
NEUROMARKETING TECHNIQUES AND THEIR INFLUENCE ON CONSUMER DECISION-MAKING IN DIGITAL ADVERTISING

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ABSTRACT

This research sparked paper offers a conceptual model on how our recent advances in neuromarketing techniques, informed by reviewing the most state-of-the-art theoretical, methodological, and applied literature from marketing, consumer neuroscience, and digital media studies, can shape consumer decision-making in the era of digital advertising. As advertising environments move from over-information, short attention spans, algorithmic targeting and affect-laden visual formats, traditional self-report methods fall short of providing a comprehensive explanation of how consumers allocate attention to, process, and respond to advertising stimuli. In this context, neuromarketing can provide an insightful framework for understanding seemingly subconscious and pre-conscious consumer responses using techniques such as electroencephalography (EEG), eye-tracking, functional magnetic resonance imaging (fMRI), skin conductance, facial coding, and related biometric metrics in the study of attention, emotion, memory, preference formation, and purchase intention in advertising settings. Neuromarketing literature has grown substantially post mid-2010s and is being increasingly applied to digital contexts such as social media advertisement, video advertisement, e-commerce interface, and marketing systems enhanced with AI among others. The primary aim of this paper is to create a conceptual framework regarding the

mechanisms in which neuromarketing methods influence the consumer's decision-making process in digital advertising. This aspect of the paper allows the authors to argue that the effectiveness of digital advertisements relies not just on conscious evaluation, but on the unconscious nature of neural and emotional processes such as attention capture, affective engagement, cognitive load, recall, trust and behavioral intention. It additionally suggests that neuromarketing tools allow us to elaborate on why some digital ads do better than others in terms of how they impact viewers in relation to visual salience, message framing, personalization, platform design, and advertising repetition. The paper is conceptual in nature, it is desk-based and it synthesizes relevant literature into a framework which connects neuromarketing inputs, psychological processes and consumer decision outcomes. The results suggest that neuromarketing can extend and bridge digital advertising theory and practice by illuminating our understanding of nonconscious drivers of consumer choice, but they also evoke ethical, privacy, manipulation, and commercial utilization issues related to biometric and neurophysiological data. This study advances marketing management literature, by (1) a structured conceptual model for future empirical assessment, (2) defining neuromarketing opportunities and limits in current digital advertising planning.

KEYWORDS: Neuromarketing, digital advertising, consumer decision-making, EEG, eye-tracking, consumer neuroscience, online advertising, advertising effectiveness.

INTRODUCTION related to the study

Because it can use neuroscience-informed methods to investigate consumer reactions, preferences, and purchasing underpinnings (e.g., with tools like electroencephalography, eye-tracking, facial electromyography, skin conductance, and functional magnetic resonance imaging) that capture a partial response (to the product) longer before and/or different from what consumers can articulate or adequately report in traditional marketing surveys and interviews, neuromarketing has undergone rapid development and has been described as a new part of marketing management; specifically, the American Psychological Association (2011) defines neuromarketing as a subdiscipline of market research regarding changes in brain activity as they relate to the products or ideas consumers like, buy, and even discuss, making it highly relevant in a time of increasingly scarce attention to digital advertising and high competition for engagement. In the contemporary context, digital advertising itself has become inherently more complex because brands are now competing across social video platforms, streaming environments, e-commerce interfaces, search ecosystems, mobile apps,

and creator-led content spaces increasingly shaped by algorithmic recommendation, personalization, short-form formats, and performance-based media buying; at this point, as Deloitte's 2025 Digital Media Trends report underscores, social video platforms are emerging as a dominant force in media and entertainment, commanding more than half of U.S. ad spending in their category while competing for an average of approximately six hours per day of media and entertainment time per person, underscoring how crowded and attention-constrained the digital environment has become; simultaneously, as IAB's 2025 digital video reporting notes, in 2024 digital video ad spend in the United States reached \$64 billion while digital video ad spend was projected to grow further in 2025, illustrating the strategic need to understand which digital stimuli actually drive consumer choice. Such environment makes the relationship between neuroscience and behavior critical, since consumer decisions are shaped not only by conscious reasoning, but also by rapid, affective, and unconscious mechanisms involved in attention, emotion, memory and cognitive load; and recent systematic and bibliometric reviews indicate that neuromarketing research has been growing exponentially in the last years (the 2016 bibliometric-in LDA review mapped 341 publications published between 2008 to 2015, finding that, after the 2015 year, publishing rates increased) and adding to this previous research, the 2025 systematic review in *Frontiers in Neuroergonomics* concludes that neurophysiological techniques are being increasingly applied in a broader manner along consumers buying stages rather than being limited only to pre-purchase analysis. This literature fueled up the rationale for the current study: where classical digital advertising metrics (clicks, impressions, and self-reported attitudes) proved to be ineffective in analyzing why certain ads capture attention, develop trust, create recall, and induce purchase intention while others do not, neuromarketing can analyze how consumer minds work while exposed to digital advertising stimuli; accordingly, we aim to explore, conceptually, what neuromarketing means and implies, what is its relationship to consumer decision-making in digital advertising, and why unconscious cognitive and affective processes have become the focus of understanding advertising effectiveness in an increasingly AI and attention-fragmented marketplace.

