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Neuroscientific Evaluation of Fear Appeal in Television Advertising: An Eye-Tracking and Biometric Study of Viewer Attention

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Neuroscientific Evaluation of Fear Appeal in Television Advertising: An Eye-Tracking and Biometric Study of Viewer Attention

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Abstract

Purpose This study aims to investigate the effects of fear-based television advertisements on viewer attention and emotional arousal within the context of increasing attentional fragmentation in contemporary media environments. Specifically, it examines whether fear appeals can function as an effective mechanism to reduce attentional decay by capturing and sustaining viewer attention through emotional activation.

Methods A total of 28 participants were included in the study. A multimethod neuroscientific approach was employed, combining eye-tracking technology and galvanic skin response (GSR) measurements to obtain objective, real-time data on visual attention and physiological arousal. Participants were exposed to both fear-based and neutral television advertisements. Fear-based stimuli included emotionally intense and threat-inducing visual elements, such as pain-related facial expressions and dental sensitivity scenarios, while neutral advertisements served as a baseline condition. Eye movements, fixation patterns, and skin conductance responses were continuously recorded throughout the experiment.

Results The findings indicate that fear-based advertisements are significantly more effective in capturing attention than neutral advertisements. Eye-tracking results revealed faster initial fixations and longer fixation durations for fear stimuli, suggesting enhanced visual engagement. “Pain face” expressions emerged as the primary focal point across participants, regardless of gender. Additionally, gender differences in attentional patterns were observed: male participants demonstrated more focused and narrow attention, whereas female participants exhibited broader and more exploratory viewing behavior. GSR data further showed

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significantly higher levels of physiological arousal in response to fear-based advertisements, indicating increased activation of the autonomic nervous system.

Conclusion The results demonstrate that fear appeals are effective in enhancing both attentional engagement and emotional arousal in television advertising. These findings suggest that fear-based strategies can help mitigate attentional decay by sustaining viewer attention and promoting deeper cognitive processing of advertising content. However, the findings should be interpreted with caution due to the relatively small sample size and the controlled laboratory setting, which may limit generalizability.

Clinical trial registration Not applicable. This study is a retrospective analysis of previously acquired open-source imaging datasets and does not constitute a clinical trial.

Keywords: Television advertising, Neuroscience, Attention, Attractiveness, GSR, Eye tracking.

Introduction

If the human subconscious holds the true key to consumer behavior, why do we continue to rely on the unreliable whispers of self-reporting? While advertising is traditionally viewed as a blend of graphics, cinema, and music designed to drive sales [1], its ultimate success hinges on attractiveness; a complex interplay of emotional interaction, memorability, and ease of attention [2]. To cut through modern market saturation, advertisers frequently employ fear appeals, leveraging perceived threats to provoke immediate protective or consumer-driven responses [3]. However, a critical tension exists: traditional data collection methods such as surveys and interviews are increasingly criticized for their inability to bypass participant bias and for individuals' inherent limitations in accurately reconstructing their own cognitive and emotional states [4,5].

To move beyond these subjective limitations, the past decade has witnessed a growing shift toward neuroscientific methodologies aimed at uncovering the unconscious drivers of human behavior [6]. By employing biometric tools such as EEG, fMRI, eye tracking, and galvanic skin response (GSR), researchers are able to observe the brain's raw and unfiltered reactions to marketing stimuli [7]. Compared to traditional techniques, these neuroscientific approaches provide a more objective and reliable framework for measuring both positive and negative responses [8, 6]. From this perspective, the present study utilizes eye tracking and GSR to offer an unbiased assessment of how fear appeals capture and sustain viewer attention in television advertisements [9,10].

This study aims to address this gap by examining the effects of fear appeals in television advertising on attention and emotional engagement through objective biometric data. The

significance of the research lies in its departure from traditional self-report methods, instead directly measuring consumer responses via physiological indicators. The study offers an original contribution by investigating whether fear elements enhance viewer attention and whether this attention is directed toward the brand message or diverted to the fear-inducing stimulus itself. The primary objective is to test the impact of fear on attention and physiological arousal, using an experimental design based on eye tracking and GSR techniques. However, the findings are limited by the specific age range and relatively small sample size, which may restrict the generalizability of the results to broader populations.

Advertising and the Strategic Deployment of Fear Appeal

In the modern multimedia landscape, advertising has transcended its traditional role as a simple informative tool for goods and services [11]. It is now a sophisticated psychological mechanism designed to capture attention and anchor messages within the consumer's memory through emotional interaction [12]. Among the various emotional levers available to advertisers, fear appeal remains one of the most potent, yet ethically and strategically complex, motivational factors for behavioral change [13]. Defined as an emotional reflex in response to a perceived threat, fear appeal operates by implying that a failure to adopt a specific suggestion, whether purchasing insurance or quitting smoking, will result in dire personal or social consequences [14,15]. While fear is a universal human experience, its efficacy in advertising is far from uniform. Early experimental research suggested that the arousal effects of fear appeal often struggle to reach the necessary threshold to influence behavioral intention [16]. Furthermore, a critical perspective reveals that cultural and demographic variables significantly mediate these responses; for instance, fear appeals in anti-smoking campaigns have shown positive effects in Western contexts while failing to elicit behavioral changes in other cultures [17]. There is also the risk of boomerang effects, where excessive fear in environmental or health messaging leads to negative attitudes toward the brand rather than the intended action [18]. The limitations of these behavioral studies have paved the way for neuroscientific validation, which seeks to map the physiological reality of fear. Recent research utilizing biometric sensors has confirmed that fear-based stimuli significantly alter physiological parameters, including increased skin conductance and respiratory acceleration [19]. Neuroimaging has further identified that fear appeals activate specific neural circuits associated with unexpected situation awareness, such as the anterior cingulate cortex [ACC] and the ventromedial prefrontal cortex [vmPFC] [20]. Unlike humorous appeals which may highlight a brand name, fear appeals tend to redirect visual attention toward the functional elements of the advertisement, such as packaging or specific warnings, often at the expense of social

elements like human faces [AB1]All in all, the power of fear lies in its ability to enhance memorability and proactively intervene in information recall, making it an indispensable, albeit high-risk, tool for advertisers in competitive markets [21,22].

