Human Attention in Advertising: EEG-Based Neuro-Marketing Insights on Media Framing and Visual Design

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Abstract:

This study investigates how intertitle design and emotional cues influence viewer attention in video advertisements, measured via EEG. The analysis revealed that repeated text intertitles in the second display generated higher EEG activity, particularly in Beta and Gamma bands, indicating enhanced attention. Graphic intertitles, compared to text-based ones, elicited more brain activity, especially in the right parietal region, confirming the stronger impact of visual elements. Negative emotional framing was more effective than positive framing in capturing attention, with significant activation in the parietal and frontal regions. Gender differences were also observed: females responded more to repeated text and negative framing, while males were more engaged with graphic intertitles and positive stimuli. These findings provide actionable insights for marketers on optimizing ads designs to increase viewer engagement through repetition, visual elements, and emotional framing. Further research should explore diverse populations and integrate additional metrics to deepen understanding.

Keywords: media framing, EEG analysis, emotional framing.

Track: Advertising & Marketing Communication

1. Introduction

In today's smart marketing, communication has evolved, reshaping how brands connect with consumers. Advertisements are no longer generic—they're crafted to grab attention, evoke emotion, and drive engagement in an oversaturated information landscape. Video advertising stands out by halting scrolling, evoking emotions, and leaving lasting impressions. Understanding the drivers of effective engagement, especially the role of design elements like repeated text or emotional framing, remains a challenge. Research highlights the power of emotionally charged, personalized ads in boosting engagement (González-Mendoza et al., 2022), but the impact of repeated design features on real-time attention in video ads is less understood. While cognitive psychology suggests repetition aids memory, its effects on attentional focus, particularly in the context of emotional framing, are unclear. Does repeated text sustain attention over time? How do emotional cues, whether positive or negative, moderate this effect?

Studies indicate that emotional distractors initially capture attention but lose impact with repetition unless novelty is introduced (Ferrari et al., 2022). Repetition enhances brand recall and behavioral intentions (Liebers et al., 2019), its impact on attention in video ads remains ambiguous. Emotional framing also influences attention, with positive and negative tones interacting with repetition in complex ways.

This research addresses these gaps by examining how repeated text and graphic intertitles, with emotional framing (positive vs. negative), influence attentional processes in video ads. Using Electroencephalography (EEG) to capture neural responses linked to attention, emotion, and memory (Ciorciari et al., 2019; Kolar et al., 2021), this study explores four key questions: (1) Does repeated text increase attention? (2) Do graphic intertitles outperform text? (3) Does negative emotional framing elicit greater engagement than positive framing? (4) How do these effects interact with content type? These hypotheses aim to enhance understanding of how design and emotional cues optimize video ads effectiveness in today's smart marketing world.

2. Theoretical background and hypothesis development

2.1. Attention, repetition, and visuals in advertising

Attention is essential for advertising effectiveness, serving as the gateway for consumers to engage with and process brand messages (Kahneman, 1973). EEG studies reveal that sustained attention is marked by alpha wave desynchronization and theta synchronization, indicating

increased neural engagement (Kolar et al., 2021). Repetition, leveraging the "mere exposure effect" (Zajonc, 1968), reduces cognitive load, enhancing memory. EEG findings show that repetition boosts prefrontal cortex activity, improving recognition (Moon et al., 2019). Visual elements, according to Dual Coding Theory, engage both verbal and imagery systems, enhancing encoding and recall (Paivio, 2006). Dynamic visuals, such as motion graphics, activate sensory pathways and reduce cognitive fatigue, enhancing engagement (García-Madariaga et al., 2020; Wooley et al., 2022). Text intertitles are more effective when paired with visuals, amplifying attention and message delivery (Shukla et al., 2019).

2.2. Emotional framing and EEG insights

Emotional framing, whether positive or negative, significantly impacts advertising engagement. Negative content triggers the amygdala and prefrontal cortex, exploiting the "negativity bias" to evoke heightened arousal and attention (Baumeister et al., 2001; Aminiroshan et al., 2021). EEG studies indicate that negative framing elicits alpha suppression and theta synchronization, reflecting greater cognitive engagement (Aminiroshan et al., 2021). Positive framing, in contrast, activates reward-processing regions such as the ventromedial prefrontal cortex, fostering emotional connections and brand loyalty (Rolls, 2000). While negative framing captures more immediate attention, positive framing tends to be more effective for building long-term relationships (Bandara et al., 2021).