Background of the Study

This study is important given how far marketing research has progressed from predominantly questionnaire/interview/recall tests/focus group-based traditional methods to the more advanced biometric/neuro-based techniques developed to better measure consumer responses that take place below the threshold of full conscious awareness; this is because although

traditional advertising research has created signal value by measuring traditional market metrics such as stated preferences, brand attitudes, and purchase intentions, a growing body of scholarship has quickly proven substantial limitations for these methods since they often fail to capture attention shifts, emotional arousal, memory encoding, and evaluative reactions that occur on a timescale of seconds and which strongly influence real-world marketplace behavior (especially in the medium of digital where consumers scroll, skip, and compare content in the seconds) helping to spur consumer neuroscience and later neuromarketing as an interdisciplinary field that merges marketing, psychology, neuroscience, and behavioral science to understand how consumers respond to marketing stimuli using physiological and neural signals, rather than asking them a question after the fact, and recent reviews have indicated this field has developed rapidly with a Systematic Review conducted in 2025 identifying large quantitative increases in the application neurophysiological techniques to multiple stages of the consumer buying process (Jabbar et al., 2026) and a bibliometric-LDA review presenting 341 publications between 2008 and 2025 illustrating how quickly consumer neuroscience has been growing with particularly active tracking after 2015 and a notably recent trend toward artificial intelligence and machine-learning-assisted analysis of consumer responses (Othman et al., 2025); within this transition period, the evolution of advertising research has also been shaped by the rise of digital advertising ecosystems with messages communicated today over search engines, e-commerce sites, social feeds, streaming services, mobile apps, and creator platforms with high levels of competition for user attention between short-form video, personalization, algorithmic targeting and rapid creative testing, which makes it increasingly problematic for managers to rely solely on self-reported feedback to evaluate advertising effectiveness, as illustrated by recent U.S. market data showing that digital video ad spend grew 18% year on year 2024 to \$64 billion and is projected to account for nearly 60% of total TV/video ad spend in 2025 and Deloitte's report that social platforms are becoming dominant competitors for audience engagement, attention, and advertising budgets with AI-optimized recommendation and engagement systems (Deloitte, 2025; Interactive Advertising Bureau [IAB], 2025); thus the relevance of this background to marketing management is that neuromarketing offers managers a more granular understanding of why certain digital advertisements succeed or fail in crowded attention markets helping with the creative design, message testing, audience targeting, and strategic decision-making in a world where immediate subconscious reactions more than ever drive observable consumer outcomes.

Statement of the Problem

However, despite the promise of these research trend observations, the conceptual role of neuromarketing relative to digital advertising strategy remains unclear, fragmented across various marketing, neuroscience, psychology, analytics, and information-systems literature streams, as despite increases in the number of publications as well as citations, recent systematic reviews indicate that markers for substantive contributions may still be a long way away (Othman et al., 2025; Sarowar et al., 2024). Neuromarketing, Consumer Response, and Digital Advertising Currently, digital advertising is one of the most data-rich segments of marketing management (Cohen, 2019; Kumari et al., 2021), generating copious measurable data (impressions, clicks, views, watch time, conversion rates, engagement scores) surrounding performance (Interactive Advertising Bureau [IAB] & PwC, 2026) and enabling organizations to assess engagement, exposure, creativity, and more at a granular level across consumer segments with ease (Interactive Advertising Bureau [IAB] & PwC, 2026). However, despite these advantages, a serious conceptually-driven and practically-relevant problem remains: We still do not know why certain digital advertisements are noticed, ignored, trusted, remembered, or acted upon by consumers, as surface measures alone do not account for the causal mechanisms at play (e.g., one advertisement somehow grabs attention and triggers purchase intention while another visually similar advertisement fails to create emotional resonance or brand recall). An urgent need for understanding actual consumer response beyond platform metrics persists, given that cloud empires currently generate trillions of in-depth impressions from marketing campaigns, posts, and pieces of content every day but actual emotional merit is effectively inscrutable without underlying mechanisms being quantified (rather than treated simply as a data cloud), and with the IAB/PwC Digital Ad Spend Reports indicating that U.S. internet advertising revenue reached \$294.6 billion in 2025 and 13.9% year-on-year growth (interactive law firm, 2026), brands are all the more heavily investing in these digital mediums without better means of understanding consumer attentiveness or decision-making elsewhere (Interactive Advertising Bureau [IAB] & PwC, 2026). Indeed traditional methods such as surveys, interviews and focus groups (Aaker et al., 2010) remain useful, however, they still hold known limits as often it is simply not possible for consumers to accurately recall, articulate, or even consciously identify the emotional and neurological processes forming basis for their choices (Dahl et al., 2022) particularly ripe environments where the stakes are high or where time constriction exists (see particularly fast-moving promotional environments such as short-form video, mobile, influencer, social commerce, and personalized platform feeds). One promising

research solution to this long-standing problem may be validated by a small but growing body of research recognizing the capacity of neuromarketing tools capable of using EEG, eye tracking, facial-coding, skin conductance, or other biometric techniques to digest and measure attention, arousal, emotion, memory, and decision readiness and vice-versa more directly (Jabbar et al., 2026) and a 2026 bibliometric-LDA review identifying 341 neuromarketing unique publications across 17 years (2008–2025) but with robust growth after 2015s, alongside skyrocketing advances in artificial intelligence or machine learning across consumer-behavior analyses whether for feature extraction or behavioral analysis (Keller, 2010; Romani et al., 2013).

Objectives of the Study

1. To explain the concept and main techniques of neuromarketing.
2. To analyze how neuromarketing relates to consumer attention, emotion, memory, and choice.
3. To examine the relevance of neuromarketing in digital advertising environments.
4. To identify opportunities and ethical concerns associated with neuromarketing use.
5. To propose a conceptual framework for future empirical research.

Research Questions

1. What is neuromarketing and how is it applied in digital advertising?
2. Which neuromarketing techniques are most relevant to consumer decision-making?
3. How do attention, emotion, and memory mediate digital advertising outcomes?
4. What opportunities does neuromarketing create for marketers?
5. What ethical and managerial concerns arise from its use?

