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Evaluating Sponsorship Effects Influenced by Involuntary Media Multitasking: Neuromarketing Approach

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Abstract

As media multitasking becomes increasingly prevalent, sports TV broadcasts—one of the primary exposure channels for sponsorship—are also influenced. This study investigates the impact of multitasking, particularly involuntary multitasking (e.g., push notifications), on sponsorship effects. Grounded in communication theories, the research employs neuromarketing techniques using EEG measurements. An EEG-based experiment was conducted with a simulated 10-minute and 15-second sport TV broadcast as the primary media with multitasking stimulus. Participants were randomly assigned to multitasking high, multitasking low, or control groups. EEG indicators, including TOA (total occipital alpha) and LFPD (left prefrontal dominance), were analyzed alongside survey data. The results show that multitasking increased TOA, indicating cognitive avoidance, and reduced LFPD, associated with negative emotions like annoyance, ultimately lowering sponsorship effects. Conversely, lower TOA and higher LFPD were linked to improved brand recall, brand attitude, and purchase intention. Despite limitations such as sample size and the use of a real brand, Nike, the findings validate the cognitive, affective, and conative mechanisms underlying sponsorship effects. The study highlights the need for sports organizations and sponsors to mitigate multitasking's negative effects or adapt activation strategies. It also reinforces the value of integrating neuromarketing tools like EEG into sponsorship evaluation, offering novel insights into evolving media consumption patterns.

Key words: sponsorship, media multitasking, neuromarketing, EEG, alpha blocking, hemispheric lateralization

Introduction

The global sponsorship market was projected to reach $90.6 billion in 2024 (Business Research Insights, 2025). Sponsorship plays a crucial role in corporate branding strategies by enhancing brand awareness and shaping brand image through repeated exposure (Leng & Zhang, 2023). Among various exposure methods, television broadcasting remains one of the most dominant, offering extensive audience reach (Nielsen Sports, 2022). The 2024 Paris Olympics saw a significant rise in viewership in the United States, with NBCUniversal reporting an average of 30.6 million viewers, marking an 82% increase compared to the Tokyo 2020 Olympics (Adalian, 2024). Similarly, in the 2025 Super Bowl, the average U.S. viewership reached 127.7 million, setting a new record for a single-network broadcast (Reuters, 2025).

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Despite the dominance of traditional television broadcasting in sport sponsorship exposure, significant changes have emerged with the rise of digital media. The rapid growth of OTT platforms, YouTube, and short-form content has altered media consumption patterns. During the 2024 Paris Olympics, NBC Sports' social media content garnered a record 6.55 billion impressions, marking a 184% increase compared to Tokyo 2020 (NBCUniversal, 2024). This shift has led to increased media multitasking, where audiences engage with additional digital content while watching TV. Examples include watching a baseball game while checking player statistics or browsing social media. In South Korea, 58.4% of respondents reported using mobile phones while watching TV, citing chatting (54.9%), habitual behavior (41.0%), and seeking information (15.2%) (Jung, 2024).

These trends raise concerns among sponsors, event organizers, teams, and broadcasters about multitasking's impact on sponsorship effects. Research suggests that multitasking reduces communication effects by diverting attention (Van der Schuur et al., 2015). This aligns with the limited capacity model (Lang, 2000, 2017), which posits that human cognitive resources are finite. When exposed to multiple media stimuli, cognitive overload may prevent full information processing, lowering effects. Sport sponsorship studies further support this claim, indicating that multitasking decreases brand recognition and negatively affects brand attitude (Lee, 2021).

The advancement of digital marketing has also led to an increase in involuntary media multitasking, where viewers are compelled to multitask. For example, push notifications during sports broadcasts can prompt distractions (Horwood, 2022). Such interruptions may not only cause cognitive overload but also induce negative emotional reactions toward the undesired stimulus (Hurbean et al., 2025). Understanding how multitasking, particularly involuntary multitasking, influences sponsorship effects is crucial in today's media environment.

Most studies on sponsorship effects have relied on surveys (Biscaia et al., 2013; Lee, 2021), which have limitations such as self-report bias and time delays between stimulus exposure and response. Neuromarketing techniques, particularly EEG, provide real-time, objective assessments of sponsorship effects (Ariely & Berns, 2010). EEG allows for the measurement of subconscious cognitive and emotional responses to stimuli. However, Lin et al. (2018) emphasized that more meaningful analysis can be achieved by simultaneously collecting and integrating EEG and survey data. While prior research has explored sponsorship effects through neuromarketing (García-Madariaga et al., 2023; Lee et al., 2024), no study has specifically examined the impact of involuntary multitasking using neuromarketing methodologies.

This study investigates sponsorship effects in a controlled sports broadcast setting where viewers engage in involuntary multitasking. By combining survey-based assessments with EEG-based neuromarketing analysis, this research seeks to provide neuroscientific insights into how multitasking influences sponsorship outcomes, particularly in cognitive, affective, and conative responses. In addition to measuring sponsorship effects, the findings of this study can inform practical strategies for sport teams and broadcasters aiming to retain audience engagement.

Literature Review

Sponsorship Effect Model

Sponsors expect sponsorship activities to enhance brand awareness, improve brand attitude, and ultimately increase sales, with brand image and attitude often regarded as the most critical outcomes (Cornwell & Kwon, 2020). Sponsorship effects contribute to brand equity, which includes strong brand awareness and a positive brand image resulting from sponsorship exposure. Sponsorship effect models explain how exposure leads to brand equity formation, with two primary frameworks being the hierarchy of effects model and the AIDA model (Cornwell, 2014). The hierarchy of effects model (Lavidge & Steiner, 1961) suggests that marketing stimuli guide consumers through stages of awareness, knowledge, liking, preference, conviction, and purchase. In the case of the AIDA model, consumers are assumed to progress through the stages of attention, interest, desire, and action (Barry & Howard, 1990). Although the two models differ in the specific labels used for each stage, they can be broadly synthesized into three simplified phases: cognitive (i.e., awareness, knowledge, attention), affective (i.e., liking, preference, conviction, interest, desire), and conative (i.e., purchase, action) (Belch & Belch, 2020). Therefore, Sponsorship, as a marketing communication tool, moves consumers through cognitive, affective, and conative stages, ultimately influencing their purchasing decisions.

Sport sponsorship studies frequently employ the hierarchy of effects model to measure cognitive, affective, and conative outcomes (Cornwell & Kwon, 2020; Wakefield et al., 2020; Speed & Thompson, 2000). Cognitive outcomes are typically assessed through brand awareness, reflecting the extent to which consumers recognize and recall a brand (Keller, 1993). A key aspect of this cognitive outcome is message retention, which refers to the process by which information about sponsorship messages is stored in memory for later retrieval and which influences brand awareness. Johar et al. (2019) demonstrated that sport sponsorship effectively enhances brand recognition. Brand awareness plays a fundamental role in consumer decision-making, as increased recognition and recall improve the likelihood of a brand being considered during the purchasing process.

