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Smokers' Reactions to Anti-Smoking Advertisements: A Preliminary Neuromarketing Study

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Main Points

- The ad with positive messages about quitting smoking is more persuasive to smokers, more memorable, and watched more attentively by participants.
- Advertising with negative messages leads to avoidance behavior, especially among individuals with high smoking dependency. Therefore, frightening content should be presented in a realistic and empathetic manner, without being overly exaggerated.
- Smokers' primary motivation for smoking is to "feel better when sad," "cope with depression," and "escape negative emotions." Advertising can emphasize that these perceived benefits are not based on reality. Additionally, smokers believe that smoking makes them appear unattractive. This negative perception can also be leveraged in advertising to influence smokers.
- To enhance the effectiveness of anti-smoking advertising, attention and emotional responses to ads should be measured using technologies such as eye tracking, electroencephalography, and face coding. This feedback can guide the design process of the advertisements.

Abstract

There is a substantial body of research on how anti-smoking advertisements are perceived by smokers and which types of messages are most effective. However, these studies have not reached a consensus, producing diverse and sometimes contradictory findings. This study aims to explore how different types of messages in anti-smoking advertisements influence smokers and whether these advertisements prompt behavioral changes toward quitting smoking. To achieve this, a study was conducted with 40 smokers using neuromarketing methods, including eye tracking, face coding, andelectroencephalography. Participants were exposed to two advertisements: one with a positive message frame emphasizing the benefits of quitting smoking and another with a negative message frame highlighting the consequences of not quitting. The findings reveal that advertisements with positive messaging attract greater attention, are more memorable, and are more effective in encouraging smoking cessation. Additionally, it was observed that individuals with higher levels of smoking addiction tend to retain positive messages more effectively and are more likely to avoid negative messages. Therefore, the study concludes that anti-smoking advertisements should emphasize positive messaging to achieve greater effectiveness.

Keywords: Addictions to tobacco, anti-smoking advertisements, neuromarketing

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Introduction

Public authorities and organizations disseminate various anti-smoking advertisements to protect individuals from tobacco use. The effectiveness of these advertisements varies depending on factors such as the type of message, audience segmentation, and message perception. Research indicates that both empathy-based and fear-based messages can be effective, but their impact depends on the target audience and context. For instance, empathy-driven messages resonate more with regular smokers and women, promoting behavioral change. Conversely, fear-based messages are generally more effective among individuals with lower levels of nicotine addiction (Shen, 2015).

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Anti-smoking advertisements, particularly those with strong emotional content, graphic imagery, and personal narratives, have been shown to significantly enhance individuals' motivation and efforts to quit smoking. These types of messages tend to elicit heightened emotional responses, which not only increase recall but also facilitate behavioral change (Leas et al., 2015). Personal testimonies that emphasize the suffering caused by smoking foster empathy and reinforce the intention to quit, while graphic depictions of the health consequences of tobacco use serve as powerful deterrents (Farrelly et al., 2012). Neurophysiological evidence further supports these effects, indicating that exposure to such advertisements increases introspection and psychological stress, which in turn enhances cessation motivation (Gupta et al., 2018). Among younger populations, visual warnings—such as pictorial health warnings on cigarette packaging—have proven particularly effective in stimulating the desire to quit smoking (Faisal & Suryati, 2023). Moreover, broad media exposure to anti-smoking messages has been associated with higher population-level cessation rates (Hyland et al., 2006). These advertisements also contribute to increased interpersonal pressure from social circles, which indirectly reinforces the decision to quit (Dunlop et al., 2014). Collectively, these findings underscore the effectiveness of emotionally compelling and visually impactful anti-smoking campaigns in promoting smoking cessation by enhancing personal awareness and leveraging social influence.

The impact of anti-smoking advertisements on smokers can be summarized as follows (Nogueira et al., 2018):

Creating Awareness: Advertisements raise awareness of the health risks of smoking, such as lung cancer, heart disease, and other severe illnesses.

Motivating Quit Attempts: Some smokers experience increased motivation to quit after viewing advertisements that evoke strong emotional or cognitive reactions.

Reducing Social Acceptance: Public service announcements challenge the social norms surrounding smoking, making it less socially acceptable.

Strengthening Quit Efforts: Advertisements can reinforce the efforts of those already attempting to quit smoking.