Neuroscientific Measurement of Attention: Beyond Conscious Perception

Attention is the concentration of consciousness into a clear perceptual state, yet it is notoriously fluid, frequently shifting between auditory cues, background imagery, and product messaging [23,24]. In advertising, capturing this fleeting focus is the prerequisite for memory encoding and subsequent purchase behavior [25,26]. However, traditional research fails to capture the "distraction" phase where attention wavers. Neuroscience addresses this by bypassing the participant's inability to accurately self-assess their cognitive state, offering a faster and more objective mapping of unconscious preferences [27].

Consumer neuroscience categorizes these objective measures into two streams: neurophysiological [brain imaging like fMRI and EEG] and biometric (physiological markers) [28]. While neurophysiological tools model three-dimensional brain activity, biometric techniques record the autonomic nervous system's downstream signals, such as pupil dilation, and skin conductivity, to reveal emotional arousal [7, 25].

Within biometric measurement, Eye Tracking serves as the primary tool for mapping visual attention. By recording pupil movements in milliseconds, researchers generate heatmaps and fixation metrics that identify exactly which advertisement elements, such as a brand logo or a threatening image, capture initial interest [29]. Complementing this, Galvanic Skin Response [GSR] measures changes in the skin's electrical properties triggered by sweat gland activity. Because the autonomic nervous system controls these responses, GSR acts as a high-fidelity parameter for emotional complexes that the participant cannot consciously suppress [30, 31]. These tools have revealed that advertising content is processed through distinct neural pathways; for instance, while beauty or celebrity presence activates trust-related regions, fear and danger stimuli trigger the amygdala, the brain's center for threat appraisal [32]. By integrating these methods, this study investigates how fear-based television commercials *command* attention at an unconscious level, providing empirical data on how threat-based stimuli shape the viewer's cognitive and emotional landscape [33].

Despite the prevalence of fear-based messaging in mass media, a significant gap remains in the empirical understanding of how these appeals psychologically "command" viewer attention during television broadcasts. This study addresses this oversight by utilizing high-resolution neuromarketing methodologies to move beyond subjective consumer reports.

The primary objective of this research is to evaluate the impact of fear appeal on the attention factor using synchronized eye-tracking and GSR measurements. Specifically, the study seeks to:

1. Comparative Analysis: Quantify the differences in attentional capture and emotional arousal between advertisements utilizing fear appeals versus neutral, information-only advertisements.
2. Gender Dimorphism: Investigate the moderating role of gender in processing threat-based stimuli, specifically how biological sex influences the intensity and duration of visual fixation and physiological response.
3. Cross-Methodological Validation: Correlate biometric data [skin conductance] with visual attention metrics [heatmaps and fixation counts] to provide a multidimensional assessment of how frightening stimuli affect cognitive load.

By triangulating these neuroscientific markers, this research aims to contribute a robust, objective framework to the existing literature, offering advertisers and scholars a more precise understanding of the unconscious drivers behind consumer interaction with high-arousal content.

Sample of the Study

The study utilized a purposive sample of 28 participants [17 males, 11 females]. While this sample size may appear modest by traditional survey standards, it is highly appropriate for neuroscientific and biometric research, where high-density data collection per subject [recording multiple physiological signals per millisecond] provides sufficient statistical power for experimental designs [6].

The selection process was guided by the following academic and technical justifications:

1. Homogeneity for Physiological Baseline: The sample was restricted to individuals aged 20–35, all of whom are university graduates and active employees. This demographic consistency minimizes physiological noise stemming from age-related differences in skin elasticity [affecting GSR], and cognitive processing speeds, thereby increasing the internal validity of the biometric measures.
2. Technological Constraints and Data Integrity: In accordance with established neuromarketing protocols, the sample size was determined by the rigorous requirements of eye-tracking and GSR synchronization. Larger samples in biometric studies often lead to diminishing returns due to the intensive data-cleaning processes required to remove artifacts [e.g., excessive blinking or movement] [5].

3. Sampling Strategy: While the study employed convenience sampling due to the high costs and logistical complexities of neuroscientific laboratory equipment [34], the voluntary nature of participation ensured that subjects were attentive and compliant with the technical demands of the sensors.
4. Target Audience Alignment: The age and socioeconomic profile of the participants directly align with the primary consumer demographic for the television advertisements used as stimuli, ensuring that the emotional responses recorded are ecologically valid for the products being tested.

Purpose and Hypotheses of the Study

Because television is primarily an entertainment medium, advertisements are often processed through a lens of perceived creativity and enjoyment. Research suggests that entertaining content utilizing positive emotional cues can significantly reduce consumer resistance to persuasion, thereby, increasing brand purchase intention [35]. However, the critical mechanism for long-term advertising effectiveness is the formation of stable memory traces, which are heavily dependent on the intensity of emotional processing, whether positive or negative, during the viewing experience [36].