Literature Review

Neuromarketing is an interdisciplinary research discipline linking neuroscience, psychology, and consumer responses, specializing in observing consumer reactions to marketing stimuli consciously and subconsciously. Neuromarketing can be defined as the use of neuroscientific methods to continents and understand human behaviour in the context of markets and marketing exchanges (Lee, Broderick and Chamberlain, 2007) or neuromarketing is useful, as many consumer preferences originate from processes which consumer cannot clarify in full by self-report (Ariely and Berns, 2010). Hence, neuromarketing is more sophisticated than traditional market research which rests on heavily on surveys, interviews, focus groups, and stated preferences with neuromarketing capturing unconscious responses like attention,

emotion, memory, and decision-making activation and readiness. One important stream of literature is related to neuromarketing tools, and specifically EEG, fMRI, eye-tracking, skin conductance, facial coding and other bio metric tools. Plassmann, Venkatraman, Huettel, & Yoon (2015) claim that consumer neuroscience can enable researchers to study valuation, choice, and preference formation, but they caution about under constraining the interpretation of neural signals. Due to its relative accessibility with respect to fMRI and its ability to record brain activity associated with attention and engagement at the moment of advertising exposure, EEG has earned special attention. Sarowar et al. EEG-based neuromarketing research 'has emerged as being important for advertising effectiveness, purchase decisions and consumer response patterns' (2024). Eye-tracking is equally popular because it can get to the bottom of what consumers see first, the amount of time spent looking at any advert, as well as what images or elements of a webpage draws the eye. Consumer decision-making theory is another basis on which neuromarketing research is based upon. Dual process theory (Kahneman, 2011) states that most of our decisions are made by fast intuitive and emotional processes and slowed down by rational processes which is very pertinent to understanding why consumers are likely to make rapid decisions while consuming digital advertising as they scroll through content. Neuromarketing can help better understand consumer choice (Morin, 2011) since many purchase decisions are made subconsciously and not solely based on intentional reasoning. Similarly, Plassmann et al. For this reason, neural approaches have made their way into the study of consumer valuation: as highlighted by (2012), emotions, memory and expectations of reward, which precede conscious expression of preferences by consumers, may be tracked through their neurological activities. With digital advertising, neuromarketing gains particular prominence, as consumers can easily become dominated and overwhelmed with high volumes of content from social media, video platforms, search engines, e-commerce interfaces, and personalized and re-targeted advertising systems. Venkatraman et al. As neurophysiological measures quantify the brain and some unconscious aspects of consumer behavior more reliably than traditional survey measures, this would imply these measures possess some utility at predicting advertising success that is above and beyond what survey responses provide answers that may have significant limitation at predicting actual behavior (Riftkin, 2015). This is especially useful in the context of digital advertising, where ads may have high click-through rates and impression but may not truly explain the measure of emotional engagement, brand recall or purchase intent. There has also been increasing reporting in the literature that tackle the new relationship between neuromarketing and artificial intelligence which was another one of the trends being reported.

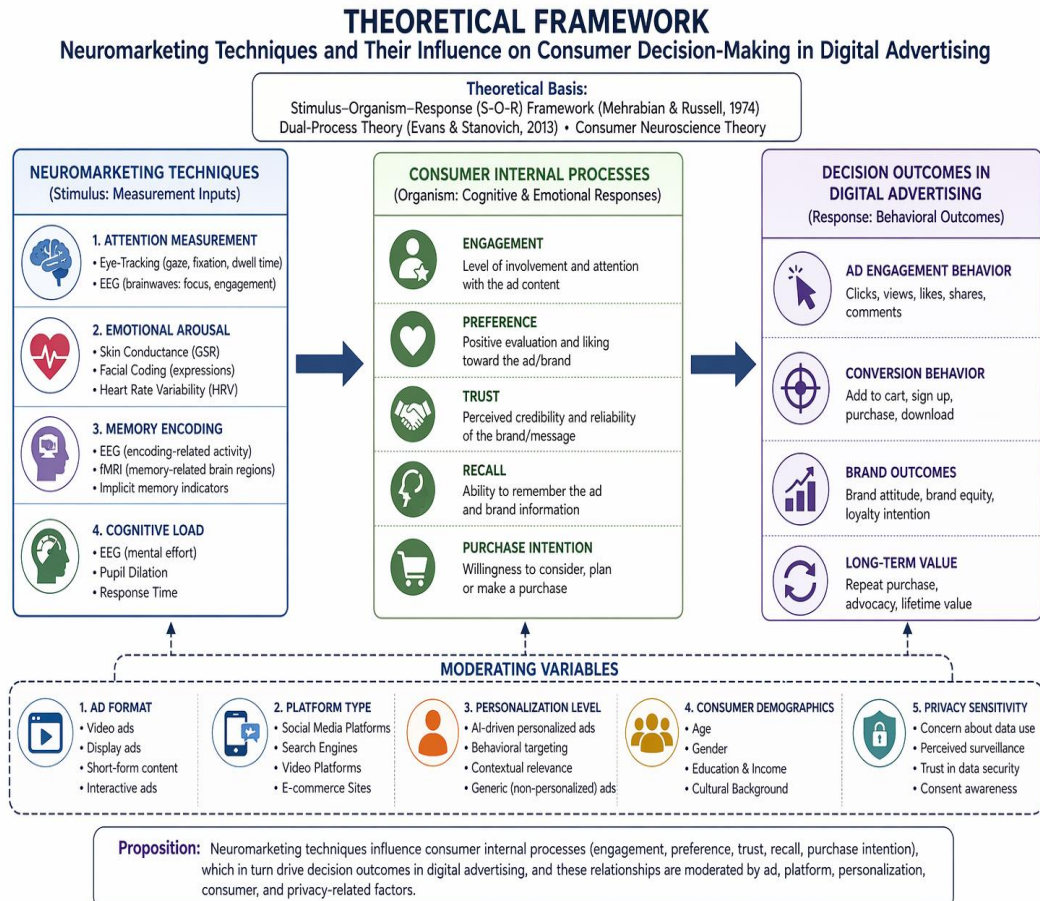
Alsharif et al. It is reported that AI is increasingly used in the analysis of neuromarketing data (2025) and in consumer prediction and enabling more advanced biomarker and neurophysiological response interpretations (2025). This is significant because digital ads are already targeted through algorithms, personalization and real-time optimization, thereby marking neuromarketing and AI as companion tools for consumer attention and behaviour. That development additionally brings a whole host of moral worries, including problems round privacy and consent, manipulation of shoppers, and the obtainability of sensitive biodata. Literature identified the main potential opportunities in the advertisement test, greater emotional insight, etc., deeper consumer segmentation, personalization, etc., and a deeper understanding of subconscious reactions [2]. For instance, it could be used to tell us if a video advertisement produces a certain emotional arousal, if a social media post draws visual fixation, or if an e-commerce layout tries to effortlessly direct cognitive engagement. The literature also identifies some limitations and backlash at the same time. Murphy, Illes, and Reiner (2008) discuss serious neuroethical issues presented by neuromarketing, especially when the persuasion use of neural and biometric data lacks transparency. But Stanton, Sinnott-Armstrong, and Huettel (2017) warn that neuromarketing needs to be scrutinized as such factors as methodological problems, small samples, high price, and overinterpretation may invalidate results. In sum, our literature review suggests that neuromarketing offers a promising conceptual lens through which to better understand consumer decision-making in an era of digital advertising whereby attention, emotion, memory, and motivation are captured much more directly compared to traditional approaches. On the other hand, however, scholars also agree that whilst neuromarketing might have no place in substitution of conventional marketing research, it only serves as a supplementary tool since neural and biometric data is difficult to interpret, needs ethical clearance, and should always be integrated with behavioural and self-report evidences. Thus, this literature supports the belief that neuromarketing holds great promise to enhance online advertising technique, but its application must be restrained by methodological rigor and ethical marketing prudence.