Affective outcomes are commonly evaluated through brand attitude, representing a consumer's positive or negative predisposition toward a brand (Mitchell & Olson, 1981). Attitude formation stems from cognitive assessments of brand attributes and emotional responses to sponsorship exposure. The affect transfer hypothesis suggests that emotions generated in an environment transfer to associated brands (MacKenzie et al., 1986; Pham, 1992). For example, positive emotions experienced while watching a favorite team win may transfer to a sponsor brand displayed during the event. This phenomenon highlights the importance of aligning sponsorship efforts with emotionally engaging content to maximize brand attitude improvements.

Conative outcomes relate to purchasing behavior, typically measured through purchase intention, which reflects the likelihood of purchasing a product (Morwitz, 2014). Purchase intention strongly correlates with actual sales, making it a key performance indicator for sponsors (Morwitz, 2014). Sport sponsorship studies often use brand awareness, brand attitude, and purchase intention as primary outcome variables to assess sponsorship effects (Biscaia et al., 2013; Lee, 2021; Tsordia et al., 2018). A stronger intent to purchase can be influenced by multiple factors, including the frequency of exposure, the credibility of the sponsor, and the perceived fit between the sponsor and the event.

In summary, the sport sponsorship effect model conceptualizes sponsorship as a marketing communication tool, with its impact developing through cognitive, affective, and conative stages. Accordingly, brand awareness, brand attitude, and purchase intention serve as key indicators of sponsorship effects. These distinct stages offer a comprehensive framework for understanding consumer response, and advancements in neuroscientific measures, such as brainwave activity, provide opportunities to gain deeper insights into the underlying cognitive and affective processes that drive these hierarchical effects in sponsorship contexts.

Media Multitasking on Sponsorship Effects

As media multitasking becomes more prevalent, numerous studies have explored its effects on marketing communications (Jeong & Hwang, 2016; Segijn et al., 2017; Voorveld, 2011). This broader body of research consistently demonstrates that concurrent media use can fragment attention, increase cognitive load, and consequently impair information processing, leading to reduced message comprehension and recall across various communication contexts. Although media multitasking is also common in sport sponsorship, its impact remains an emerging research area (Lee, 2021; Rubenking & Lewis, 2016). Research suggests that media multitasking negatively affects brand awareness and attitude.

Unlike general marketing communications, sport sponsorship often involves highly engaging and emotionally charged content. It also features distinctive sponsorship messages, which encompass all brand-related stimuli presented within the sponsored event or broadcast, including visual elements (e.g., logos on uniforms, stadium signage, product placements) and auditory mentions. These distinctive characteristics may lead to different or amplified effects of media multitasking on consumer processing and sponsorship outcomes. Rubenking and Lewis (2016) found that viewers engaged in non-sport-relevant multitasking (e.g., browsing unrelated social media) experienced reduced enjoyment and lower fan identification. Similarly, Lee (2021) demonstrated that multitasking, such as instant messaging during a game, impaired brand recall and attitude toward sponsors. These findings suggest that media multitasking may interfere with the consumer's ability to form strong sponsorship-related associations and reduce the depth of information processing, leading to weaker brand recall and recognition.

While the mainstream literature often points to detrimental effects of media multitasking on advertising effects (e.g., Segijn & Eisend, 2019; Jeong & Hwang, 2016), the overall picture of its impact is complex, with findings sometimes fragmented or inconclusive regarding specific outcomes or conditions (Garaus, 2020). For instance, studies differentiating between memory outcomes suggest that while concurrent media use may impair spontaneous brand recall, consumers might still retain the ability to recognize sponsor brands when prompted (Jensen et al., 2015; Garaus, 2020). More critically, the nature of the multitasking activity itself and the advertising strategy play crucial roles. Research indicates that when secondary media activities are congruent with the primary media content or involve social accountability (e.g., live discussions about the game), the negative impact on brand recall and recognition can be mitigated, or even enhanced (Segijn et al., 2017). Furthermore, the type of advertising appeal (e.g., emotional vs. rational) can moderate the influence of multitasking on brand attitude, with emotional appeals sometimes reducing negative effects (Garaus, 2020). Beyond mere mitigation, academic work focusing on integrated media experiences and social coviewing, particularly within sport broadcasts, suggests that interactive elements, complementary content, or social interaction during multitasking can increase viewer engagement with the overall program and embedded advertising/sponsorship messages (e.g., Boehmer, 2016; Cunningham & Eastin, 2017; Wu & Kim, 2021). These findings highlight that the effects of media multitasking are not universally negative across all measures, but are profoundly influenced by the type of multitasking, the context, and the design of the concurrent media experience. Despite these nuances, a comprehensive understanding of the underlying cognitive mechanisms, especially involuntary distractions in highly engaging contexts like sports, remains underexplored. This is critical for optimizing sponsorship effects.

The limited capacity model explains how media multitasking affects sponsorship effects (Lang, 2000, 2017; Rubenking, 2017). This model, rooted in cognitive psychology and mass communication research (Berger et al., 2009), posits that human cognitive resources are finite. Information processing consists of encoding, storage, and retrieval. Encoding involves selecting information for working memory, storage transforms short-term memory into long-term memory, and retrieval reactivates stored information (Lang, 2000, 2017; Rubenking, 2017). Multitasking places a burden on these processes, affecting information retention. When cognitive resources are divided across multiple tasks, attention to any single task is reduced, limiting effective encoding and retention of sponsorship messages. This division of resources also weakens message elaboration, further diminishing the effectiveness of sponsorship communications.

Cognitive overload from multitasking disrupts brand recall during sports events (Lee, 2021; Rubenking & Lewis, 2016). Increased cognitive demand at the encoding stage leads to deficits in storage and retrieval. Viewers focusing solely on a game encode only its content, whereas those multitasking must encode both the game and external content. This division of cognitive resources weakens storage and retrieval, reducing memory of sponsor brands. Consequently, the ability to recall sponsorship messages is compromised, leading to decreased brand awareness and weaker attitudinal associations. The limited capacity model suggests that excessive cognitive load on one subprocess negatively impacts others. Additionally, repeated interruptions may lead to increased mental fatigue, further reducing engagement with sponsorship messages and limiting their overall effects.

In a media multitasking context, viewers allocate cognitive resources to both the game and secondary media, causing deficits in storage and retrieval. This weakens recall and attitudes toward sponsors. Involuntary multitasking, such as push notifications during broadcasts, not only distracts attention but also triggers avoidance motivation (Jeong & Hwang, 2016; Voorveld, 2011). Avoidance motivation impairs cognitive processing efficiency, further diminishing sponsorship effects. Additionally, repeated distractions may create negative associations with sponsor brands, further undermining sponsorship effects. As multitasking becomes more prevalent, it is increasingly critical to explore how sponsors can adapt their communication strategies to mitigate these effects and maintain brand engagement.