While positive reinforcement is a common strategy, the strategic deployment of fear elements offers a unique motivational pathway. By activating the autonomic nervous system, fear appeals may bypass conscious filters to create more immediate and durable cognitive imprints. To provide empirical evidence for this strategy, this study utilizes neuroscientific methods to extract and quantify "emotional involvement", a metric often inaccessible through traditional surveys. Specifically, this research tests the effectiveness of fear as a primary driver of attentional focus and physiological arousal. Based on this framework, the following hypotheses were proposed.

H1.a. When the GSR measurements are analysed, it is observed that all the participants were attracted to television programmes with high appeal of fear. There is a significant increase in the level of attention towards advertisements.

H1.b. There is a significant difference between the attention levels of those who find the advertisement frightening and those who do not find the advertisement frightening according to GSR measurements.

H1.c. According to GSR measurements, there is a significant difference between the attention levels of those who find the advertisement remarkable and those who do not find the advertisement remarkable.

Eye tracking operates on the fundamental, yet critically debated, Eye-Mind Hypothesis, which posits that what an individual observes directly reflects their immediate cognitive processing [37]. In advertising research, this tool transcends simple visibility checks by providing granular metrics such as Fixation Count [FC], Total Fixation Duration [TFD], and Time to First Fixation [TTFF]. These metrics allow researchers to quantify how specific creative elements, such as fear-inducing imagery, compete for limited cognitive resources.

However, a critical perspective is required: gaze does not always equate to comprehension or positive engagement. For example, the presence of high-arousal stimuli, such as "happy faces" in pharmaceutical ads, has been shown to paradoxically distract viewers, thereby reducing the objective understanding of mandatory health warnings [38]. Similarly, while prolonged fixation durations (occurring within the first 5–10 seconds) often correlate with aesthetic preference or "liking" [38], in the context of fear appeals, long fixations may instead indicate "attentional hijacking" or a paralysis of processing due to the intensity of the threat.

By isolating visual attention patterns in television commercials containing fear elements, this study seeks to determine if horror-based stimuli function as a *visual magnet* that increases focus on the brand or if they create a *vampire effect* where the fear element overshadows the product message. Consequently, the following hypotheses are proposed:

H2. When eye tracking measurements are analysed, the number of fixations tends to increase while watching television commercials with fear appeal.

H2.a. When eye-tracking measurements are analysed, there is a significant difference between the number of fixations of men and women while watching fear-appealing television commercials.

H2.b. When eye tracking measurements are analysed, there is a significant difference between the number of fixations of those who find the advertisement frightening and those who do not.

H2.c. When eye-tracking measurements are analysed, there is a significant difference between the number of fixations of those who find the advertisement attractive and those who do not.

H2.d. When eye-tracking measurements are analysed, there is a significant difference between men and women's attention levels towards fear-attracting television advertisements

Research Methodology

To overcome the inherent subjectivity of self-report measures, this study employs a synchronized biometric architecture to capture real-time cognitive and physiological fluctuations. The experimental stimuli consisted of seven television commercials, four utilizing

fear appeals and three informative controls, validated by a panel of experts to ensure clear categorical distinction. Additionally, this study was approved by the Gümüşhane University Scientific Research and Publication Ethics Committee in terms of research ethics.

The data collection was conducted in a controlled, sensory-isolated laboratory to eliminate confounding environmental variables. Visual attention was mapped using the GazePoint GP3 [150 Hz] eye-tracking system. This high sampling rate is critical for capturing micro-saccades and precise fixation durations that lower-frequency devices miss. To ensure data integrity, a multi-point calibration was performed for each participant prior to exposure.

Simultaneously, emotional arousal was quantified using the Empatica E4 wristband, a medical-grade device capable of recording high-fidelity Galvanic Skin Response [GSR]. To address the "noisy" nature of physiological data, the raw GSR signals were processed through a custom Python-based pipeline. This included:

1. Filtering: Removal of movement artifacts and high-frequency noise.
2. Normalisation: Adjusting for individual baseline variations to ensure inter-subject comparability.
3. Feature Extraction: Converting raw conductance into instantaneous arousal values.

By selecting a sample of 28 predominantly right-handed participantsa standard practice to control for hemispheric brain dominance and maintaining a strict double-blind approach regarding the study’s specific aims, this methodology ensures that the resulting heatmaps and arousal spikes are a direct, unfiltered reflection of the stimuli's psychological impact. This robust triangulation of 150 Hz gaze data and normalized skin conductance provides a level of empirical certainty that traditional marketing surveys cannot achieve.