2.3. EEG advancements for optimizing advertising

EEG has become a powerful tool for understanding consumer behavior, offering real-time insights into neural responses to advertisements. Metrics such as frontal theta and parietal alpha activity are key to identifying moments of peak engagement (Kolar et al., 2021). Recent advancements in EEG technology, combined with machine learning, enable advertisers to predict and optimize content design, enhancing emotional resonance (Tao et al., 2023). By distinguishing the effects of design elements and emotional framing, EEG has become an invaluable tool for refining advertising strategies (Shukla et al., 2020).

2.4. Hypotheses development

Repetition in advertising leverages the *mere exposure effect* (Zajonc, 1968) to enhance recognition and recall. Repeated exposure strengthens neural connections in the prefrontal cortex, improving attention and memory encoding (Moon et al., 2019). EEG studies show repeated stimuli evoke stronger neural responses, reducing cognitive effort and enhancing

engagement (Wang, 2019). Effects are most significant after repetitions, improving memory and purchase intentions (Davtyan et al., 2020). Repetition also boosts perceived truthfulness, especially after the second exposure (Hassan & Barber, 2021). **H1**: *The second display of the same text intertitle will stimulate higher attention than the first display.*

Visuals are processed more efficiently than text through dual coding pathways, rapidly capturing attention. Graphics elicit stronger frontal theta activity and parietal alpha suppression, indicating greater engagement (Wooley et al., 2022). Animated visuals further reduce cognitive effort and enhance emotional connection (García-Madariaga et al., 2020; Bandara et al., 2021). Their speed in processing also makes visuals more effective in fast-paced environments (Moon et al., 2019). **H2**: *The graphic intertitle will stimulate higher attention than the text intertitle.*

The brain's *negativity bias* prioritizes threats, making negative stimuli more attention-grabbing. Such content activates the amygdala and prefrontal cortex, boosting arousal, memory encoding, and prolonged focus (Aminiroshan et al., 2021; Shukla et al., 2020). Negative imagery demands cognitive evaluation, sustaining viewer attention (Wooley et al., 2022). **H3**: *The negative graphic intertitle will stimulate higher attention than the positive one.*

Negative framing in text directs attention to risks, heightening cognitive engagement. EEG studies show negative framing increases theta wave activity, enhancing processing and retention (Aminiroshan et al., 2021; Shukla et al., 2019). It creates urgency, ensuring the message is both noticed and remembered (Moon et al., 2019). **H4**: *The negatively framed text intertitle will stimulate higher attention than the positively framed one.*

3. Methodology

This study used an experimental design to examine the effects of repetition, text, graphic, and emotional framing on viewer attention. EEG measured neural activity, providing insights into cognitive and emotional processes. Custom advertisements were created to eliminate brand-related biases, ensuring consistency in visual content, text, and graphic intertitles.

A total of 100 participants (50 males, 50 females, aged 17–36, mean age: 24) were recruited from a university's social media platform in Taiwan. Participants had varied educational backgrounds (14 master's, 55 bachelor's, 31 high school diplomas) and were screened for mental illness and normal vision and hearing. After a detailed EEG briefing, participants gave informed consent and received a US$10 incentive for participation.

EEG data were recorded using a 32-channel wireless system (Vega, Artise Biomedical Co. Ltd., Taiwan), with electrodes positioned according to the international 10-20 system and

mastoid electrodes as references. Impedance was maintained below 20 kΩ for optimal signal quality, with data recorded at 500 Hz. Pre-processing in MATLAB using EEGLAB included noise filtering, down-sampling to 250 Hz, and epoch extraction aligned with key stimuli (e.g., text and graphic appearances).

Positive text intertitle | Negative text intertitle | Positive graphic intertitle | Negative graphic intertitle

Figure 1. Advertisement frame excerpt from the experiment

Event-related potential (ERP) analysis assessed neural responses time-locked to stimulus onset. Statistical comparisons between video ads frame were made using the Wilcoxon signed-rank test ($p<0.05$). Time-frequency plots visualized brain activity across frontal, central, parietal, and occipital regions, revealing temporal dynamics and frequency variations. These analyses provided insights into the neural mechanisms underlying attention in response to media framing and visual design elements in advertisements.