Although some prior studies confirm the negative impact of multitasking on sponsorship (Lee, 2021; Rubenking & Lewis, 2016), they have not fully explored the underlying mechanisms. This study addresses this gap by applying the limited capacity model and neuromarketing methodology to examine how media multitasking influences sponsorship effects. Understanding the specific ways in which cognitive load distribution affects brand recall and consumer attitude formation is critical for refining sponsorship strategies in a multitasking media environment. By identifying key factors that contribute to reduced sponsorship effects, this study aims to provide actionable insights that can help sponsors develop more resilient and engaging marketing strategies tailored to an increasingly distracted audience.

Neuromarketing Approach

Neuromarketing applies neuroscientific methods to study consumer responses to marketing stimuli (Ariely & Berns, 2010). It measures psychophysiological data from the brain, heart, skin, and eyes to enhance marketing effects (Potter & Bolls, 2012). For instance, EEG measures brain-wave activity while consumers view advertisements, helping researchers assess responses and preferences (Khushaba et al., 2013; Ohme et al., 2010; Rothschild & Hyun, 1990). By capturing subconscious consumer reactions, neuromarketing allows marketers to refine strategies and improve consumer engagement with advertisements.

Psychophysiological techniques offer several advantages over traditional self-report methods (Lin et al., 2018). First, they record real-time responses, capturing subconscious reactions that self-reports may miss. Second, they reduce biases, such as memory distortion or social desirability effects (Churchill, 1999). Self-reports rely on retrospective recall, whereas neuromarketing tools such as EEG and ECG (electrocardiography) collect physiological data at the moment of stimulus exposure, providing a more accurate measure of consumer reactions. However, studies using EEG alone often provide rich neurophysiological data but lack contextual depth regarding consumer intentions or attitudinal interpretations (Pozharliev et al., 2015; Lin et al., 2018). By combining EEG-based measurements with self-reported survey data in the present study, we aim to capitalize on the strengths of both methodologies—capturing subconscious brain responses in real time while also contextualizing them within cognitive, affective, and conative sponsorship outcomes. This integrative approach allows for a more comprehensive understanding of sponsorship effects. Therefore, the current research collects both EEG and survey data for measuring sponsorship effects by multitasking.

Additionally, EEG and fMRI are key neuromarketing tools, measuring neural responses to marketing stimuli (Khushaba et al., 2013; Pozharliev et al., 2015). While fMRI provides high spatial resolution, it has low temporal resolution. Conversely, EEG offers high temporal resolution, collecting up to 1,000 brain-wave signals per second, making it effective for studying rapid cognitive responses (Cerf & Garcia-Garcia, 2017).

Due to its cost-effectiveness and temporal precision, EEG is widely used in neuromarketing, especially for product testing and advertisement (ad) evaluation (Rothschild & Hyun, 1990). EEG has been particularly useful in studies on consumer engagement with television advertisements, measuring brain activity in response to different advertising techniques. EEG research in sports marketing remains limited, yet studies suggest it can provide real-time insights into sponsorship effects (Lee et al., 2024).

Its high temporal resolution is particularly advantageous for capturing the rapid, dynamic brain responses to fleeting visual (e.g., brand logos, stadium signage) and auditory sponsorship exposures (e.g., brief mentions of the sponsor) common in fast-paced, emotionally charged sport broadcasts. This real-time, objective measurement is crucial for understanding subconscious processing during live events, aligning directly with the needs of sport management research aiming to optimize real-world sponsorship impact. Furthermore, by analyzing specific brainwave activities such as alpha power, EEG provides direct insights into cognitive processes like attention, information encoding, and memory formation, which are fundamental to message retention (Bonnefond & Jensen, 2012). This study addresses this gap by analyzing EEG responses to sponsorship stimuli embedded in sports broadcasts. Understanding how brain activity changes during sponsorship exposure can offer valuable insights into consumer engagement and message retention.

Alpha Power and Information Processing

Brain waves are classified into five frequency bands: delta (0.5-4 Hz), theta (4-8 Hz), alpha (8-13 Hz), beta (13-30 Hz), and gamma (above 30 Hz). Among these, the alpha band is central to EEG research due to its stable patterns, which reflect fundamental cognitive processes (Klimesch, 2012). Alpha power increases in relaxed states and decreases with mental effort or attention engagement. Research has shown that fluctuations in alpha power are closely associated with attention shifts and memory encoding processes, making it a crucial variable in neuromarketing studies.

Alpha-wave activity indicates cognitive responses to stimuli. A sharp decrease in alpha power, known as alpha blocking, signals vigilance and attentional focus (Moscovitch, 1979; Rothschild & Hyun, 1990). This response is particularly useful in measuring consumer attention to advertisements or sponsorship messages. If cognitive processing continues, alpha power remains suppressed, reflecting deep information processing (Bonnefond & Jensen, 2012). Prolonged alpha suppression suggests that a stimulus has captured sustained attention and is actively being encoded into memory. Conversely, if alpha power quickly returns to baseline, it indicates disengagement and minimal retention of the stimulus information.

Occipital alpha waves are particularly sensitive to visual stimuli, making them relevant for neuromarketing research on video advertisements and brand placement (Rothschild & Hyun, 1990). When an ad scene changes or a brand logo appears, occipital alpha blocking can indicate engagement. Memory formation is associated with sustained alpha suppression; greater suppression leads to stronger retention (Bonnefond & Jensen, 2012). By monitoring occipital alpha power, researchers can assess whether sponsorship messages embedded in sports broadcasts are effectively capturing audience attention.

In the context of involuntary multitasking, secondary media stimuli serve as new stimuli. Upon their appearance, brief alpha blocking occurs, but if perceived as disruptive, viewers may exhibit avoidance motivation, leading to rapid alpha recovery (Voorveld, 2011). This limits cognitive processing, reducing the effectiveness of the multitasking stimulus. Despite existing insights into cognitive processing during multitasking, the specific interaction between involuntary multitasking and sponsorship exposure remains underexplored, particularly concerning its effects on sponsorship recall and attitudes in dynamic environments like sports broadcasts.

Hemispheric Lateralization

The brain's left and right hemispheres function differently based on the task, a phenomenon known as hemisphere lateralization (Moscovitch, 1979). The left hemisphere is dominant in verbal, analytical, and logical tasks, while the right hemisphere is dominant in nonverbal, creative, and artistic tasks (Davidson, 2004). This division of cognitive labor enables the brain to efficiently process various types of information depending on the demands of the stimulus.

When attending to a visual stimulus, occipital alpha blocking is more likely in the right hemisphere than in the left (Moscovitch, 1979; Rothschild & Hyun, 1990). This right-hemisphere dominance occurs because vigilance requires distinguishing a stimulus from its environment, a task demanding relatively low cognitive effort. The right hemisphere specializes in such discriminative work more than the left (Moscovitch, 1979). However, stimulus characteristics influence lateralization; verbal stimuli reduce right-hemisphere alpha blocking, whereas nonverbal stimuli enhance it (Rothschild & Hyun, 1990). Thus, the way information is presented determines which hemisphere is more active in processing it.