Research Findings

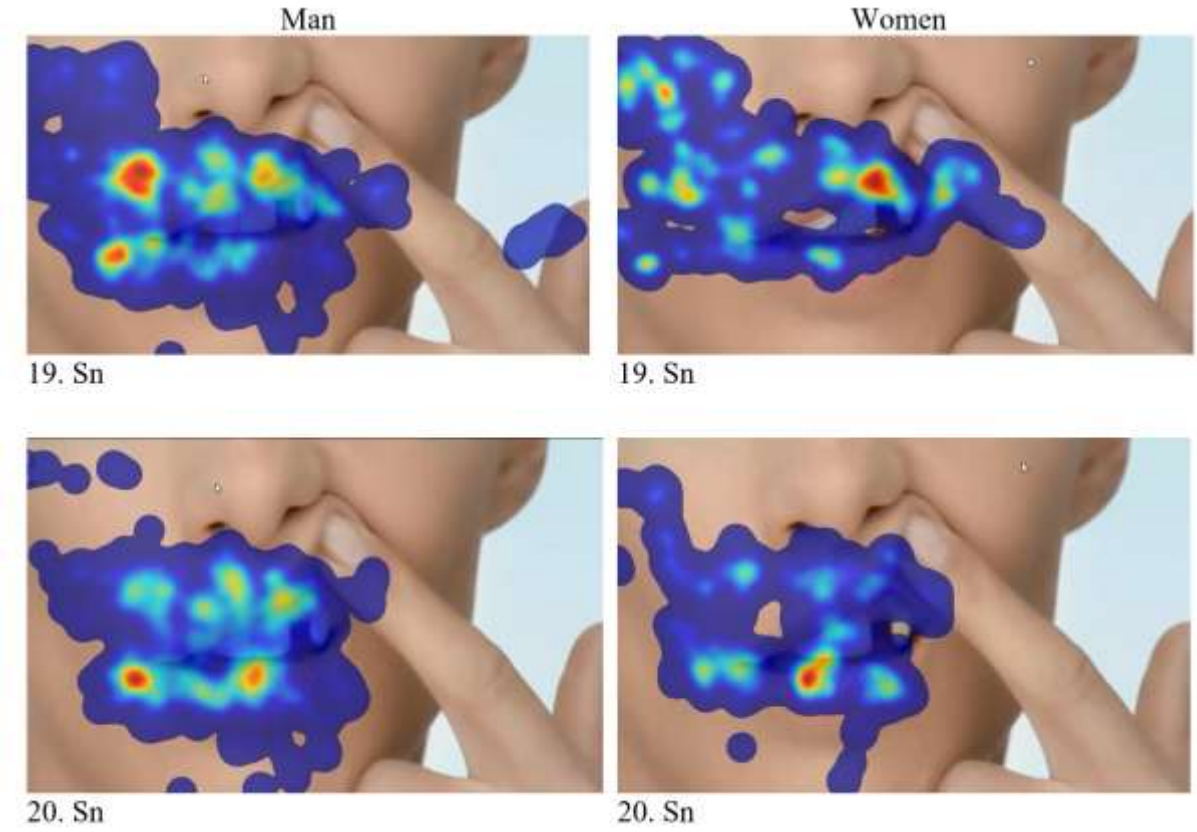
The eye-tracking data were analyzed to evaluate the attentiveness of participants specifically in relation to the perceived intensity of fear-based stimuli. This analysis focused on how visual engagement with threatening scenes varied according to gender and how these patterns evolved during the commercial's duration. By utilizing high-resolution biometric tracking, this study provides an objective mapping of the emotional and cognitive reactions elicited by high-arousal television content.

A critical contribution of this research is the identification of distinct "scanpaths" the specific sequence of eye fixations that differ significantly between male and female viewers. Furthermore, the data reveals that attention to fear appeal is not a static reaction but a dynamic temporal process that peaks and recedes alongside the narrative arc of the advertisement. This section provides a detailed examination of these findings, elucidating how gender serves as a biological mediator in the processing of threat-based marketing communication.

Analysis of Eye Tracking Data in the Context of Attention Attractiveness

This phase of the analysis specifically isolates the "threat climax"—a two-second sequence [seconds 19–20] depicting acute tooth loss. By defining the oral cavity and surrounding facial features as a primary Area of Interest [AOI], the study quantifies how high-intensity fear stimuli override general scanning behaviors.

Figure 1. [AB2]Parodontax Toothpaste Malkron Technology Tooth Loss Scene with Heat Map Created with the Stop Scene of the Advertisement



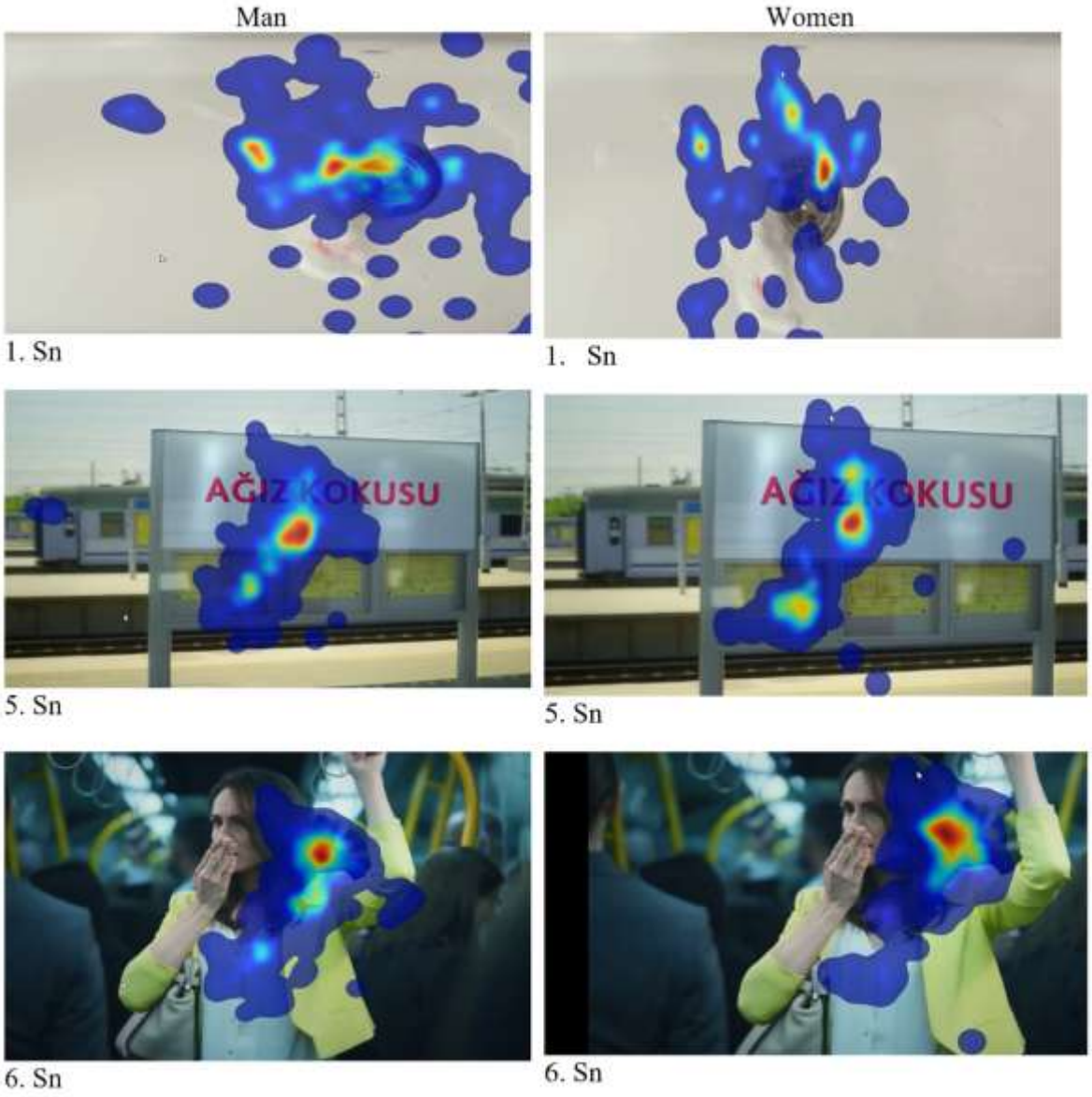
The empirical results indicate a lack of significant gender variance in Total Fixation Duration [TFD] for the threat sequence; both cohorts exhibited prolonged visual dwell times on the tooth loss imagery. This suggests that the biological salience of physical "mutilation" or loss functions as a universal attentional anchor, bypassing gender-conditioned decorative processing.