Theoretical Foundations

This study is theoretically based on an extended conceptual framework that connects neuromarketing inputs to internal psychological processes and ultimately behavioral outcomes in the context of the digital channel, where neuromarketing techniques (attention [eye-tracking and EEG], emotional arousal [skin conductance and facial coding], memory

[EEG and fMRI] and cognitive load [neurophysiological indicators]) represent stimuli inputs that interact with consumer-processes (engagement, preference formation, trust, recall and purchase intention) that together combine to form decision outcomes (click-through behavior, brand choice, conversion and long-term loyalty) in a structure that closely relates to the Stimulus-Organism-Response (S-O-R) paradigm originally proposed by Mehrabian and Russell (1974) and expanded to the areas of digital marketing to explain how external stimuli prompt internal cognitive and emotional states that culminate in all important behavioral responses, in which neuromarketing techniques act as superior measurement tools, allowing researchers to look into the “organism” stage more closely than other measurement methods can do, thus further enhancing the ability to explore how consumers process advertising stimuli in crowded digital environments; furthermore, this conceptual model has at its core the concept of S-O-R and also supported by dual-process theory, most notably the framework by Evans and Stanovich (2013), in which two systems serve as the mental foundations for decision-making: System 1 (fast, automatic, affect-driven processes) and System 2 (slow, deliberate, analytical processes) showing in the digital advertising context that system 2 is mostly marginalized since fast (intuitive) applications operate through visual cues, affect-driven decisions and cognitive shortcuts, therefore neuromarketing techniques are especially appropriate to seize this fast-to-take real-time (i.e.: instantaneous, split-second) responses; In fact, attention, emotion and memory are interrelated processes, where attention determines exposure, emotional arousal enhances encoding and memory effects later decision-making according to some contemporary consumer neuroscience (Vecchiato et al.) research. et al. (2011) also showed that emotional and attentional neuro-physiological metrics are predictive of advertisement effectiveness; however, this relationship is moderated by factors such as ad format (short-form video vs display ads), type of platform (social media vs search engine), level of personalization (AI-driven vs generic), consumer demographic variables (age, culture, digital literacy), and privacy sensitivity (now relevant due to big changes in the very recent landscape of data-driven marketing and data collection, where consumer perception may change depending upon whether consumers feel that they are being monitored to be targeted) for instance, highly personalized social media video advertisements may be more analyzable emotionally and more memorable than a static display ad, but may also undermine trust due to privacy related concerns; moreover, these processes further exemplarily require relating measures that bridge behavioral, cognitive, and neuroscientific descriptors; additionally, neuromarketing is needed theory in the service of risk of marketing management practice for this broad theoretical basis; the theoretical foundation of this study lies in the

observation that advertisement effectiveness is not just a function of exposure to advertisement messages, but rather how deeply and analogous affectively, the advertisement messages are processed by the consumer.