Following vigilance, deeper information processing shifts dominance to the left hemisphere, marked by lower occipital alpha power on the left than on the right (Klimesch, 2012). This shift occurs because processing requires detailed assessment of visual information, a function more specialized in the left hemisphere (Davidson, 2004; Rothschild & Hyun, 1990). For example, when a product appears in an advertisement, initial vigilance triggers right-hemisphere alpha blocking. If viewers engage in deeper processing, left-hemisphere dominance emerges (Ohme et al., 2010). This suggests that higher engagement levels are associated with a shift from right-hemisphere vigilance to left-hemisphere processing.

Hemispheric lateralization also occurs in the frontal lobe, governing emotions and motivation (Davidson, 2004; Käckenmester et al., 2018). Positive emotions and approach behaviors activate the left frontal hemisphere, whereas negative emotions and avoidance behaviors activate the right (Davidson, 1993, 2004). Negative emotions such as anxiety and annoyance are linked to withdrawal, while positive emotions like happiness and comfort promote approach behavior. For instance, when watching emotionally charged movies, viewers exhibit greater left-frontal activity for positive emotions and greater right-frontal activity for negative emotions (Davidson, 2004). Similarly, Khushaba et al. (2013) found that product alternatives inducing positive feelings increased left-frontal hemisphere activation, whereas those evoking negative feelings increased right-frontal activation.

In marketing, positive responses to products and brand names are typically associated with left-frontal activation. However, in this study, multitasking is assumed to be involuntary, potentially eliciting negative emotions such as annoyance and avoidance. Therefore, under multitasking conditions, the right frontal/prefrontal cortex is expected to be more active, reflecting an avoidance response. This activation pattern suggests that involuntary multitasking may interfere with the cognitive and emotional processing of sponsorship messages, reducing their effects.

Applying Neuromarketing in Media Multitasking in Sport Sponsorship

Based on sponsorship effect models, media multitasking, and neuromarketing theories–particularly alpha power, information processing, and hemispheric lateralization–this study proposes hypotheses to analyze the impact of multitasking on sponsorship effects. To clearly articulate the hypothesized relationships between brain activity and consumer responses, we first define the key neurophysiological measures used in this study:

- Total Occipital Alpha (TOA): Represents the overall alpha power measured in the occipital region of the brain. A decrease in TOA (alpha blocking) signifies increased attention, vigilance, and cognitive processing of stimuli. Conversely, an increase in TOA often indicates a relaxed state, reduced attention, or cognitive overload (Klimesch, 2012; Rothschild & Hyun, 1990).
- Right Prefrontal Dominance (RFPD): Refers to greater activation in the right prefrontal cortex compared to the left. This pattern is typically

associated with negative emotions and avoidance motivation (Davidson, 1993, 2004; Käckenmester et al., 2018).

- Left Prefrontal Dominance (LFPD): Refers to greater activation in the left prefrontal cortex compared to the right. This pattern is consistently linked with positive emotions and approach motivation (Davidson, 1993, 2004; Harmon-Jones et al., 2010).

H1: Impact of Involuntary Multitasking on Brain Activity

In the context of sport broadcasts, involuntary multitasking is expected to induce cognitive overload and negative emotional responses, impacting viewers' brain activity. According to the limited capacity model, dividing attention across multiple stimuli, especially during highly immersive content like a sports game, places a burden on cognitive resources (Lang, 2000, 2017). This cognitive overload interferes with efficient information processing, preventing sustained attention and leading to a state of disengagement from the primary content. Consequently, this reduced cognitive effort is reflected as an increase in alpha power (Puma et al., 2018; Klimesch, 2012). Furthermore, the involuntary nature of multitasking, such as disruptive push notifications, can trigger feelings of annoyance and avoidance motivation (Jeong & Hwang, 2016; Voorveld, 2011). Given the established link between negative emotions and avoidance motivation with right prefrontal activation (Davidson, 1993, 2004), involuntary multitasking is expected to result in greater right prefrontal dominance.

Based on this, we hypothesize:

H1-1: Involuntary multitasking will increase in TOA.

H1-2: Involuntary multitasking will result in RFPD.

H2: Brain Activity and Sponsorship Recall (Cognitive Outcome)

Sponsor brand recall serves as a crucial cognitive outcome of sponsorship effectc, indicating successful memory encoding and retrieval of brand information (Keller, 1993). Enhanced cognitive processing and attention are fundamental to improving learning and memory (Belanche et al., 2014). From a neurophysiological perspective, a decrease in TOA, indicative of alpha blocking, signals increased vigilance and attentional allocation towards a stimulus. This heightened attention and deeper cognitive processing facilitate the encoding of sponsorship stimuli into memory, thereby positively affecting sponsor brand recall (Rothschild & Hyun, 1990; Bonnefond & Jensen, 2012). Additionally, approach motivation, reflected LFPD, is associated with positive emotional states that can facilitate engagement and sustained processing of information. Although LFPD is primarily an affective measure, positive affect and approach motivation are generally conducive to learning and memory consolidation, as they promote sustained interaction with stimuli (Davidson, 2004; Harmon-Jones et al., 2010). Thus, individuals exhibiting a more positive and approach-oriented brain state are expected to show better memory for sponsor brands.

Based on this, we hypothesize:

H2-1: Participants with higher sponsor brand recall will exhibit decreased TOA

H2-2: Participants with higher sponsor brand recall will exhibit LFPD.

H3: Brain Activity and Sponsor Brand Attitude (Affective Outcome)

According to the Hierarchy of Effects model, successful progression through the cognitive stage, marked by adequate attention and information processing, directly influences the formation of brand attitudes (Lavidge & Steiner, 1961; MacKenzie et al., 1986). A decrease in TOA indicates heightened cognitive engagement and deeper processing of sponsorship messages. This sustained attention facilitates comprehensive message elaboration, which is essential for developing favorable attitudes toward the sponsor brand. Furthermore, attitude formation is strongly linked to emotional responses and motivational states. LFPD is consistently associated with positive emotions and approach-oriented motivation (Davidson, 2004; Harmon-Jones et al., 2010). Therefore, individuals who experience more positive emotional states and an inclination to approach during sponsorship exposure are expected to develop more favorable attitudes toward the sponsor brand.

Based on this, we hypothesize:

H3-1: Participants forming a positive attitude toward the sponsor brand will exhibit decreased TOA.
H3-2: Participants forming a positive attitude toward the sponsor brand will exhibit LFPD.