Numerous studies have investigated the effectiveness of public service announcements on smoking cessation, using neuromarketing methods alongside surveys and interviews. For example, a study by Wang et al. (2013) utilizing fMRI revealed that strong messages in public service announcements activate specific brain regions, increasing smokers' motivation to quit. Similarly, Harris et al. (2019) demonstrated, using electroencephalography (EEG), that advertisements with intense emotional content capture greater attention and have a higher potential to drive behavioral change.

In contrast, Schmälzle et al. (2020) found that anti-smoking posters evoking negative emotions were associated with lower click-through rates, suggesting that while negative emotional reactions might seem persuasive, they do not necessarily lead to action. Yang (2018), using NeuroSky's MindWave device, emphasized that the framing of advertising messages significantly impacts their effectiveness. Advertisements that align with viewers' emotional and cognitive responses are more likely to succeed in encouraging smoking cessation. Cahill (2006) demonstrated that women exhibit stronger emotional responses to positively framed content and show higher emotional engagement, particularly in the context of health communication.

Cartocci et al. (2018) found that fear-inducing messages were more effective in eliciting cognitive activity compared to ironic or purely informative approaches. However, the effects varied by gender. Similarly, Lindstrom (2012) demonstrated that health warnings on cigarette packaging, despite being designed to deter smoking, sometimes increased smokers' desire to smoke. Lindstrom's findings highlighted the disparity between what participants claimed to feel and their actual behavior.

A study by Park and Lee (2021) reported that social norm messages were particularly effective in changing smokers' attitudes, whereas fear-based messages were less impactful. Conversely, it was Wakefield et al. (2013) observed that television advertisements visually illustrating the harms of smoking were highly effective among smokers in low- and middle-income countries.

This study aims to investigate the effectiveness of anti-smoking advertisements framed with positive and negative messages on smokers by employing neuromarketing methods such as EEG, eye tracking, and face coding. The main objectives are to determine which type of message elicits greater attention, emotional engagement, and memory retention, and to explore how these effects vary based on the level of nicotine addiction and gender. Based on prior literature and framing theory, the study hypothesizes that (H1) advertisements with positive messages will attract more attention and be more memorable than those with negative messages; (H2) individuals with higher addiction levels will exhibit avoidance behavior toward negatively framed advertisements; and (H3) female participants will show greater engagement with positive message advertisements compared to male participants.

Material and Methods

The target population for this study comprised cigarette smokers. In neuromarketing research utilizing methods such as eye tracking and EEG, a sample size of 34 participants is considered sufficient to measure advertisement effectiveness with 90% accuracy (Koşar & Tor Kadiroğlu, 2020: 205). In this study, a total of 40 participants were included. Participants were selected using a simple random sampling method among individuals who were known to be smokers and accessible during the research period (October 1 – 20, 2024). Potential participants were approached through public spaces (e.g., university campus, social gathering areas, and cafés) and invited to participate voluntarily. Individuals who met the inclusion criteria (18 years or older, regular cigarette use) were randomly chosen from among those who agreed to participate. No participants were excluded from the study.

Participants were required to meet the following inclusion criteria: (1) being 18 years of age or older, and (2) being a regular cigarette smoker (at least one cigarette per day for the past 6 months). Exclusion criteria included individuals with known neurological or psychiatric disorders that could interfere with

neuromarketing measurements, such as epilepsy, Parkinson's disease, or perceptual impairments. To assess these conditions, a brief pre-screening questionnaire was administered prior to participation. Participants were asked to self-report any such conditions, and those who did not meet the criteria were excluded from the study. These precautions were taken to ensure the reliability and accuracy of EEG, eye tracking, and face coding results.

This study combines traditional research methods, such as surveys, with neuromarketing techniques. Initially, participants were administered the "Psychological Dependence on Smoking Assessment Scale," developed by Bardakçı et al. (2021) to assess their levels of smoking addiction. This 3-point Likert scale enables differentiation among varying degrees of dependence. Since the number of participants exceeded 30, and the skewness and kurtosis values were within the acceptable range of ± 1.5, the assumption of normality was considered to be met. Therefore, the data obtained through the survey were analyzed using parametric tests (Can, 2014).