Above diagram showing the Theoretical Foundations related to the study

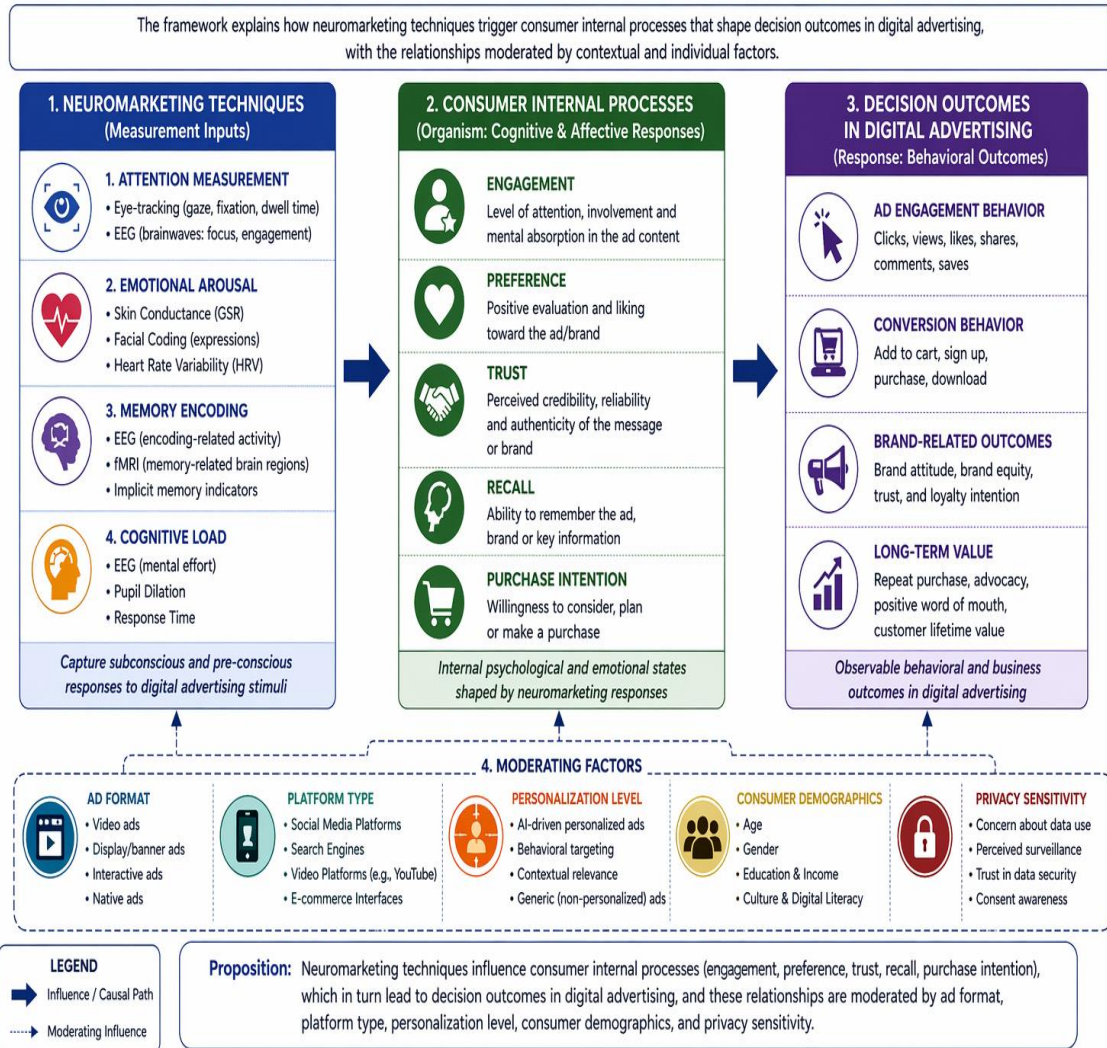
Conceptual Framework

The conceptual framework of this study on is designed to outline a causal chain between neurophysiological measurement tools and consumer behavior outcomes in digital environments and to integrate insights from key fields of consumer neuroscience, behavioral decision theory and digital marketing systems, in which neuromarketing techniques including attention measurement, captured using eye-tracking fixation patterns and EEG signals; emotional arousal, measured via skin conductance and facial expression analysis; memory encoding, measured through neural activation patterns and implicit recall indicators; and cognitive load, evaluated using neural efficiency and processing indicators are the primary stimulus inputs that influence consumer internal processes such as engagement (level of attention and involvement), preference (affective evaluation of the advertisement or brand),

trust (perceived credibility and reliability), recall (ability to remember advertising content), and purchase intention (likelihood of behavioral action), and these internal processes in turn determine decision outcomes in digital advertising, including ad engagement behavior (clicks, views, shares), conversion outcomes (purchases, sign-ups), and long-term brand responses (loyalty, advocacy), a structure that is conceptually compatible with the extended Stimulus–Organism–Response paradigm as applied in various digital marketing research contexts (Eroglu, Machleit, & Davis, 2001), as well as contemporary attention economy theory, arguing that consumer attention is a scarce resource that can be influenced by competition through platform design and content opportunities (Davenport & Beck, 2001); in addition, the framework acknowledges that the strength and directionality of these relationships are moderated by ad format (e.g., short-form video, display, interactive ads), platform type (e.g., social media feeds, search engines, e-commerce interfaces), personalization level (AI-driven targeting versus generic messaging), as well as consumer demographics (age, gender, cultural background, digital literacy) and privacy sensitivity, which are increasingly relevant in data-driven advertising environments, where consumers may react differently when they know behavioral tracking or biometric data are involved (Aguirre, Mahr, Grewal, de Ruyter, & Wetzels, 2015) by finding that personalization is beneficial for consumer responses but decreases trust when perceived to be intrusive; finally, prior empirical and review-based studies indicated that neuromarketing variables like attention and emotional arousal were better at predicting advertising effectiveness and memory recall than traditional variables, and AI-enhanced analytics can further sharpen these predictions using behavioral and neurophysiological data (Boerman, Kruijemeier, & Zuiderveen Borgesius, 2017; Hakim & Levy, 2024), illustrating that a highly personalized video advertisement in a social media platform could trigger higher emotional engagement and memory encoding and therefore increase its likelihood to be converted, but on the other hand also raises the question whether it constitutes a breach of privacy and ethics; thus, this conceptual framework offers a structural foundation for linking neuromarketing techniques to consumer cognition and behavior while accounting for contextual and individual differences and establish a theoretical basis for understanding the drivers of digital advertising effectiveness both in terms of observable behaviors and subconscious processes.

CONCEPTUAL FRAMEWORK

Neuromarketing Techniques and Their Influence on Consumer Decision-Making in Digital Advertising



Above diagram showing the Conceptual Framework related to the study

Methodology adopted related to the study

The methodology adopted for the conceptual study entitled is a qualitative, desk-based, exploratory, analytical and secondary-source-based review, because the study is not collecting primary experimental data from consumers, but is developing a conceptual understanding by synthesizing existing knowledge from a variety of fields, including marketing, neuroscience, consumer psychology, advertising research and digital media studies (and this is an appropriate approach because neuromarketing research is still maturing across multiple disciplines, and more recent studies have suggested that organizing fragmented evidence into clearer frameworks that associate neurophysiological techniques with consumer decision-making outcomes was needed), therefore, the study relies journal articles, systematic review papers, conceptual papers, academic books, conference papers, industry research,