H4: Brain Activity and Purchase Intention (Conative Outcome)

Purchase intention represents the conative, or behavioral, stage of consumer decision-making within the Hierarchy of Effects model (Lavidge & Steiner, 1961; MacKenzie et al., 1986). It serves as a strong predictor of actual purchasing behavior (Morwitz, 2014). For consumers to form an intention to purchase a sponsor brand, they must first successfully process sponsorship information (cognitive stage) and develop a favorable attitude towards the brand (affective stage). From a neurophysiological perspective, a decrease in TOA indicates sustained attention and deep cognitive processing of sponsorship messages. This enhanced processing contributes to stronger memory formation (H2-1) and more positive attitude development (H3-1), which are prerequisites for forming purchase intentions (Morwitz, 2014). Similarly, LFPD, reflecting positive emotions and approach motivation, is fundamentally linked to consumers' willingness to engage with and ultimately act upon marketing stimuli. Approach motivation directly drives behavioral intentions (Davidson, 2004; Harmon-Jones et al., 2010), making LFPD a strong neurophysiological correlate for purchase intention. Therefore, brain activity patterns indicative of effective cognitive processing and positive emotional engagement are expected to translate into higher purchase intentions.

Based on this, we hypothesize:

H4-1: Participants forming purchase intention toward the sponsor brand will exhibit decreased TOA.
H4-2: Participants forming purchase intention toward the sponsor brand will exhibit LFPD.

Methodology

Experimental Design

To investigate sponsorship effects during multitasking using EEG, this study employed an experimental approach. The experiment consisted of three groups: A Control group (no multitasking), a Multitasking Low group (low-frequency interruptions), and a Multitasking High group (high-frequency interruptions). Participants were randomly assigned to one of the three groups using a computerized randomization process, ensuring similar group sizes and minimizing selection bias. Random assignment was performed immediately prior to the experiment after informed consent was obtained.

The experiment stimuli consisted of two components: a primary media stimulus simulating a sports broadcast and a secondary media stimulus to induce multitasking. The primary stimulus was an edited sports broadcast video from an English Premier League (EPL) match, chosen due to its popularity in South Korea, particularly with the involvement of Korean players. The experimental video featured a 10-minute, 15-second segment from the 35th-round match between Tottenham Hotspur and Arsenal in the 2019-2020 EPL season. Tottenham won 2:1, with Korean player Son Heung-min scoring a goal. To maintain external validity, the video was edited to prevent revealing the final match result. Sponsorship brand exposure was manipulated using Nike advertisements on stadium perimeter boards and a Nike logo overlay appearing every 1 minute and 20 seconds, lasting 5 seconds each time (seven total exposures). The controlled placement of sponsorship stimuli allowed for an analysis of brand recall and recognition under multitasking conditions.

The secondary stimulus simulated multitasking using animal cards with images and text. The frequency of exposure varied by group. The Multitasking Low group saw four interruptions, while the Multitasking High group experienced seven interruptions. The multitasking frequency for the High and Low groups was manipulated based on prior research. Previous studies have classified multitasking as low when interruptions occurred approximately once every two minutes, and as high when interruptions occurred about once per minute or more frequently (Mi et al., 2025; Segijn et al., 2017). The Control group viewed the broadcast without distractions. Each animal card appeared on the left side of the screen for 10 seconds per exposure. Both the primary and secondary experimental stimuli were presented on a single video monitor (27-inch). Participants watched the experimental video from a distance of approximately 80 cm from the screen. The primary stimulus (football broadcast) occupied approximately three-fourths of the right side of the screen, while the secondary stimulus (animal cards) was displayed on the remaining one-fourth of the left side.

Although using two separate devices—such as a monitor/TV for the primary media and a smartphone for the secondary media—may more accurately simulate real-world media multitasking, this setup was not feasible in the present study due to the measurement of EEG signals. Head movements required to switch between devices could introduce EEG noise (Jansen et al., 2012). Therefore, the multitasking condition was implemented by presenting the two stimuli side by side on a single screen, allowing only eye movements to shift between tasks. This method aimed to simulate dual-device multitasking while minimizing EEG artifacts. The structure of the experimental videos and the sequence of multitasking stimuli presentation are summarized in Figure 1 and Table 1. This design ensured that multitasking levels were systematically controlled to assess their impact on sponsorship effects.

In addition to the multitasking condition-based group assignments, additional grouping was performed post-experiment based on participants' responses to the survey for hypothesis testing. First, participants were divided into two groups—Recall Yes and Recall No—based on whether they recalled the experimental brand, Nike. Second, based on the brand attitude score toward Nike, participants were classified into Attitude High and Attitude Low groups using the median score as

Table 1. Sequences of Experiment Stimulus

Event	Match Highlight (10 min. 15 sec.)									
Goal	1:39	2:30							8:00	
Nike	1:00	2:20	3:40		5:00	6:20		7:40		9:00
Multi Low	1:20		3:40			6:20			8:40	
Multi High	1:20	2:20	3:20	4:10	5:00	6:00	6:50	7:40	8:30	9:20

Figure 1. Structure of Experimental Stimulus.

a cutoff. Lastly, purchase intention was also used to divide participants into Purchase Intention (PI) High and PI Low groups following the same median-split procedure as brand attitude.

Experiment Procedure

Institutional Review Board (IRB) approval was obtained before conducting the experiment. Participants were recruited via public advertisement and received an incentive of 30,000 Korean Won (approximately $22) for participation. Upon arrival, participants were briefed on the study, signed an IRB-approved consent form, and were informed they could withdraw at any time without consequences.

EEG electrodes were attached to six sites for alpha wave measurement, following Klimesch (2012) and Rothschild & Hyun (1990): two on the prefrontal cortex (Fp1 and Fp2) and two on the occipital cortex (O1 and O2). The placement of these electrodes was selected to optimize the detection of cognitive and emotional responses to sponsorship stimuli. Participants then watched the 10-minute, 15-second edited sports broadcast while real-time alpha wave activity was recorded using the Biopac MP-150 system and EEG-100 module (Thomson & White, 2014).

Following the video and EEG recording, participants completed a post-experiment questionnaire assessing video affective response, brand recall, brand attitude, purchase intention, and demographic information. The questionnaire served as a secondary measure to complement EEG data. Upon completion, EEG electrodes were removed, incentives were distributed, and participants were dismissed. This systematic procedure ensured the collection of reliable data regarding sponsorship effects under multitasking conditions.

Results

Participant Characteristics and Manipulation Check

A total of 73 individuals participated in this study. Data from seven participants were excluded due to electrode detachment or noise interference, leaving 66 participants for analysis. Participants were randomly assigned to three groups: 22 in the Multitasking High group, 22 in the Multitasking Low group, and 22 in the Control group. Among them, 41 were male (62.12%) and 25 were female (37.88%). Participant ages ranged from 20 to 27 years, with a mean age of 23.02 ($SD = 1.45$).

A manipulation check was conducted to assess the effects of the multitasking condition. Participants were asked to recall the number of animal cards they saw during the experiment. The Multitasking High group reported an average of 8.14 cards ($SD = 1.52$), the Multitasking Low group 3.82 cards ($SD = 0.85$), and the Control group 0.18 cards ($SD = 0.50$). An ANOVA test confirmed significant differences between groups ($F = 319.90, df = 2, p < .001$).