Various neuromarketing methods were employed in this study. Neuromarketing is an interdisciplinary research approach that brings together neuroscience, psychology, and marketing to better understand consumer behavior. Traditional marketing methods often rely on subjective measures such as surveys or interviews, which can be limited by participants' self-awareness and ability to articulate their thoughts (Ariely & Berns, 2010). In contrast, neuromarketing techniques allow for the objective evaluation of consumers' emotional and cognitive responses through the use of physiological and neurobiological tools such as electroencephalography (EEG), eye tracking, and facial coding (Morin, 2011). These tools offer valuable insights into unconscious processes such as attention, emotional arousal, memory encoding, and decision-making (Plassmann et al., 2012). In the context of advertising, neuromarketing helps identify which elements of a message are most effective in capturing attention and evoking emotional engagement, particularly in public health campaigns like anti-smoking advertisements. By integrating marketing insights with neuroscientific data, neuromarketing enables a more comprehensive analysis of how persuasive messages influence human behavior.

Neuromarketing techniques, including eye tracking, Face Coding, and EEG, were then applied:

Eye tracking: This technique identifies which elements attract consumers' attention, making it vital for analyzing advertising content (Wedel & Pieters, 2006). The study evaluated participants' attention levels using eye tracking metrics, such as the K-Coefficient, and generated heat maps to visualize the areas of advertisements that received the most attention (Špakov & Miniotas, 2007).

Face coding: This method measures emotional changes by analyzing facial expressions during advertisement viewing. It helps determine positive or negative emotional reactions to marketing content (McDuff & El Kaliouby, 2016).

The eye tracking and face coding measurements were conducted using RealEye, an AI-supported application capable of detecting 60 gaze points per second via webcam (Fazio et al., 2020).

Electroencephalography: Electroencephalography was used to assess participants' emotional states and evaluate the effectiveness of marketing messages. Measurements were conducted with the Muse 2 headband, which uses dry electrodes and tracks brainwave activity at a sampling rate of 256 Hz. EEG data were analyzed using metrics such as Frontal Alpha Asymmetry (FAA), Frontal Theta Asymmetry (FTA), and Frontal Theta scores (Morán-Mirabal, et al. 2024).

Data Analysis

EEG data were processed using the Julius.ai platform (https://julius.ai/). Preprocessing steps included artifact removal via Independent Component Analysis, bandpass filtering, and segmentation. Key EEG metrics analyzed included:

Frontal Alpha Asymmetry (FAA): A measure of emotional processing and motivation, with higher scores indicating positive emotional responses and approach behaviors (Chai et al., 2014).

Frontal Theta Asymmetry (FTA): A measure linked to emotional states and decision-making behaviors (Zhao et al., 2018).

Frontal Theta Scores: Associated with memory retention, recall, and preference for advertisements (Fischer et al., 2018).

EEG findings were further interpreted in consultation with a neurology expert.

Data Collection Process

To ensure reliable data collection, participants were evaluated in a quiet and controlled environment, free from external noise and emotional distractions. Each participant was individually admitted into a designated room and seated at a standardized distance of 65 cm from the laptop screen, in accordance with established scientific guidelines. Prior to viewing the advertisement, participants were asked to complete a questionnaire designed to assess their general level of psychological dependence on smoking, ensuring that responses were not influenced by the emotional content of the videos. Afterward, participants watched two anti-smoking advertisements presented in a randomized order to eliminate order bias. Eye tracking and face coding analyses were conducted online through the RealEye platform, which uses webcam-based artificial intelligence technology to monitor real-time eye movements and facial expressions. Since these analyses were conducted directly via the RealEye system, no additional time was required for setup or calibration. The entire data collection process, including questionnaire completion and neuromarketing measurements, took approximately 15 to 20 minutes per participant. All neuromarketing procedures—including eye tracking, face coding, and EEG measurements—were administered by trained researchers with expertise in neuromarketing tools and protocols. The research team received prior training in the operation of RealEye and Muse 2 systems, ensuring reliable and standardized data collection. Before the study began, each participant was informed about the purpose, methods, and confidentiality of the research and signed a voluntary informed consent form. They also completed a brief pre-screening form to confirm that they did not have any neurological or perceptual disorders. Ethics committee approval and legal permissions for the study were obtained from Afyon Kocatepe University (Date: January

12, 2024; Meeting number: 2024-01). This structured and individualized data collection process was designed to maximize objectivity, data accuracy, and participant comfort.

Participants were informed about the safety of the devices used, the confidentiality of the data collected, and the voluntary nature of their participation. Detailed explanations were provided, and informed consent forms were signed prior to their participation.