neuroscience sources, psychology literature and digital advertising reports to examine how techniques such as EEG, eye-tracking, fMRI, skin conductance, facial coding and biometric measurement explain attention, emotion, memory, cognitive load, engagement, trust, recall and purchase intention in online advertising contexts (the review procedure involves identifying relevant literature, grouping the sources thematically, comparing theoretical arguments and interpreting the findings in relation to digital advertising formats, such as social media ads, video ads, display ads, e-commerce interfaces, search advertising and AI-personalized advertisements), and this methodology can be justified, for example, by recent scholarship such as Othman, Alsharif, Salleh and Baharum's 2025 systematic review, which show that neuromarketing literature increasingly examines affective, cognitive and behavioral components across the full consumer journey and Sarowar et al. 2017, a trend of using EEG to study the relationship between advertising effectiveness, purchase decisions and consumer response patterns, suggesting that secondary literature offers an insight-rich source for conceptual model building. Alsharif et al. Further, the relevance of the study is additionally reinforced by the growing importance of algorithmic targeting, automated personalization, and data-driven prediction to digital advertising (Raghunathan et al., 2022), which makes the synergies between neuromarketing and artificial intelligence particularly salient to the explanation of current consumer behavior (Baller et al., 2020); therefore, the study uses thematic analysis to categorize reviewed literature into main themes that emerged neuromarketing techniques, the internal processes of the consumer, outcomes to digital advertising, ethical implications, privacy sensitivity concerns, and managerial implications and employs conceptual analysis to construct a framework illustrating how neuromarketing facilitates consumer decision-making to influence advertising outcomes, making its methodology appropriate for a conceptual paper that aims to clarify theory, identify research gaps, and provide a foundation for future empirical tests, rather than seek statistical generalization from a compilation of primary data.

Discussion related to the study

However, in a digital landscape where consumers can mindlessly scroll past dozens of social media ads, video ads, search results, e-commerce pages and personalized AI-driven content daily, a clearer understanding of why some messages generate engagement, recall, trust and purchase intention and others are ignored is of utmost importance, which ultimately shows the utility of subconscious response analysis techniques revealing how consumers attend to, emotionally evaluate, memorize and respond to advertising stimuli before they have the

opportunity to fully articulate these thoughts through conscious self-report (e.g., Mulligan & Benabou, 2019; Othman et al., 2021) Neuromarketing methods include: Eye-tracking to assess visual attention on different visual elements (e.g., systematical identification of which parts of a banner, product image or landing page elicited eye movements); EEG to measure attention and engagement during video or social media exposure; Skin conductance to assess emotional arousal; Facial coding, which identifies visible affective reactions; fMRI, which can offer deeper insights into valuation and memory-related brain activity; And each technique serves its own purpose for advertising goals (e.g., testing visual layout, measuring emotional appeal, evaluating brand memory, predicting purchase-related responses). Substantial evidence suggests that neuromarketing methods are of growing appropriateness and utility across consumer journey (see Othman et al. Similarly, Sarowar et al. (2025) and the study on neurophysiological techniques support in evaluating cognitive, affective, and behavioural components of consumer buying stages. (2024) demonstrate that neuromarketing from EEGs can provide valuable insights, enabling businesses to design better advertisements and to avoid misguided efforts through identification of positive and negative consumer impressions; however, the ensuing discussion suggests that neuromarketing should be regarded as a complement, rather than a substitute, for traditional marketing research methods, because traditional methods such as clicks, surveys, interviews, A/B tests and sales data remain invaluable sources of behavioral and contextual information, while neural and biometric tools facilitate a more comprehensive understanding of underlying mechanisms of these outcomes; furthermore, more recent literature on AI neuromarketing indicates that machine learning has the potential of amplifying the interpretation of biometric signals, but may also exacerbate over personalization and consumer profiling risk (Alsharif et al., 2025); thus, although neuromarketing can improve advertising design, emotional targeting, segmentation, campaign evaluation, its use has to be ethically constrained by informed consent, data minimization, privacy protection, methodological caution and avoidance of manipulative practices, given that recent Neuroethics research has indicated that it can raise the issue of consumer autonomy and the protection of vulnerable groups, and lead to concerns about transparency when brain or biometric data are being used in the commercial context (Ferrell et al., 2025; Pierce, 2025); as such, this study shows that while neuromarketing can add value, it is best used as a way to responsibly inform based marketing; it provides marketers with hints into deep-seated consumer impressions while playing carefully by the rules of ethical digital advertising practice.

Managerial Implications

The managerial implications of this study are substantial because neuromarketing provides a more sophisticated lens through which to understand consumer response to digital advertising than traditional metrics like clicks, impressions, views, and conversions, especially as tools like eye-tracking, EEG, facial coding, skin conductance, and biometric analysis help determine if an advertisement captures attention, resonates affectively, aids memory encoding, reduces cognitive load, or increases purchase intention; these insights can improve campaign planning for marketing managers, who can determine which messages, visuals, colors, product placements, and calls-to-action are most likely to impact consumer decisions, and strengthen creative testing for advertisers and digital agencies, who can ascertain whether short-form videos, social media ads, search ads, display banners, or e-commerce visuals elicit the desired affective and cognitive response prior to committing a significant budget (thus addressing the need for the present digital landscape to shift toward more predictive decision-making environments as adoption of AI in media planning, activation, and campaign analysis takes off [Interactive Advertising Bureau (IAB), 2025; IAB Europe, 2025]); these findings can help inform ad placement, timing, format, and interface design decisions for platform strategists, as well as support brand positioning for brand managers, who should test emotional consistency, brand recall, trust, and long-term consumer attachment rather than immediate clicks; however, managers should use neuromarketing as an adjunct, not replacement, to traditional research, as surveys, interviews, A/B tests, sales data and customer analytics remain needed to explain context, motivation, and actual behavior whilst revealing hidden psychological mechanisms (because neural and biometric methods do not replace surveys that capture what people would admit to and can strengthen online models of human behavior). Importantly too, managerial neuromarketing must remain ethically responsible, as Deloitte's 2025 connected consumer research finds consumers want innovation but also expect transparency, control, and data security while recent literature on AI-driven marketing indicates intrusive personalization may trigger privacy, manipulation, consumer autonomy and surveillance problems (Deloitte, 2025; Saura, 2025); practically, this means firms should leverage neuromarketing for creative design, media strategy, personalization, and effectiveness, but must use privacy-by-design, informed consent, transparent data practices, and non-manipulative advertising standards to preserve consumer trust.