Participants also rated their agreement with the statement, “There were elements that interfered with my viewing of the soccer broadcast,” using a 7-point Likert scale. The Multitasking groups combined had a mean score of 3.61 ($SD = 1.90$), while the Control group had a significantly lower mean score of 2.59 ($SD = 1.53$). A t-test revealed a significant difference ($F = 4.82, df = 2, p < .032$), indicating that multitasking participants experienced more distractions. These results confirm that the multitasking manipulation was effective.

EEG Data Processing

EEG data were collected using the MP150 system (BIOPAC Systems) and processed with AcqKnowledge 4.1 and Python 3.12. The data were sampled at 1,000 Hz and processed in four steps. First, 60 Hz line frequency noise and eye movement artifacts (EOG signals) were removed. Second, alpha waves (8–13 Hz) were extracted. Third, alpha power was calculated in 0.5-second intervals. Finally, two key indicators—Total Occipital Alpha (TOA) and Left Prefrontal Alpha Dominance (LFPD)—were computed to assess cognitive and emotional responses.

Line frequency noise (60 Hz, corresponding to Korea’s 220V power supply) was removed using the

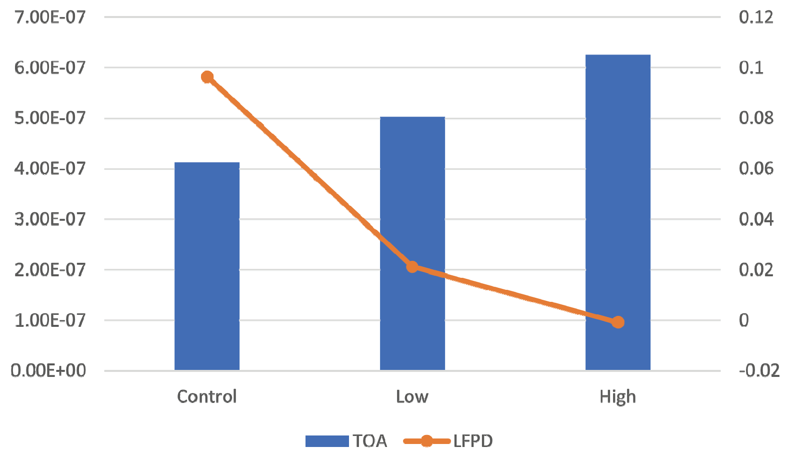

Figure 2. Averages of TOA and LFPD by Multitasking.

Digital IIR Band Stop Filter in AcqKnowledge. Eye movement artifacts were eliminated via the EOG removal function. A band-pass filter was applied to extract alpha waves from each EEG channel. The processed alpha power data were exported to Python, where alpha power was computed at 0.5-second intervals.

TOA was defined as the sum of alpha power recorded at the left (O1) and right (O2) occipital sites (Rothschild & Hyun, 1990):

$$TOA = O1alpha + O2alpha$$

LFPD was calculated as an index of left prefrontal cortex activation relative to the right prefrontal cortex. A positive LFPD value indicates greater left prefrontal activation, associated with approach motivation and positive emotional responses. Conversely, a lower LFPD value suggests greater right prefrontal activation, linked to withdrawal motivation and negative emotions (Davidson, 2004). Based on Rothschild & Hyun (1990), LFPD was computed as follows:

$$LFPD = (Fp2alpha - Fp1alpha) / (Fp2alpha + Fp1alpha)$$

where Fp2alpha represents the alpha power recorded from the right prefrontal site (Fp2), and Fp1alpha represents the alpha power recorded from the left prefrontal site (Fp1). This approach allowed for the assessment of sponsorship effects through neural activity under different multitasking conditions.

Hypothesis Test

Based on the processed EEG data, hypothesis testing was conducted. Hypothesis 1-1 tested was tested. The results showed that the TOA for the Control group (no multitasking) was 4.13E-07 (*SD = 8.35E-06*), for the Multitasking Low group was 5.03E-07 (SD = 7.80E-6), and for the Multitasking High group was 6.26E-07 (*SD = 7.05E-6*). An ANOVA test revealed a significant difference among the groups ($F = 5.16$, $df = 2$, $p = .006$). As expected in the hypothesis, the Control group had the lowest TOA, while the Multitasking High group had the highest TOA. Therefore, Hypothesis 1-1 was supported (see Figure 2).

Next, Hypothesis 1-2 was tested. RFPD is indicated by a lower LFPD value. The LFPD values were the highest in the Control group (.097, *SD = .39*), followed by the Multitasking Low group (.021, *SD = .32*), and the lowest in the Multitasking High group (-.001, *SD = .37*). The ANOVA test indicated a statistically significant mean difference among the groups ($F = 540.80$, $df = 2$, $p < .001$). Therefore, Hypothesis 1-2 was supported (see Figure 2).

Hypothesis 2-1 was tested next. Participants were divided into two groups based on whether they recalled the sponsoring brand (Nike). The TOA for the Recall

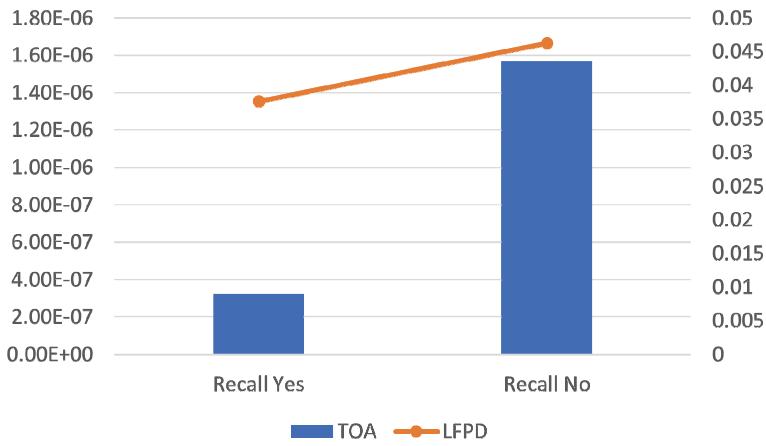

Figure 3. Averages of TOA and LFPD by Brand Recall.

Yes group was 3.25E-07 (*SD = 5.43E-6*), and for the Recall No group was 1.57E-06 (*SD = 1.52E-5*). A t-test revealed a statistically significant difference between the groups (*F = 273.11, df = 1, p < .001*), with the Recall Yes group showing lower TOA (see Figure 3). Therefore, Hypothesis 2-1 was supported.

Hypothesis 2-2 was tested by comparing LFPD values between the groups. The LFPD for the Recall Yes group was .038 (*SD = .35*), while the Recall No group had an LFPD of .046 (*SD = .41*). The results indicated that left-hemisphere dominance (positive emotion) was more evident in the Recall No group, contrary to hypothesis 2-1. A t-test revealed a statistically significant difference between the groups (*F = 5.82, df = 1, p = .016*). Therefore, Hypothesis 2-2 was rejected (see Figure 3). The reverse relationship, which is contrary to the hypothesis, will be discussed in detail in the Conclusions and Discussions section.