Two advertisements produced by the Turkish Green Crescent Society were shown to participants. The first advertisement conveyed positive messages, emphasizing the health benefits of quitting smoking (e.g., Quit Smoking, Do not Quit Life 3). The second advertisement focused on negative messages, highlighting themes such as the health risks of smoking, death, emotional separations, and social disconnections (e.g., Quit Smoking, Do not Quit Life 2).

The selection of these advertisements was based on message framing theory, which examines consumer responses to different communication frames. This theory posits that varying presentations of the same topic—such as gain-loss, concrete-abstract, or emotional-rational contrasts—can yield different consumer behaviors (Florence et al., 2022). Specifically, the study incorporated both positive and negative advertisements based on Tversky and Kahneman's (1981) hypothesis that individuals are more sensitive to losses than to gains. This theoretical foundation underpins the positive and negative framing strategies frequently employed in marketing.

Data Analysis

Demographic Characteristics and Addiction Levels of Participants

The study included 40 cigarette smokers, equally divided between males (n = 20) and females (n = 20), aged between 19 and 46 years. Participants smoked an average of 16.58 cigarettes per day. "Based on the levels of addiction, the severity of addiction was low in 17.5% of participants, moderate in 57.5%, and high in 25%."

Reliability Analysis

To assess the internal consistency and reliability of the survey, a Cronbach's Alpha analysis was conducted. Cronbach's Alpha

Table 1.
Psychological Dependency on Smoking Assessment Scale

Statement	*N*	X	Standard Deviation
I believe I am accepted by others when I smoke.	40	1.63	.740
Smoking helps me relax.	40	2.58	.549
I can only have a good time if I smoke.	40	1.78	.620
I can concentrate better when I smoke.	40	2.05	.749
I feel confident when I smoke.	40	1.38	.586
Smoking provides me with the energy I need.	40	2.03	.768
Smoking is my best friend/companion.	40	1.60	.632
Smoking allows me to adopt the character I want to embody.	40	1.15	.427
Smoking makes me appear attractive.	40	1.08	.267
I think more clearly when I smoke.	40	1.98	.698
Smoking creates an irresistible craving and desire in me.	40	2.28	.784
Smoking at parties and social gatherings makes the atmosphere more enjoyable.	40	2.42	.636
I enjoy smoking more when I drink alcohol.	40	2.17	.874
When I feel sad or depressed, smoking helps me feel better.	40	2.63	.540
Smoking helps me manage my stress.	40	2.55	.552
Smoking helps me control my anger.	40	2.38	.740
Smoking brings me great pleasure.	40	2.28	.679
Smoking helps me manage my anxiety.	40	2.13	.648
Smoking helps me calm down.	40	2.42	.594
Smoking gives me a sense of satisfaction.	40	2.45	.639
Smoking is an addiction associated with illness, cancer, and death. Yet, I have decided to continue smoking.	40	2.38	.705
Smoking is harmful, and nicotine is a drug. Yet, I have decided to continue smoking.	40	2.42	.712
I spend money on cigarettes that I could use for other things, but I think it is worth it.	40	2.03	.768
Smoking around my family affects their health. Yet, I will continue to smoke.	40	1.53	.679
Smoking at my workplace affects and disturbs my colleagues. However, I will continue to smoke.	40	1.88	.791

is a widely used statistical measure to evaluate the homogeneity of survey items (Yıldız & Uzunsakal, 2018). In this study, the Cronbach's Alpha value was calculated as 0.864, indicating a high level of reliability for the survey instrument.

Participants' Attitudes Toward Smoking Addiction

Table 1 presents the responses of participants to questions assessing smoking addiction. The survey used a 3-point Likert scale, where (3) indicates "very often," (2) indicates "sometimes," and (1) indicates "never." According to the results, participants most agreed with the statement, "Smoking when I feel sad or depressed helps me feel better," while they least agreed with the statement, "Smoking makes me look more attractive."

Eye Tracking and Electroencephalography Data of Participants

According to the data obtained in the study, participants paid closer attention to the advertisement containing positive messages (34.60 > 31.48). The FAA score was also higher for the advertisement with positive messages (0.23 > 0.01). The higher average FAA score for the advertisement with positive messages indicates that participants watched this advertisement with higher motivation and demonstrated an approach behavior toward it. Attention data obtained from eye tracking further supports this interpretation. Additionally, the high Frontal Theta Wave activity in the advertisement with positive messages (0.36) indicates that the advertisement was more memorable. However, the FTA score of −0.050 suggests the presence of anxiety or concern, potentially indicating resistance to change.