However, a critical divergence emerges in the Gaze Dispersion metrics. Male participants exhibited a "foveal lock", a highly concentrated and collective fixation pattern directly on the source of the threat. In contrast, female participants displayed a more "diffuse" scanning strategy. While their total time spent on the scene was comparable to males, their scanpaths were non-collective, frequently alternating between the threat and peripheral contextual elements.

This suggests that while the intensity of attention is consistent across genders, the quality of that attention differs: men engage in "foveal vigilance" [exclusive focus on the danger], whereas women maintain environmental surveillance [incorporating the surrounding scene while processing the threat]. This distinction is vital for advertisers, implying that

peripheral branding elements may be more effectively processed by female audiences during high-fear sequences, whereas male audiences may require branding to be placed in direct proximity to the focal point of the threat.

Figure 2. Bloody Saliva and Bad Breath Scene with Heat Map Created by the Pause Duration of Paradontax Ultra Cleaning Advertisement



During the critical "bloody spitting" sequence [seconds 5–6], which illustrates the consequences of oral neglect, eye-tracking data revealed a high degree of spatial overlap in initial Attentional Capture. Both cohorts prioritized the visceral fear stimulus, suggesting that biologically significant or "disgust-inducing" imagery functions as a universal attentional anchor regardless of gender.

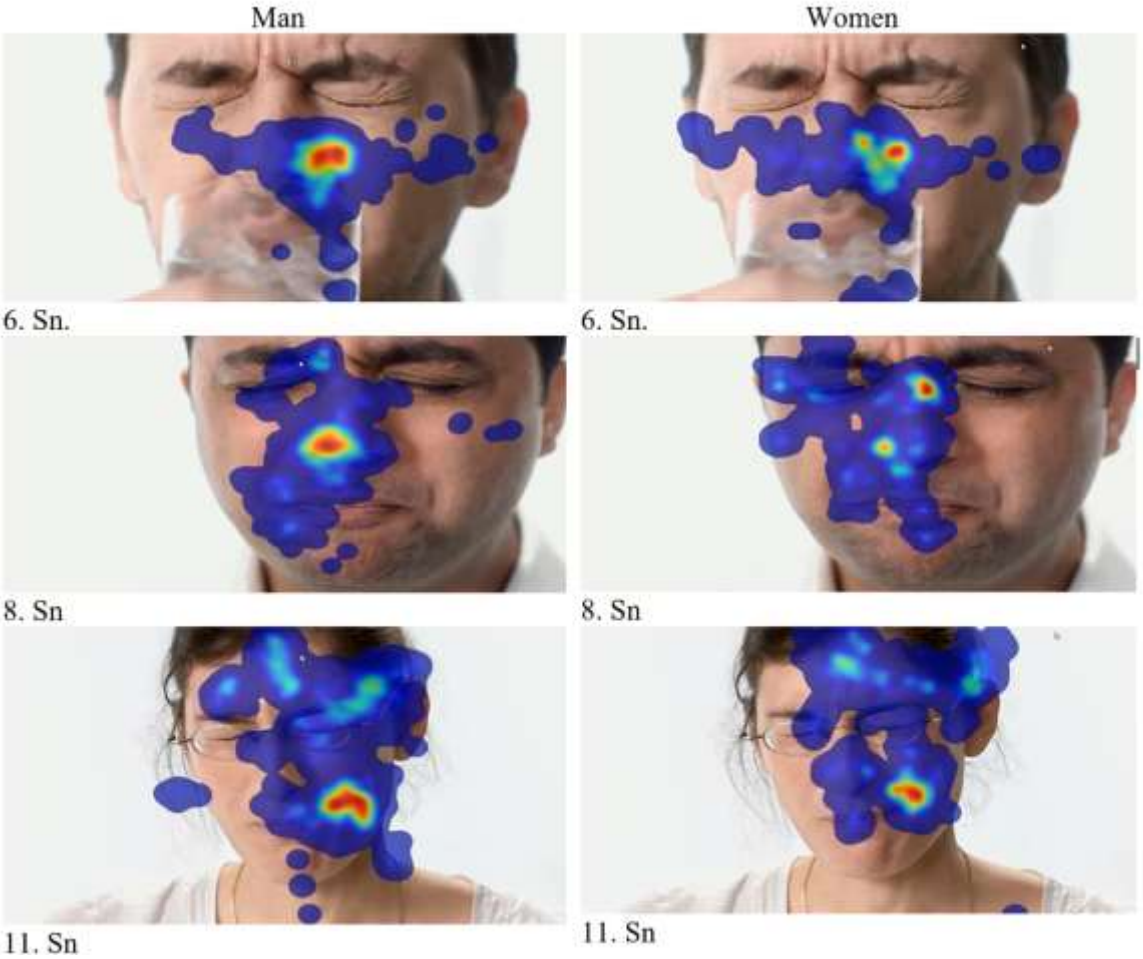
However, a critical divergence in Gaze Dispersion was identified. Male participants exhibited a significantly more concentrated eye-tracking pattern, characterized by a *foveal lock* on the central threat. This *tunnel vision* suggests that for males, high-arousal fear stimuli trigger a narrow, high-intensity focus. In contrast, female participants displayed a significantly higher Gaze Dispersion Index. While their gaze remained centered on the fear element, their scanpaths integrated a wider array of contextual and peripheral details within the scene.