Next, Hypothesis 3-1, was tested. Participants were divided into two groups based on their attitude towards the sponsor brand scores, using the median score (6.5) as a cutoff. Those scoring above the median were categorized as the Attitude High group, while those below were categorized as the Attitude Low group. The TOA for the Attitude High group was 3.93E-07 (*SD = 7.11E-06*), and for the Attitude Low group was 5.98E-07 (*SD = 8.16E-06*). A t-test indicated a statistically significant difference between the groups (*F = 13.82, df = 1, p < .001*), with the Attitude High group showing lower TOA (see Figure 4). Therefore,

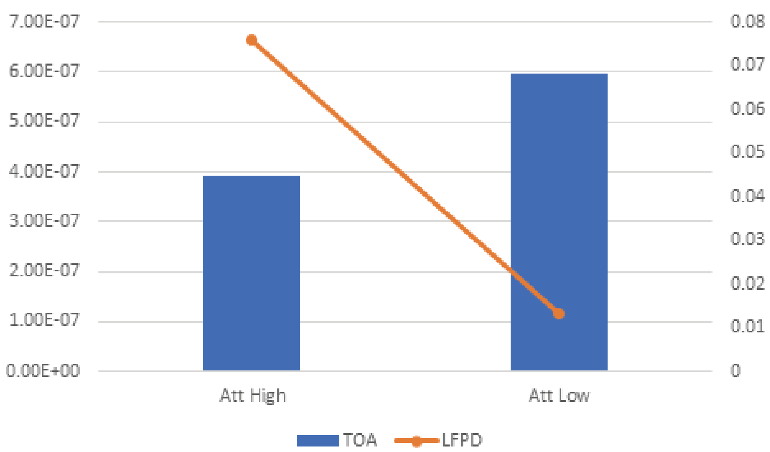

Figure 4. Averages of TOA and LFPD by Brand Attitude.

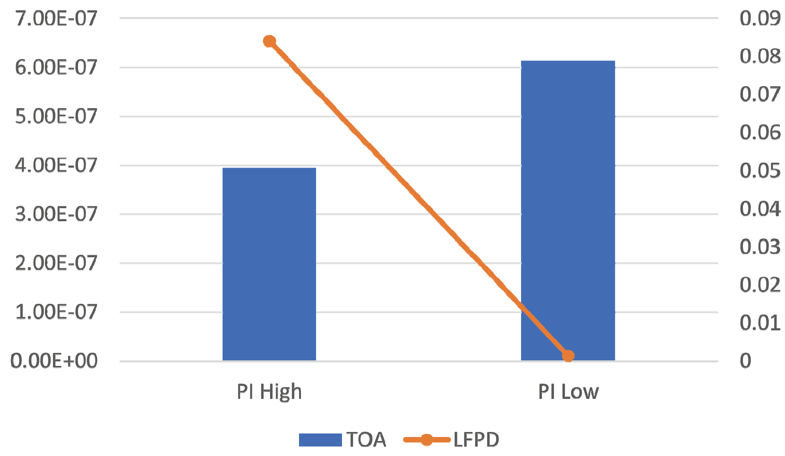

Figure 5. Averages of TOA and LFPD by Purchase Intension.

Hypothesis 3-1 was supported.

Hypothesis 3-2 was tested by comparing LFPD values between the groups. The LFPD for the Attitude High group was .076 (*SD* = *.38*), while the Attitude Low group had an LFPD of .013 (*SD* = *.35*). A t-test indicated a statistically significant difference between the groups ($F = 585.79, df = 1, p < .001$), with the Attitude High group showing greater left-hemisphere dominance (see Figure 4). Therefore, Hypothesis 3-2 was supported.

Next, Hypothesis 4-1 was tested. Participants were divided into two groups based on their purchase intention (PI) scores, using the median score (6.33) as a cutoff, with those scoring above the median categorized as the PI High group and those below as the PI Low group. The TOA for the PI High group was 3.95E-07 (*SD* = *6.03E-7*), and for the PI Low group was 6.13E-07 (*SD* = *8.95E-06*). A t-test revealed a statistically significant difference between the groups ($F = 16.06, df = 1, p < .001$), with the PI High group showing lower TOA (see Figure 5). Therefore, Hypothesis 4-1 was supported.

Finally, Hypothesis 4-2 was tested by comparing LFPD values between the groups. The LFPD for the PI High group was 0.084 (SD = .37), while the PI Low group had an LFPD of 0.001 (*SD* = *.35*). A t-test indicated a statistically significant difference between the groups ($F = 1055.25, df = 1, p < .001$), with the PI High group showing greater left-hemisphere dominance (positive emotion). Therefore, Hypothesis 4-2 was supported (see Figure 5).

Conclusions and Discussions

This study applied the media multitasking phenomenon, which has significantly transformed consumer media consumption, to a sports TV broadcast context to examine its effects on sport sponsorship effects. A neuromarketing methodology was employed to measure the effects of sponsorship stimuli using EEG. The results of hypothesis testing are summarized in Table 2.

While most hypotheses were supported, Hypothesis 2-2— “The brand recall group will exhibit LFPD”— was rejected. Interestingly, the Recall No group exhibited greater LFPD. This finding suggests that emotional positivity alone does not necessarily facilitate brand recall. Rather, recall may be primarily a cognitively driven process, and emotional states (as indexed by LFPD) may not directly enhance memory encoding under multitasking conditions. This interpretation aligns with prior research suggesting that memory retention is not always improved by positive emotional states under divided attention (Lang, 2000; Jeong & Hwang, 2016).

This result may be explained by considering the distinct roles of TOA and LFPD. Brand recall is fundamentally a cognitive process involving exposure,

Table 2. Summary of Hypotheses Tests

Hypotheses	Statements	Results
H1-1	Multitasking will increase TOA (opposite of alpha blocking).	Supported
H1-2	Multitasking will result in RFPD (right-hemisphere dominance).	Supported
H2-2	The sponsor brand recall group will exhibit decreased TOA (alpha blocking).	Supported
H2-2	The sponsor brand recall group will exhibit LFPD (left-hemisphere dominance).	Rejected
H3-1	The group forming a positive attitude towards the sponsor brand will exhibit decreased TOA.	Supported
H3-2	The group forming a positive attitude towards the sponsor brand will exhibit LFPD.	Supported
H4-1	The group forming purchase intention toward the sponsor brand will exhibit decreased TOA.	Supported
H4-2	The group forming purchase intention toward the sponsor brand will exhibit LFPD.	Supported

comprehension, and memory, where arousal, attention, and approach motivation play key roles (Keller, 1993). Consistent with Hypothesis 2-1, TOA reduction likely increased arousal and attention toward sponsorship stimuli, thereby enhancing recall. In contrast, LFPD may reflect affective processes that occur downstream of cognitive processing and may not directly facilitate encoding under conditions of media multitasking. Although some studies (Pham, 1992; Belanche et al., 2014; Hazlett & Hazlett, 1999) suggest positive emotions enhance recall, others (Lang, 2000; Jeong & Hwang, 2016) argue that emotional states alone may not significantly influence memory. Thus, the relationship between LFPD and brand recall remains complex and warrants further investigation.