For the negative-themed advertisement, the data suggest it may have a lasting impression on viewers' long-term memory (0.144). However, this value is lower compared to the advertisement with positive messages (0.36 > 0.144). The FTA score (−0.096) reflects the presence of anxiety or concern among viewers.

Figure 1 presents the heatmap of the scene in the positive message advertisement that participants watched with the highest level of attention. In this scene, the attention score was calculated as 1.00. The attention score in the Realeye system ranges between −1 and +1 (Lewandowska & Wisiecka, 2022). A value of 1.00 indicates that the scene was viewed with the maximum level of attention. The scene depicts an elderly individual engaging in outdoor exercise after quitting smoking. A significant portion of participants focused on the face of the exercising individual.

Table 2.
Eye Tracking and Electroencephalography Data of Participants

Positive Message Advertisement	*N*	Mean
Eye tracking attention score	40	34.60
Frontal alpha asymmetry mean	40	0.23
Frontal theta asymmetry mean	40	−0.050
Frontal theta score mean	40	0.3624
Negative Message Advertisement		
Eye tracking attention score	40	31.48
Frontal alpha asymmetry mean	40	0.01
Frontal theta asymmetry mean	40	−0.096
Frontal theta score mean	40	0.144

Figure 2 shows the heatmap of the scene in the negative message advertisement that participants watched with the highest level of attention. In this scene, the attention score was calculated as 0.86. While this score is high, it is slightly lower compared to the positive message advertisement. The scene depicts a young individual in a hospital, reliant on medical equipment. Participants predominantly focused on the actor's face in this scene.

Facial Coding Analysis of Participants

Figure 3 illustrates the graph of participants' facial expressions while watching the positive message advertisement. According to the figure, participants exhibited limited expressions of surprise

Figure 1. Heatmap of the Scene with the Highest Attention Score in the Positive Message Advertisement.

Figure 2. Heatmap of the Scene with the Highest Attention Score in the Negative Message Advertisement.

and demonstrated a moderate degree of happiness (approximately Max = 0.18).

Facial Coding Analysis of Participants

Figure 4 presents the graph of participants' facial expressions while watching the negative message advertisement. According to the figure, participants exhibited almost no expressions of surprise and showed very minimal happiness (approximately Max = 0.1). When comparing the two advertisements, it can be concluded that participants experienced more happiness while watching the positive message advertisement.

Relationship Between Smoking Addiction and Neuromarketing Results

Tables 3 and 4 show the relationship between participants' smoking addiction levels and their responses to advertisements. In the correlation analysis conducted within the study, participants' responses to the addiction-related survey were compared with EEG and eye tracking data. According to the results obtained from the correlation analysis, there is a weak positive linear relationship between the Frontal Teta score and the addiction variable (0.04 < 0.05). This suggests that as participants' addiction levels increase, the Teta score, which indicates the recall rate of the advertisement, also rises. Individuals with higher levels of smoking addiction tend to retain the anti-smoking advertisement with positive messages for a longer period in their memory.

Furthermore, a negative relationship was found between the FAA score and the FTA score (0.03 < 0.05). This suggests that the advertisement may have triggered emotional and cognitive conflict in participants. In individuals with smoking addiction, while the advertisement elicited emotional responses, attention and cognitive evaluation processes were hindered.

Table 4 shows the relationship between the EEG and eye tracking data from negative message advertisements and the participants' addiction levels. According to the obtained data, there is a moderate negative correlation between the participants' addiction levels and FAA scores (0.42, $p < .05$). This means that as the addiction levels of smokers increase, their willingness to avoid advertisements highlighting the negative aspects of smoking addiction also increases. Furthermore, this suggests a negative change in the participants' emotional or motivational states. The "moderate" negative correlation between smoking addiction and frontal asymmetry indicates a significant relationship between these two variables.