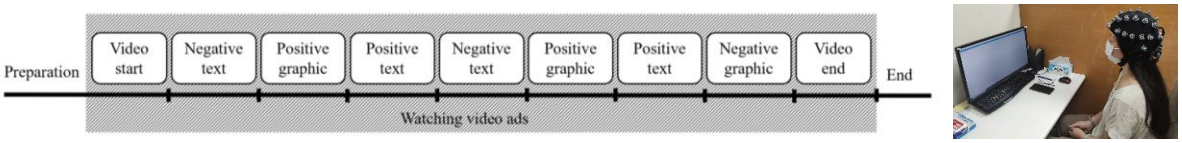

Figure 2. (a) Experiment Schema, (b) Picture of participant wearing EEG cap

4. Results

The EEG analysis compared brain activity between the first and second displays of the same text intertitle. Heatmaps revealed that the second display exhibited higher EEG activity, particularly in earlier timeframes, as indicated by red/yellow regions. This suggested greater attention, confirmed by increased activity in higher frequency bands such as Beta and Gamma, which are typically associated with attentional processes. The right parietal region, known for its role in visual-spatial attention, showed increased activation, particularly for repeated stimuli. The line graph further supported these findings, with the second display consistently showing higher EEG power. Statistically significant differences ($p < 0.05$) confirmed that the second display elicited greater attention, supporting the hypothesis that the second display of the same text intertitle stimulates higher attention.

The subsequent analysis of graphic versus text intertitles demonstrated that graphic intertitles elicited significantly more brain activity, particularly in the right parietal region,

which is linked to attentional and cognitive processing. This heightened activity was observed in the Beta and Gamma frequency bands, reflecting greater cognitive engagement.

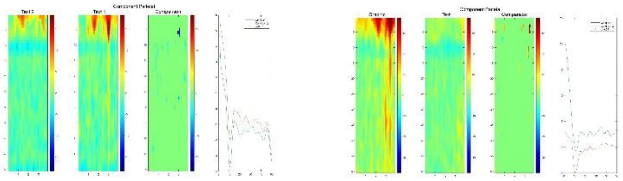

Figure 3. Parietal component for (a) repetition of the same text intertitle, and (b) the graphic versus the text intertitle.

The graphic intertitle consistently displayed higher EEG amplitudes compared to the text intertitle, with statistically significant differences ($p < 0.05$) confirming the greater attentional response to the graphic format. These findings support the hypothesis that the graphic intertitle stimulates higher attention, particularly through increased activity in the Beta and Gamma bands.

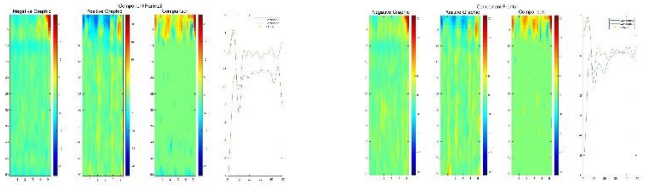

Figure 4. Parietal and frontal responses to negative and positive graphic intertitles.

The comparison between negative and positive graphic intertitles revealed that negative graphic intertitles elicited higher EEG activity, especially in the Beta and Gamma bands. This effect was most pronounced in the parietal region, involved in attentional processing, and the frontal region, associated with cognitive functions. Statistically significant differences confirm the hypothesis that negative graphic intertitles stimulate higher attention ($p < 0.05$). The results suggest that the right parietal region, crucial for visual-spatial attention, played a key role in processing negative stimuli, driving greater attentional engagement.

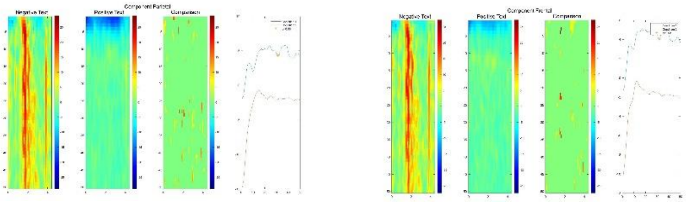

Figure 5. Parietal and frontal responses to negative and positive text intertitles.

The final analysis of framed text intertitles confirmed the results. The negative-framed text intertitle triggered significantly higher EEG activity than the positive-framed one, particularly in the parietal and frontal regions. This activity, concentrated in the Beta and Gamma bands, indicated that the negative frame attracted more attention. Statistically significant differences

($p < 0.05$) supported the hypothesis that negative-framed text intertitles enhance attention, with increased activation in the right hemisphere, especially the right parietal and frontal regions.