These findings suggest a fundamental gender-based difference in threat processing:

1. Males adopt a Vigilance Strategy, prioritizing the immediate source of danger with exclusive focus.
2. Females employ an Integrative Processing Strategy, maintaining high attention on the threat while simultaneously scanning the environment to encode the broader narrative or brand context.

This distinction provides empirical evidence for neuro-segmentation, implying that peripheral branding may be more effective for female audiences during high-fear sequences, whereas male audiences require branding to be placed in direct proximity to the focal threat to ensure encoding.

Figure 3. Sensodyne Quick Relief and Quick Solution to Sensivity Pain Scenes of Glare Scenes with Heat Map Generated by the Duration of the Stopping Time of the Advertisement

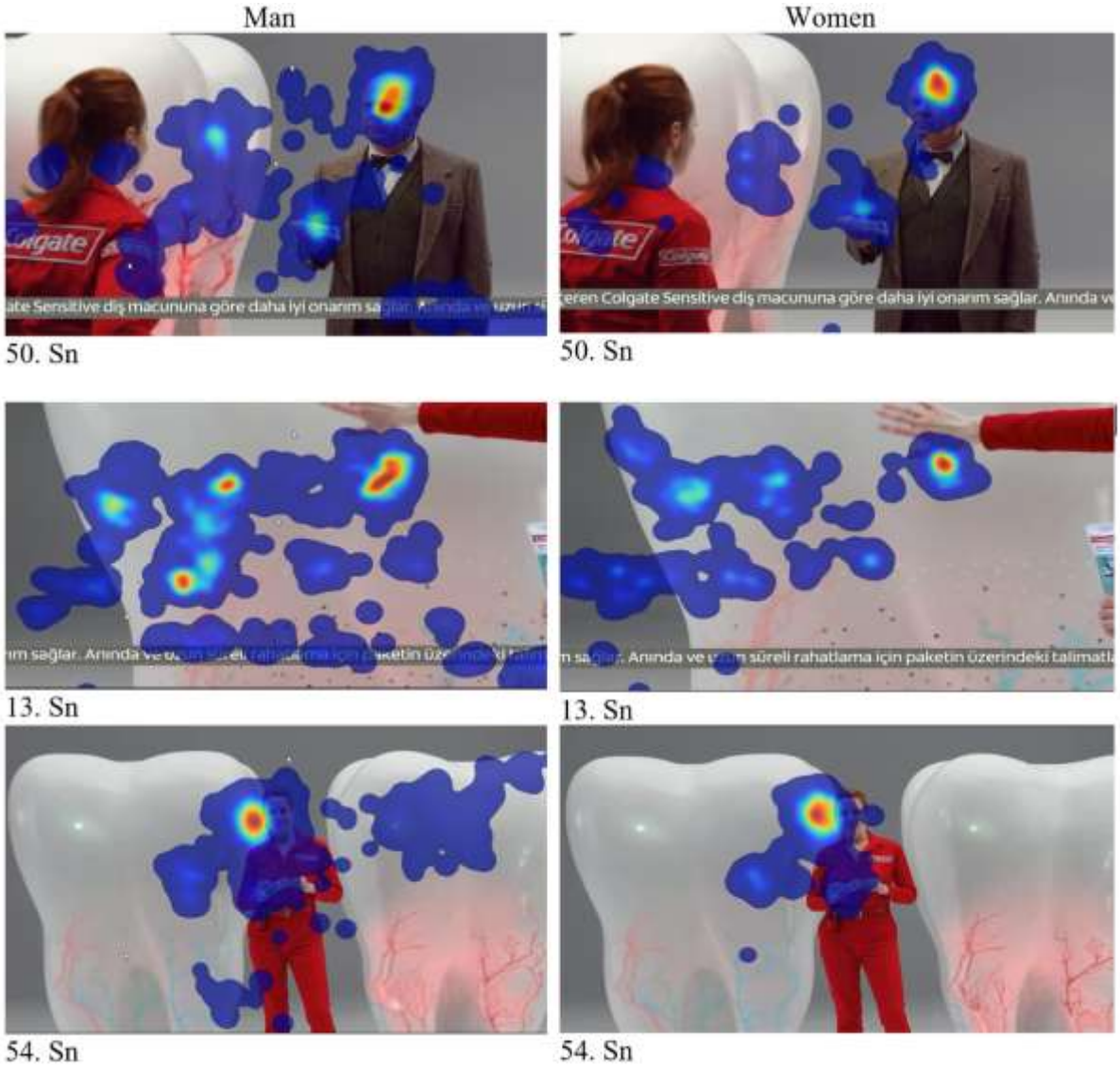


Analysis of the tooth sensitivity sequence [seconds 6, 8, and 11] reveals that both genders prioritized the actor's facial expressions as the primary AOI. This confirms that the pain face, a non-verbal fear stimulus, functions as a high-salience social cue that anchors visual attention.