Additionally, a moderate negative correlation was found between the FTA scores and FAA scores. This negative relationship between FTA and FAA indicates that anti-smoking

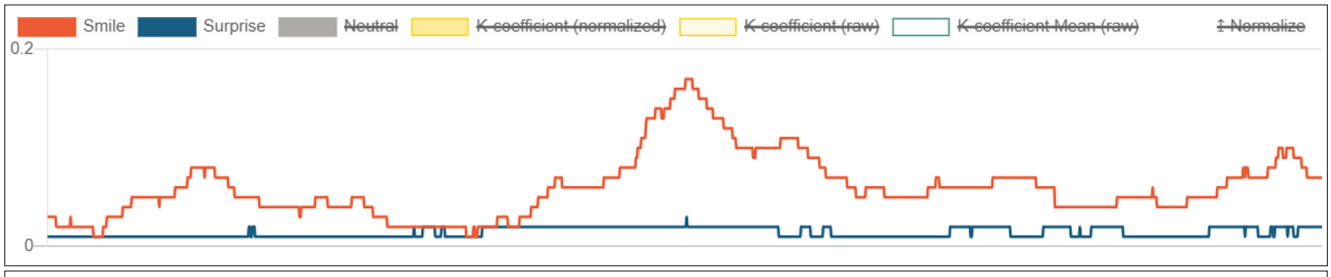

Figure 3. Facial Coding Graph for the Positive Message Advertisement.

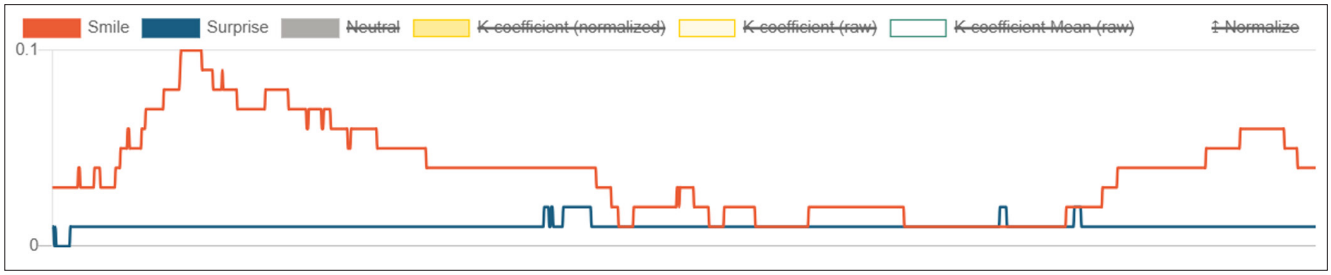

Figure 4. Facial Coding Graph for the Negative Message Advertisement.

advertisements may cause emotional discomfort for viewers, while also capturing their attention at a high level.

Comparison of Eye Tracking Data by Gender

The results of the t-test conducted to determine whether the attention shown by participants to the positive message advertisement differs by gender are presented in Table 5. The attention value shows a significant difference by gender. Specifically, women paid more attention to the positive message advertisement than men.

Discussion

Numerous studies have yielded varying, and sometimes contradictory, results regarding the effects of anti-smoking advertisements on smokers. The primary objective of such research is to identify the types of messages that are most effective in encouraging smoking cessation. This study investigated the effects of advertisements containing positive and negative messages on smokers, utilizing methods such as EEG, eye tracking, face coding, and surveys.

According to the findings from the survey section of the study, the statement, "When I am sad or depressed, smoking helps me feel better," was the most agreed upon by participants, whereas the statement, "Smoking makes me look attractive," received the least agreement. These results suggest that participants often rationalize their smoking behavior by citing emotional states such as sadness or depression. Similar findings in the literature have also demonstrated a link between depression and smoking addiction (Kiviruusu et al., 2024). Conversely, participants expressed skepticism regarding the perception of smoking as a factor that enhances physical attractiveness.

The study identified distinct differences in the effectiveness of positive versus negative message advertisements. Neuromarketing

Table 3.
Relationship between Positive Message Advertisement and Attention and Asymmetry Values

		Addiction	Eye Tracking Attention Value	Frontal Alpha Asymmetry Score	Frontal Theta Asymmetry Score	Frontal Theta Score
Addiction	Pearson correlation	1	−.120	−.209	.075	.391
	Sig. (2-tailed)		.461	.305	.722	**.048**
	N	40	40	40	40	40
Eye tracking attention value	Pearson correlation	−.120	1	−.020	−.032	.080
	Sig. (2-tailed)	.461		.923	.897	.697
	N	40	40	40	40	40
Frontal alpha asymmetry score	Pearson correlation	−.209	−.020	1	−.440	−.086
	Sig. (2-tailed)	.305	.923		**.031**	.683
	N	40	40	40	40	40
Frontal theta asymmetry score	Pearson correlation	.075	−.032	−.440	1	−.320
	Sig. (2-tailed)	.722	.897	.031		.119
	N	40	40	40	40	40
Frontal theta score	Pearson correlation	.391	.080	−.086	−.320	1
	Sig. (2-tailed)	.048	.697	.683	.119	
	N	40	40	40	40	

