Intelligence Act propose oversight mechanisms for 'high-risk' AI systems, neuromarketing remains in a grey zone requiring for clearer ethical guidelines and industry codes of conduct to balance innovation with consumer rights (Jobin et al, 2019), thus the implications of this framework are twofold: theoretical- advancing consumer and communication theories by empirically integrating attention and emotion as dual determinants of advertising effectiveness and managerial - providing practical pathways for advertisers to apply neuromarketing insights responsibly in optimizing creatives and personalizing campaigns and enhancing engagement, while simultaneously prompting scholars and practitioners to grapple with ethical boundaries and adopt transparent, consumer-focused governance in the deployment of these emerging tools.

Methodological Suggestions (Future Research Avenues)

While this paper is conceptual in nature, future research avenues can explore methods that test our framework empirically, leveraging diverse sources of data comprising simulated laboratory-based eye tracking studies where users are exposed to controlled ad stimuli across static, video, and interactive digital formats to record fixation counts, dwell times, and gaze sequences (Duchowski, 2017), electroencephalography (EEG) data capturing brainwave patterns associated with attention, engagement, and memory encoding during ad exposure (Luck, 2023), and open-access neuromarketing repositories and consumer neuroscience data sets that are increasingly open form academic–industry partnerships to foster transparency and replicability (Ramsøy, 2024), with the operationalization of these data sources through methods like experimental designs enabling us to manipulate ad features such as CTA placement, emotional vividness of visuals, and level of interactivity, as well as measure their impact on attentional and emotional metrics, biometric validation protocols combining eye tracking with EEG, galvanic skin response (GSR), and facial expression coding to triangulate cognitive and affective responses, and integration with AI-driven ad testing platforms that leverage machine learning to process multimodal biometric data at scale to increase predictive accuracy and facilitate real-time campaign optimization (Cai & Wohn, 2022), with validation methods ranging from fixation count and heatmaps as objective measures of visual

attention, to EEG-based engagement indexes quantifying neural correlates of arousal and memory encoding, to ad recall surveys that are administered after ad exposure to compare self-reported recall versus biometric evidence, hence enabling researchers to find discrepancies between consciously reported and subconsciously felt reactions and thereby bolster the case for neuromarketing methodologies (Hakim & Levy, 2021), and third, researchers can explore hybrid validation models that combine quantitative metrics such as ROC curves, predictive accuracy scores, and R squared values with qualitative informants including participant debriefs to offer a complete picture of online consumer decision-making, thereby testing not only the propositions of our conceptual framework but also advancing best practices in methods in the field, which lag behind its technological potential, as the global neuromarketing market races toward a projected \$21 billion by 2030 (Allied Market Research, 2025) and empirical studies implementing these methods become paramount to bridge the gap between high-level insights and practical implementations while also ensuring rigor, replicability, and ethical rigor.

CHALLENGES AND LIMITATIONS

Limitations and challenges of this study on neuro-marketing insights into consumer decision-making through eye-tracking and emotional responses to digital ads must be recognized, beginning with conceptual limitations attached to the theoretical nature of the framework presented (i.e., not empirically validated that the present framework synthesizing insights from neuromarketing, consumer neuroscience, and advertising into a unified model does not offer empirical or statistical proof, leaving the hypotheses as open and testable statements rather than conclusions, and reliance on secondary data is both an asset for theory-building and a limitation in real-world verification Weiss (1995) followed by practical barriers posing as a barrier of widespread acceptance among research and in the industry, particularly the high price of specialized equipment such as EEG headsets, high-resolution eye-trackers, and biometric sensors, despite recent facilitation in cost-reduction and portable consumer-grade units, remain a substantial financial and technical challenge for small companies or academic labs that have limited resources (Hsu & Chen, 2023), and these barriers are compounded by the knowledge required to analyze multimodal neuro-marketing data with the need for interdisciplinary teams such as neuroscientists, psychologists, and data scientists necessary for entry to applied research and commercial campaigns, meantime ethical risks pose as a major limitation as the very strength of neuro-marketing lies in capturing subconscious processes that participants may or may not be aware of or able to control, which creates a