Ethical Implications related to the study

Consideration of the ethical implications of the study is especially relevant because neuromarketing represents a more sensitive application of neural, biometric, and psychological data to learn about consumer attention, emotion, memory, and subconscious decision-making processes than ordinary marketing analytics—and requires strict ethical safeguards around informed consent, privacy, transparency, consumer autonomy, and responsible commercialization; first, informed consent is critically important because consumers should clearly understand what type of data will be collected, for example, whether neural data will be collected via EEG, eye-tracking, facial coding, or skin conductance, through emotion recognition or AI-assisted biometric analysis, how that data will be used, for instance in advertising personalization or targeting, as recent neuroethics literature has emerged promoting autonomy and informed consent as central ethical concerns in neuromarketing practice (Ferrell et al., 2025); second, privacy and biometric data protection matter more than ever because neural and physiological signals can reveal sensitive information about an individual’s emotional states, preferences, vulnerabilities, or behavioral tendencies until now ignored in prior literature, as recent legal scholarship notes neural data as a distinct and highly sensitive category of usually unregulated information not generally subject to state privacy law, especially a California 2024 Senate Bill 1223 dedicated to defining state privacy law as applied to neural data (Pierce, 2025); third, consumer manipulation is a serious issue since digital advertising is already using personalization, algorithmic targeting, and behavioral tracking, and when combined with neuromarketing insights, message design may influence subconscious reactions that threaten consumer autonomy and vulnerability through persuasive pressure on vulnerable groups that may include children, elderly consumers, financially stressed users, or psychologically vulnerable groups (Saura, 2025); fourth, transparency in data collection is essential because consumers may surely feel deceived by marketing firms that capture eye movement, emotional expression, or biometric reactions, and ethical marketing frameworks mention that as a fundamental principle of transparency because misleading consumers requires the balance of personalization with privacy, control, and explainability, otherwise eroding consumer trust (Saura, 2025); and finally, establishing the broader neuroethics framework in digital advertising requires marketers, agencies, platforms, and researchers to avoid claims of reading minds and overinterpretation of neural signals, respect participant confidentiality, minimize data collection, obtain voluntary consent, and apply privacy-by-design principles, as major neuroethics considerations have recently been identified as privacy, confidentiality,

human dignity, informed consent, scientific validity, vulnerable groups, and fears of manipulation or mind control (Ferrell et al., 2025); therefore, this study directly implies that the ethical adequacy of neuromarketing to improve digital advertising is contingent on whether its use is governed by transparency, consent, data minimization, methodological caution, and consumer-protection standards rather than the application of an intrusive tool for hidden persuasion using advanced technology.

Contribution of the Study

This study offers a conceptual contribution by seeking to integrate fragmented literature across marketing management, consumer neuroscience, psychology, digital advertising, artificial intelligence, and neuroethics to provide a unified conceptual understanding of how these techniques can explain classical theories of consumer decision-making in the context of digital advertising, because neuromarketing research is maturing rapidly but also remains scattered across a multitude of methods, tools, decision stages and application areas (Recent systematic reviews show that while the research in this area is growing rapidly, studies are often disaggregated by methods, tools, decision stages, and application areas (Lee, et al., in press; Pappas, 2023a, b) therefore, it represents an academic contribution as it connects neuromarketing more closely to the field of digital advertising management and explains how specific techniques (e.g., EEG, eye-tracking, facial coding, skin conductance, fMRI, biometric analysis) can reveal consumer attention, arousal, memory encoding, cognitive load, engagement, trust, recall, intention to purchase to be capitalized in digital advertising contexts (e.g., social media ads, video ads, e-commerce interfaces, personalized ads, AI-assisted advertising systems) (Othman et al., 2025; Sarowar et al., 2024); It also provides a conceptual framework in which neuromarketing techniques represent measurement inputs and consumer internal processes represent mediating psychological mechanisms and decision outcomes ad engagement, conversion, brand attitude, loyalty, and purchase intention act as behavioral consequences and moderators (e.g., ad format, platform type, personalization level, consumer demographics, and privacy sensitivity)—which can help explain why the same advertisement yields different effects for different audiences and platforms; this is an important contribution since recent literature on AI and neuromarketing provides evidence of the increasing use of artificial intelligence to collect, process, and analyze biometric and neurophysiological data (Alsharif et al., 2025) and calls for further clarification of how such technologies should be used in support of advertising strategy and/or practice without using consumers in a merely deterministic manner as predictable data patterns; Practically, we

contribute to marketers, advertisers, digital agencies, platform strategists, and brand managers by showing in what ways neuromarketing can inform creative testing, design of emotional messages, media placement and relative effectiveness, segmentation of heterogeneous consumer populations, and personalization (and precision) of advertising, but at the same time exposing what neuromarketing does not accomplish relative to more classical research methods regarding survey data, interviews, A/B testing, and behavioral analytics; Ethically, we contribute by emphasizing that the tensions around privacy, biometric data use, informed consent, manipulation, transparency, and consumer autonomy as a central concern of neuromarketing as a commercialized, AI-enabled advertising application remain fundamentally relevant; Finally, our study indicates future research avenues such as (1) empirical testing of our proposed framework, (2) cross-platform comparisons, (3) cross-cultural studies, (4) longitudinal analysis of neuromarketing-driven advertising effects, and (5) more stringent ethical governance models to the use of neural and biometric data in digital marketing.