Table 4.
Relationship between Negative Message Advertisement and Attention and Asymmetry Values

		Addiction	Eye Tracking Attention Value	Fronthal Alpha Asymmetry Score	Frontal Theta Asymmetry Score	Frontal Theta Score
Addiction	Pearson correlation	1	.068	−.337*	.241	.209
	Sig. (2-tailed)		.676	.042	.157	.221
	N	40	40	40	40	40
Eye tracking attention value	Pearson correlation	.068	1	−.266	.010	.032
	Sig. (2-tailed)	.676		.111	.953	.855
	N	40	40	40	40	40
Frontal alpha asymmetry score	Pearson correlation	−.337*	-.266	1	−.556	.046
	Sig. (2-tailed)	.042	.111		.001	.791
	N	40	40	40	40	40
Frontal theta asymmetry score	Pearson correlation	.241	.010	−.556	1	−.131
	Sig. (2-tailed)	.157	.953	.001		.453
	N	40	40	40	40	40
Frontal theta score	Pearson correlation	.209	.032	.046	−.131	1
	Sig. (2-tailed)	.221	.855	.791	.453	
	N	40	40	40	40	40

*Correlation is significant at the 0.05 level (2-tailed).

data indicated that participants paid more attention to and were more motivated by the advertisements with positive messages. Metrics such as the FAA score, frontal theta score, and eye tracking attention score were higher for the positive message advertisements. This suggests that advertisements with positive messaging were more persuasive, left stronger impressions in memory, and were viewed with greater attention.

Interestingly, the FTA scores for both advertisements were negative, indicating that both ads caused some level of emotional disturbance among participants. However, the proximity of these scores to zero suggests that neither advertisement elicited a particularly strong emotional impact. Similarly, Face Coding analysis showed that participants displayed more expressions of happiness while watching the positive message advertisements compared to the negative ones.

Eye tracking data revealed that participants focused primarily on human faces during the advertisements, suggesting that they established an emotional connection with the individuals portrayed in the ads. There is also evidence in the literature suggesting that emotional connection influences smoking behavior among users (Leas et al., 2015)

Another key focus of this study was the relationship between smoking addiction levels and reactions to different messages. Correlation analysis revealed that as participants' addiction levels increased, so did their tendency to avoid advertisements that conveyed the negative aspects of smoking. A moderate relationship was identified between addiction levels and the avoidance of negative advertisements. Additionally, participants with higher addiction levels demonstrated greater recall rates for advertisements with positive messages. In other words, smokers with higher levels of addiction were more likely to retain information from positive advertisements while avoiding those with negative messages.

Gender differences in responses to the advertisements were also examined. According to the results of the T-test, women viewed the positive message advertisements with more attention compared to men. This gender-based difference may stem from a combination of emotional, psychological, and sociocultural factors. Previous studies have found that women are more likely to respond empathetically to emotionally positive content and display higher affective engagement in health communication contexts. Additionally, societal norms often associate caregiving and self-care behaviors more strongly with women, potentially

Table 5.
t-test Comparing Participants' Attention Values by Gender

Dimensions	Gender	*n*	X	**p*
Positive message	Women	20	38.05	.016
	Man	20	31.15	

$p < 0.05$.
X: arithmetic mean.

enhancing their receptiveness to positive, health-promoting messages. While this study did not directly examine these variables, future research should explore the interplay between gender, emotional reactivity, and addiction severity in greater depth.

The findings of this study contradict certain results in the literature. For instance, Lindstrom (2012) found that images of cancerous lungs or decayed teeth on cigarette packaging increased smokers' cravings to smoke. In contrast, this study revealed that participants tended to avoid negative message advertisements and approached them with negative motivation. Similarly, Cartocci et al. (2018) argued that fear-inducing advertisements are more effective in triggering cognitive activity; however, this study found lower FAA and FTA scores in response to fear-inducing advertisements.