However, distinct gender-based scanning strategies emerged. Male participants exhibited higher Fixation Intensity, with gaze points tightly clustered on the source of discomfort (the mouth and eyes), suggesting a narrow, vigilance-driven focus. Conversely, female participants demonstrated a significantly higher Gaze Dispersion Index; while they acknowledged the facial expression, their eye movements were distributed across the broader scene.

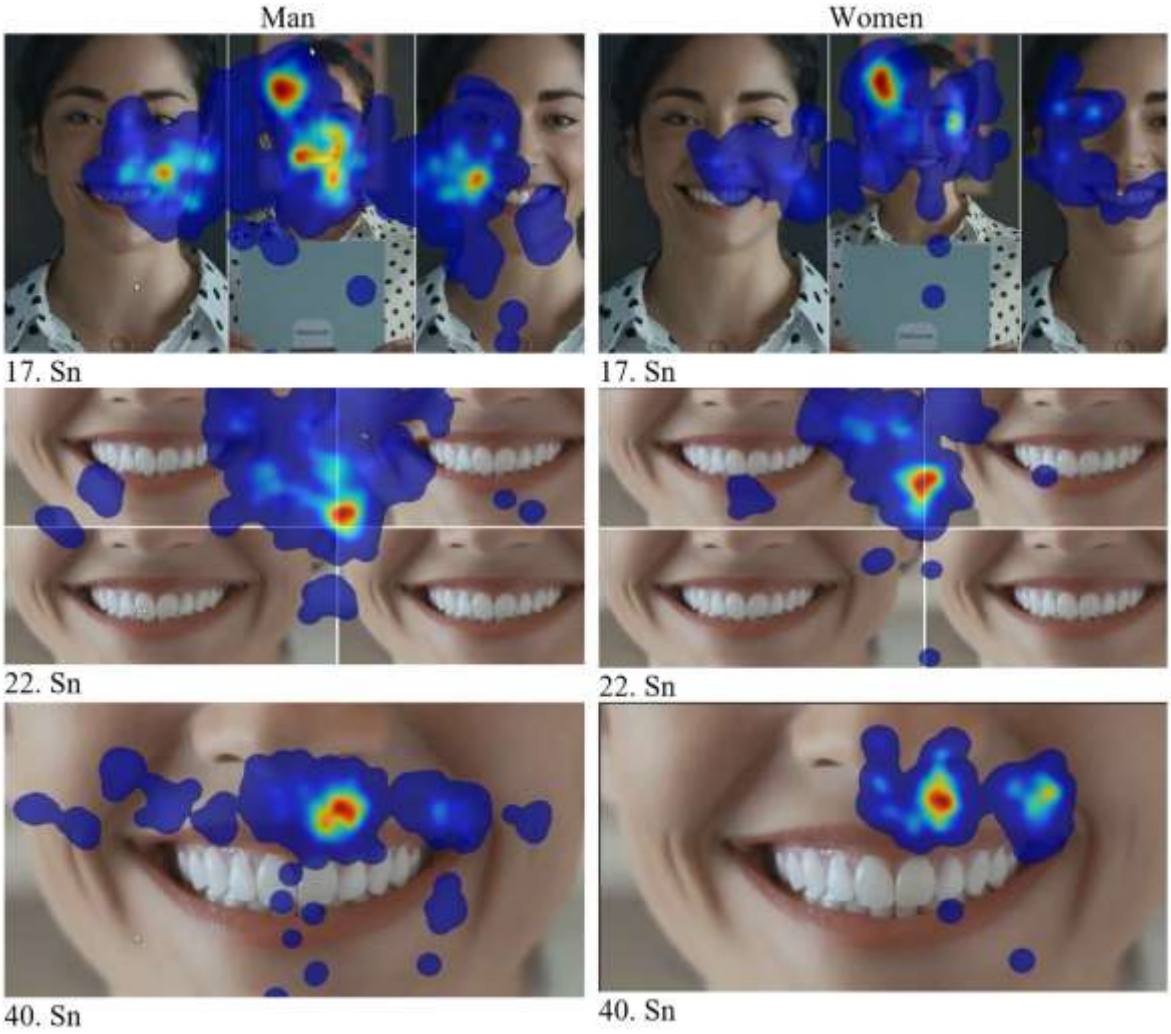
These metrics indicate that while the subject of attention is universal, the breadth of attention is gender-dependent. For males, the fear element acts as a visual *black hole*, excluding peripheral information. For females, the fear element is integrated into a wider contextual scan. These findings suggest that gender is a critical mediator in how "frightening" an advertisement is perceived and how deeply its narrative elements are processed.