5. Discussion

This study provides insights into how video ad elements—such as repeated text, graphic intertitles, and emotional framing—affect viewer attention. EEG analysis showed that the second display of repeated text intertitles resulted in greater brain activity, particularly in the Beta and Gamma bands, indicating that repetition enhances cognitive engagement. Increased activation in the parietal region, associated with visual attention, supports the idea that repetition sustains viewer focus. These findings suggest that repetition is an effective tool for capturing and maintaining audience attention.

Comparison of graphic and text-based intertitles revealed that graphic intertitles generated more brain activity, particularly in the parietal region, indicating deeper viewer engagement with visual stimuli. The heightened Beta and Gamma band activity suggests that graphics prompt greater cognitive processing. This study contributes to existing research by providing EEG-based evidence that visual elements in advertisements foster better viewer engagement than text alone.

The study also examined the effect of emotional framing in advertisements. It was found that negative framing, whether through graphic or text intertitles, resulted in higher brain activity compared to positive framing. This suggests that negative content may grab viewers' attention more effectively, likely due to the emotional response it triggers. The increased attention to negative stimuli, particularly in the parietal and frontal regions of the brain, aligns with previous research showing that people tend to pay more attention to negative information. These findings emphasize that emotional content, especially negative framing, can be a powerful tool for advertisers to capture viewers' attention.

In exploring additional factors, gender differences were found to play a role in how viewers respond to different types of video advertisements. Female respondents showed higher levels of attention to repeated text intertitles, suggesting that women may be more sensitive to repetition as a means of gaining attention. On the other hand, male respondents exhibited a stronger response to graphic intertitles, indicating that men may be more visually oriented in their attention. Furthermore, when examining emotional framing, female respondents were more likely to show heightened attention to negative graphics and negative text intertitles, whereas male respondents responded more strongly to positive stimuli. These gender-based

differences suggest that advertisers may need to tailor their ads according to the specific preferences and attentional tendencies of different demographics.

Reflecting on the overall findings, this study highlights the importance of understanding how viewers process video advertisements at a cognitive level. By examining the neurological responses to various advertisement elements, this research offers practical guidance for marketers looking to improve the effectiveness of their campaigns. The results confirm that repetition, graphic elements, and emotional framing can significantly increase viewer engagement, helping advertisers capture attention in an increasingly crowded and fragmented media environment.

These findings have significant implications for the advertising industry. Marketers should consider integrating more repeated content, graphic elements, and emotionally charged framing into their video ads to maximize viewer attention. Additionally, understanding gender differences in attentional responses will allow advertisers to create more targeted and effective campaigns, reaching the right audience with the most engaging content.

The results of this study can be explained by the brain's natural tendency to focus on new, emotionally stimulating, and visually engaging content. Repeated text intertitles may enhance attention by increasing familiarity, while graphic intertitles and negative framing engage the brain's emotional processing systems. This research contributes to the growing understanding of how different advertisement formats affect viewer attention, providing a deeper understanding of how ads are processed in the brain.

Based on these findings, advertisers should revise their video ad strategies to include repetition, graphic content, and emotionally compelling frames. It is also important to consider gender-specific responses to different types of ads, allowing for more personalized approaches. Given the effectiveness of negative framing—especially for female viewers—advertisers may want to experiment with incorporating more emotionally charged negative content to capture attention and improve engagement.

6. Conclusion

This study underscores the crucial role of repetition, visual elements, and emotional framing in capturing viewer attention in video advertisements, as measured through EEG analysis. Repeated text intertitles generated higher neural activity, confirming that repetition enhances attention. Graphic intertitles were more engaging than text-based ones, highlighting the stronger impact of visual stimuli. Negative emotional framing was particularly effective in

capturing attention, with gender differences revealing that females responded more strongly to repeated text and negative framing, while males showed greater engagement with graphic intertitles and positive stimuli.

These findings contribute to our understanding of cognitive processes in advertising by providing empirical evidence on how design and emotional strategies influence attention. For marketers, the results offer actionable insights on optimizing ad designs through repetition, visual enhancements, and targeted emotional framing to maximize viewer engagement.

However, the study's focus on a specific demographic and reliance on EEG data alone limit its generalizability. Future research should consider diverse populations and incorporate additional neuroimaging or behavioral metrics to deepen insights into advertising effectiveness.

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