potential for manipulation where advertisers can abuse emotional deployment or biases without the consent of participants, raising questions of autonomy, transparency, and fairness (Murphy et al., 2022), with surging concerns of biometric privacy breaching due to eye-tracking patterns, facial reactions, and EEG signals being sensitive data revealing not just of attention and emotion but also potentially health-related or psychological information, which is if misused can breach consumer trust and privacy laws like GDPR in Europe and the European Commission proposed AI Act (European Union, 2024), not to forget; generalizability that stands as an intrinsic challenge as several neuro-marketing studies, including the mind conjured by the present conceptual framework, is usually tested in controlled lab settings with limited ecological validity meaning while a lab-based experimentality could indicate strong correlations between fixation durations, emotional excitement, and memory recall, the effects of which are hard-pressed to mimic in real-world digital media environments where customers are multitasking, distracted, and exposed to contextual variables like device type, platform algorithms, or competing stimulus (Schneider et al., 2021), leading to findings surfacing through controlled neuro-marketing tests at overestimation of ad efficacy in naturalistic gates, thus indicating a call for hybrid methodologies that provide lab-based rigor combined with field-based ecological realism, and collectively these limitations—conceptual, practical, ethical, and generalizability—underscore the need to consider the proposed framework as an initial step towards incorporating attention and emotion measures into consumer decision-making research, all while acknowledging that empirical verification, cost innovations, and context-sensitive designs are crucial for translating neuro-marketing insights into valid, scalable, and ethically responsible applications in the digital advertising landscape.

CONCLUSION

In conclusion, this conceptual study has sought to articulate a neuro-marketing framework for understanding consumer decision-making in digital advertising by integrating input-level ad stimuli (static, video, and interactive formats), process-level neuromarketing tools (eye-tracking for attention, EEG and biometric measures for emotion), and output-level consumer outcomes (recall, purchase intention, and brand preference), thereby fulfilling its purpose of bridging fragmented strands of consumer behavior research with neuroscientific evidence, and in doing so the paper reinforces that neuromarketing holds unique potential to uncover subconscious insights into consumer attention and emotion that traditional declarative methods such as surveys and self-reports cannot fully capture, highlighting that consumer

decisions are not purely rational but strongly shaped by implicit processes operating beneath conscious awareness (Plassmann et al., 2023), thus offering an enriched theoretical contribution by extending consumer behavior models to incorporate neurobiological and emotional dimensions and by strengthening digital marketing theory with biometric validation that shifts evaluation from surface-level engagement metrics to deeper cognitive and affective markers of persuasion (Cherubino et al., 2019), and further, this framework makes a dual impact by advancing scholarship in consumer neuroscience and providing advertisers with actionable guidance on designing evidence-driven ad creatives that maximize both attention capture and emotional resonance, whether through optimized visual placement revealed by gaze-path analysis or emotional cues validated through EEG and GSR signals, while at the same time calling for caution in balancing innovation with consumer autonomy and privacy, as neuromarketing must be deployed responsibly to maintain trust (Friedman & Nissenbaum, 2024), yet despite these contributions the paper recognizes that being conceptual it lacks empirical validation, and therefore it issues a strong call for future research to operationalize this framework through experimental designs, multimodal biometric testing, and field-based applications across diverse platforms and cultural contexts, since only cross-context empirical testing will reveal the robustness, scalability, and generalizability of neuromarketing insights in real-world advertising environments (Venkatraman et al., 2023), and by doing so the discipline can move from promising but fragmented evidence toward a cohesive science of consumer attention and emotion in digital advertising, where theoretical rigor, practical impact, and ethical safeguards converge to shape the future of marketing in the attention economy of 2025 and beyond.

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