On the other hand, the results align with some studies. Schmälzle et al. (2020) found that advertisements evoking negative emotions resulted in lower engagement, as smokers tended to avoid these messages even if they were affected by them. Similarly, Park and Lee (2021) reported that fear-based messages are less effective for smokers. Additionally, Shen (2015) found that fear-based messages are more effective for individuals with lower addiction levels. In line with these findings, this study showed that participants with higher addiction levels were more likely to avoid fear-inducing advertisements while responding more favorably to positive messaging. The results indicate that when the appropriate messages are delivered, such advertisements can be effective for participants and may contribute positively to smoking cessation efforts. This finding is generally supported by the existing literature (Gupta et al., 2018).

The effectiveness of positive message advertisements in this study supports Tversky and Kahneman's (1981) hypothesis that "people are more sensitive to gains than to losses."

Based on the findings, the following recommendations can be made for organizations creating anti-smoking advertisements:

Emphasize Positive Messaging: Advertisements that highlight a healthy, happy lifestyle and evoke positive emotions should be prioritized. Such content is likely to attract greater attention, enhance recall, and improve the likelihood of smoking cessation.

Balance Negative Messaging: Negative message advertisements can trigger avoidance behaviors, especially among individuals with high levels of addiction. Therefore, fear-based content should be presented in a balanced and empathetic manner to prevent excessive aversion. Negative messaging may be more effective for less addicted individuals but should still be used with caution.

Address Emotional Triggers: Since smokers often cite sadness and depression as motivations for smoking, advertisements can emphasize alternatives to smoking for coping with these emotions. Additionally, the perception that smoking does not enhance physical attractiveness can serve as a motivational factor in advertising campaigns.

Increase Emotional Impact: This study found that anti-smoking advertisements did not elicit a strong emotional impact. To strengthen the emotional connection with smokers, advertisements should incorporate more emotionally engaging elements.

Segment Audiences According to Emotional Reactions: Move beyond demographic targeting and consider segmenting audiences based on their neurocognitive and emotional responses to messages. This strategy enhances the relevance and impact of public health communications.

Develop Emotionally Intelligent, Personalized Health Messages: Public health campaigns should leverage real-time neurophysiological data (e.g., EEG, eye tracking) to tailor anti-smoking messages to individuals' emotional and attentional profiles. Personalized, positively framed messages are particularly effective for highly nicotine-dependent individuals and can enhance cessation outcomes.

Implement Emotional Segmentation in Health Communication: Instead of relying solely on demographic variables, public health strategies should classify target audiences based on their emotional responses to health messages. This approach fosters more nuanced and effective behavioral interventions.

Design Digital Content Specifically for Health Campaigns: Based on attention and memory data, public health agencies should produce short, emotionally engaging videos optimized for social media platforms. These formats increase accessibility and engagement, especially among younger demographics.

This study makes several contributions to the literature. It is the first study to combine multiple analysis methods—EEG, eye tracking, face coding, and surveys—allowing for a more comprehensive examination of anti-smoking advertisement effectiveness. The findings demonstrate that advertisements with positive messages are more effective in motivating smoking cessation, creating stronger impressions, and enhancing recall, particularly among individuals with higher addiction levels. Additionally, the study highlights gender-based differences, with women showing greater attention to positive advertisements. Lastly, the study challenges the notion that fear-based messaging is universally effective, particularly for highly addicted individuals.

Limitations and Future Directions

As with any research, this study has limitations. First, the sample size was relatively small. Future studies could involve larger and more diverse samples. Additionally, this study did not differentiate participants by age groups or generations; future research could explore generational differences. The study was conducted exclusively in a specific region, and results may vary in other geographical, cultural, and demographic contexts. Gender and other demographic factors were not extensively tested in this study. Future research could enhance the depth of analysis by incorporating these variables.

While this study employed EEG, eye tracking, face coding, and surveys, future research could incorporate other methods such as fMRI or Galvanic Skin Response to deepen the analysis. Longitudinal studies could also be conducted to assess the long-term effects of different types of advertisements. Future research could further investigate the interaction between gender, emotional response level, and dependency level. Finally, future studies

could explore additional message framing strategies, such as focusing on economic impacts, environmental harm, or emotional well-being, to determine their effectiveness in encouraging smoking cessation.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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Informed Consent: Written informed consent was obtained from the participants who agreed to take part in the study.

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