In addition to the rejection of Hypothesis 2-2, the other hypotheses in this study were supported and provide meaningful implications. Specifically, Hypotheses 1-1 and 1-2 confirmed that involuntary multitasking increases TOA and induces RFPD, indicating cognitive disengagement and negative emotional states. Hypotheses 2-1, 3-1, and 4-1 demonstrated that lower TOA—signaling greater attention—was associated with higher sponsor recall, more favorable brand attitude, and stronger purchase intention. Hypotheses 3-2 and 4-2 further showed that LFPD, linked to approach motivation and positive affect, significantly predicted both favorable brand attitude and conative intention. Collectively, these findings support the utility of EEG indicators in measuring sponsorship effects across cognitive, affective, and behavioral dimensions.

Despite the rejection of H2-2, this study contributes to sport sponsorship literature in several ways. First, it empirically validated the process of brand recall, brand attitude, and purchase intention formation based on the hierarchy of effects model. This model conceptualizes sponsorship stimuli as progressing through cognitive, affective, and conative stages, reinforcing the role of sponsorship as a marketing communication tool (Lavidge & Steiner, 1961; Keller, 1993; Wijaya, 2012).

Second, the study examined media multitasking, a rapidly evolving media behavior, in a sports broadcast setting. The findings revealed that multitasking increased TOA and induced right-hemisphere dominance (RFPD), which is associated with negative emotions and avoidance motivation. This aligns with prior research suggesting that multitasking impairs communication effects (Puma et al., 2018; Segijn et al., 2017; Van der Schuur et al., 2015) and sport sponsorship outcomes (Lee, 2021). Finally, this study integrated EEG-based neuromarketing with traditional survey methods to assess sponsorship effects. By cross-validating brand recall, brand attitude, and purchase intention with EEG data, the findings support the convergent validity of neuromarketing techniques, consistent with Lee et al. (2024).

Although numerous studies have examined sponsorship effects using self-reported data, only a few have attempted to validate its cognitive and emotional mechanisms through neuroscientific tools such as EEG (Plassmann et al., 2015). Previous EEG-based sponsorship studies primarily focused on general advertising contexts or product placement, without systematically linking neurophysiological signals to established sponsorship effect models (e.g., the hierarchy of effects model). By incorporating both EEG and survey-based measures in a sport sponsorship setting, this study addresses this gap and contributes to a more integrated and objective understanding of sponsorship effects.

The study's findings have practical significance for sponsors and sports organizations. First, the validity of brand recall, brand attitude, and purchase intention as key sponsorship effect measures was reaffirmed (Biscaia et al., 2013; Lee, 2021; Tsordia et al., 2018). Therefore, sponsors should continue using these indicators to evaluate sponsorship effects. To leverage these findings, sponsors should implement activation strategies that maximize brand recall through frequent and strategically timed visual exposures. Additionally, to enhance brand attitude, sponsors should align their messaging with emotionally positive segments of the broadcast, such as halftime/breaktime shows and signing events for fans. Finally, to increase purchase intention, brands can integrate exclusive mobile promotions for spectators. In 2021, Dunkin' Donuts ran a mobile coupon campaign tied to NFL games—offering in-app "touchdown" discounts that were triggered by team scoring events. Post-campaign analysis showed a 30% uplift in redemption rates and a 15% sales increase at stadium-area outlets (Saettler, 2021), demonstrating mobile-based activations' effects in converting viewer engagement into actual purchases. These approaches, grounded in the validated metrics of recall, attitude, and intention, offer actionable pathways to optimize sponsorship ROI in distracted media environments.

Second, the study demonstrated EEG's utility as a tool for measuring sponsorship effects similarly the prior research (e.g., Lee et al., 2024). Neuromarketing techniques should be actively integrated into sponsorship evaluation to obtain more immediate and precise consumer insights. EEG-based studies provide real-time measurements, reducing biases associated with traditional survey-based approaches.

Third, strategies to address media multitasking's negative effects on sponsorship should be developed. This study confirmed that multitasking reduces sponsorship effects. Sports organizations and sponsors should implement strategies to minimize multitasking among viewers. Segijn et al. (2017) found that media multitasking often results from boredom. Viewers are more likely to multitask when a game is slow-paced and less engaging, whereas dynamic, fast-paced events reduce multitasking. Sports leagues should consider modifying game structures to enhance engagement. For example, Major League Baseball (MLB) introduced the pitch clock rule to prevent slow play and retain viewer attention (Wiles, 2024).

Alternatively, given the prevalence of multitasking, sponsors must adapt their strategies to maintain or enhance effects. One approach is increasing the prominence and frequency of sponsorship stimuli within primary media. Larger and more frequent brand logo exposures on stadium billboards may enhance the mere exposure effect, improving sponsorship outcomes (Cornwell et al., 2005). Additionally, intense stimuli—such as extreme sports, aggressive game strategies, or high-impact moments in motorsports—may help sustain viewer attention, strengthening sponsorship effects even in multitasking environments (Lee & Suh, 2021).

Despite its contributions, this study has some limitations. First, participants were randomly assigned into three equal groups of 22 (total 66). Increasing the sample size in future research would enhance the statistical power of the findings. Second, this study used Nike as the experimental brand. Although random assignment was assumed to balance pre-existing brand attitudes across groups, baseline differences may still exist. Future studies could address this issue by conducting pre-tests to measure brand attitudes before exposure or by using fictitious brands to ensure more controlled experimental conditions.

Third, this study assumed TV broadcasts as the primary medium and mobile devices as the secondary medium. However, given the shift toward mobile-dominated media consumption (Guttmann, 2024), future research should examine experimental designs where mobile devices serve as the primary medium and TVs act as the secondary medium. Finally, this study employed the MP-150 EEG system with wet electrodes, requiring considerable preparation time and potentially causing participant discomfort. Future research could explore more user-friendly alternatives, such as dry electrodes, which allow for faster setup and greater participant convenience (Liu et al., 2023).

By addressing these limitations and expanding the scope of future research, this study contributes to the growing understanding of sponsorship effects in multitasking contexts using neuromarketing techniques.

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Author Contributions

Sanghak Lee contributed to the conceptualization, formal analysis, and investigation of the study. He also led the project administration, including conducting the experiment, and coordinated the writing and editing process.

Kitae Kim was involved in the conceptualization and data curation. He conducted formal analysis and participated in the investigation and drafting of the manuscript.

Yong J. Hyun contributed to the study's conceptual framework and participated in drafting and revising the manuscript. He also provided visionary guidance on the overall direction of the neuromarketing component of the study.

Byungho Park supported data collection and investigation efforts. He also contributed to the writing of the original draft.

Conflict of Interest

The authors declare no conflict of interest.

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