Limitations of the research paper

The limitations of this conceptual research paper largely arise from the non-empirical and secondary-source nature of the study, as this hasn't collected primary data through EEG experiments, eye-tracking tests, biometric measurement, surveys, interviews, or real digital advertising campaigns testing consumer responses using traditional statistical techniques; another limitation is that the quality of the paper depends heavily upon the availability, reliability, scope, and methodological quality of the reviewed studies given recent neuromarketing reviews indicating that the field is still methodologically heterogeneous, with the literature varying greatly in tools, sample sizes, stimuli, research settings, and interpretations neurophysiological signals (Sarowar et al., 2024; Othman et al., 2025); furthermore, neuromarketing and digital advertising are evolving rapidly with artificial intelligence, machine learning, algorithmic personalization, biometric analytics, and platform-based targeting leading to the emergence of new tools, platforms, privacy rules, and consumer behaviors, suggesting that findings drawn from the current literature may soon become trivial as recent reviews point to an increasing adoption of AI-assisted neuromarketing and machine-learning-based interpretations of consumer data (Alsharif et al., 2025; Jabbar et al., 2026); the paper is also limited in generalizability across all markets, industries, platforms, cultures, and consumer groups just because consumer responses to digital advertising will differ by age, gender, income, digital literacy, cultural background,

privacy sensitivity, product category, ad format, and platform type and therefore a short-form video advertisement on Instagram or Youtube Shorts may not garner the same attention, emotion, or purchase intention as a search ad, display banner, or e-commerce product recommendation; lastly, there are interpretative risks linked to neuromarketing itself as neural and biometric indicators like attention, arousal, gaze fixation, or facial expression do not automatically correspond to persuasion, preference, or purchase behavior, yet recent systematic reviews continue to warn against over-generalizing findings from individual neurophysiological tools to holistic consumer decision outcomes (Bazzani et al., 2023; Castelo et al., 2025); thus, while the paper proposes a beneficial conceptual framework for the capturing of how neuromarketing may shape consumer decision-making in the context of digital advertising, its conclusions ought to be regarded as theoretical and explorative, necessitating prospective empirical substantiation through strictly controlled experiments, cross-platform studies, longitudinal designs, and mixed-method research.

Directions for Future Research

While the present study establishes theoretical connections between neuromarketing techniques, internal consumer processes, and digital advertising outcomes, additional experimental validation across many different types of digital campaigns using methods such as EEG, eye-tracking, facial coding, skin conductance, surveys, A/B testing, and behavioral analytics is necessary to confirm whether attention, emotional arousal, memory encoding, and cognitive load actually predict engagement, recall, trust, and purchase intention; future scholars should also conduct comparative studies across ad formats, for example short-form videos, display banners, search ads, influencer posts, e-commerce product pages, livestream shopping, and interactive mobile ads, as recent neuromarketing reviews show that consumer responses differ at various stages of the buying journey, and thus much more stage-specific and context-specific research is needed (Othman et al., 2025); in addition, an important and emergent area of research is the intersection of neuromarketing and artificial intelligence in ad personalization, given growing integrated between AI, consumer neuroscience, and neuroethics particularly in terms of biometrics interpretation and predicting consumer responses which could extend understanding of whether AI-personalized ads increase relevance and emotional connection or privacy concerns and perceived manipulation (Alsharif et al., 2025); future studies should also look into cross-cultural consumer responses as emotional expression, visual attention, privacy expectations, and advertising trust may vary between countries, age groups, and cultural backgrounds and findings in one market

may not replicate elsewhere; furthermore, researchers must develop stronger ethical governance frameworks for neuromarketing in digital advertising, especially as related to informed consent, neural and biometric data protection, vulnerable consumers, and transparency; indeed, recent neuroethics research has identified privacy, autonomy, dignity, and manipulation as primary concerns in commercial neuromarketing practice (Ferrell et al., 2025); finally, future research should explore neuromarketing in the social commerce and mobile advertising context wherein consumers increasingly come across personalized ads, creator recommendations, in-app shopping prompts and AI-driven content feeds that blend entertainment, persuasion, and commerce into highly attention-sensitive formats that are the perfect setting for assessing how subconscious responses hold sway in real purchase decisions.

CONCLUSION

Because neuromarketing helps unpack the subconscious mechanisms of attention, emotion, memory, arousal, and cognitive load which increasingly underpin consumer choices before people can verbalize their reaction, it provides a powerful perspective for examining human response to digital advertising: particularly relevant in a dense digital landscape, where social media ads, short-form videos, search advertisements, e-commerce recommendations, and AI-personalized messages frequently jostle for space in consumers' attention within seconds, and findings of systematic reviews indicate neuromarketing is increasingly being linked to different stages of the consumer decision journey (Othman et al., 2025; Alsharif et al., 2025); more recent research on AI and neuromarketing further underpin this relationship by positioning attention, emotion, and memory as key gatekeepers of predicting consumer behavior in digital contexts; together, this raises question of how techniques including electroencephalogram (EEG), eye-tracking, facial coding, skin conductance, fMRI, biometric analysis, etc. can provide insight to marketers that some digital advertisements stimulate engagement, trusted, recall, and purchase intention more than others despite similar levels of exposure, alongside emerging evidence that neuromarketing metrics complement behavioral data to be more useful in understanding online purchase decision-making (ScienceDirect, 2026); however, the strategic value of neuromarketing is contingent on a careful reading of the indicators, as neural or biometric indicators cannot simply be viewed as strong evidence of persuasion and purchase behavior and must be triangulated with more traditional marketing research methods, such as surveys, interviews, A/B testing, sales analytics, and platform performance data; likewise, the ethical value of neuromarketing relies on stringent

safeguards, with recent neuroethics research continuing to highlight that informed consent, privacy, consumer agency, manipulation and protection of neural or biometric data (Ferrell et al., 2025; Pierce, 2025) remains crucial when applying neuromarketing measures in light of the growing personalized and AI-driven nature of digital advertising; ultimately, this conceptual paper concludes that neuromarketing can contribute to a richer digital advertising paradigm by uncovering hidden consumer responses, but it must be employed as a responsible adjunct to a broader marketing research solution and behave ethical principles of methodological rigor, transparent data practices, ethical governance, and consumer trust.

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