Figure 4. Colgate Sensitivity Pro Solution Scenes of Dental Experts and Painful Tooth Model Scenes with Heat Map Created by the Duration of the Advertisement



When the eye-tracking data used to measure the attention of the participants during the scenes of tooth sensitivity in the advertisement [10th, 13th and 24th seconds] are analysed in terms of gender differences, it is seen that there are differences in attention levels, but both female and male participants focus on similar areas in scenes involving fear. As in other adverts, it is also seen in this advertisement that women have a wider attention span compared to men.

Figure 5. Signal Whaite Now Laughing and White Teeth Scenes with the Heat Map Created by the Duration of the Advertisement



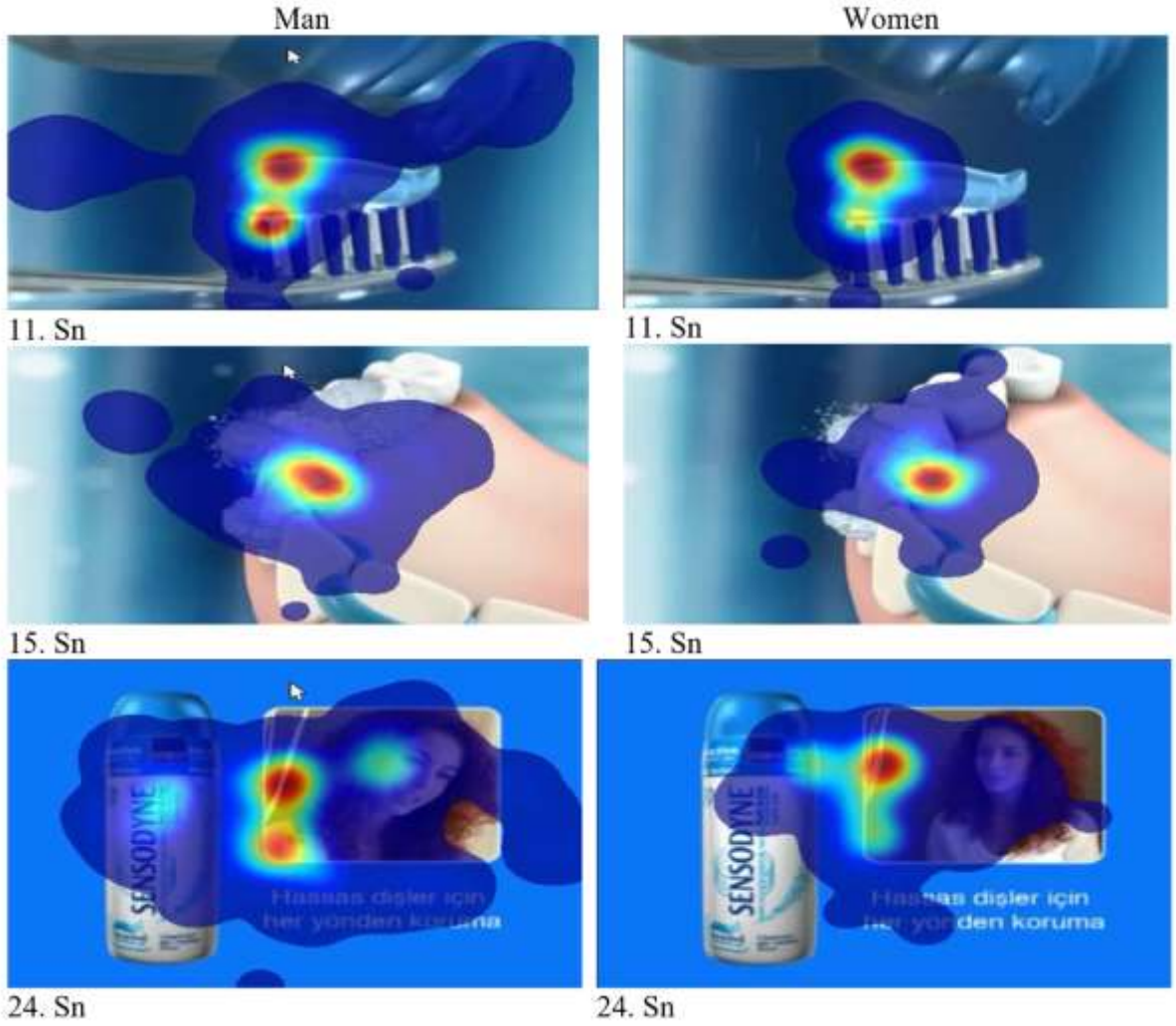
Analysis of the tooth sensitivity sequences [seconds 10, 13, and 24] reinforces a consistent pattern of AOI prioritization. Both cohorts exhibited high Fixation Counts on the facial indicators of pain, confirming that the *distress signal* acts as the primary visual anchor in threat-based narratives.

Despite this shared focus, a critical divergence in Attentional Breadth was observed. Male participants demonstrated a highly concentrated gaze pattern, a phenomenon known in cognitive psychology as *Attentional Narrowing* or *tunnel vision* triggered by high-arousal stimuli. In contrast, female participants maintained a significantly wider Gaze Dispersion Index. While they remained engaged with the fear-inducing elements, their eye movements successfully integrated peripheral details, indicating a more holistic scanning strategy.

These results suggest that gender serves as a key mediator in the scope of visual processing during fear appeals. For males, the fear stimulus creates a bottleneck that excludes secondary information, whereas for females, the fear appeal is processed alongside a broader environmental context. This finding suggests that advertisers targeting women may

successfully place secondary brand information in the periphery, while strategies targeting men should keep essential messaging central to the primary threat.

Figure 6. Sensodyne Iso Active Toothpaste Scenes with the Heat Map Created by the Duration of the Ad Stopping

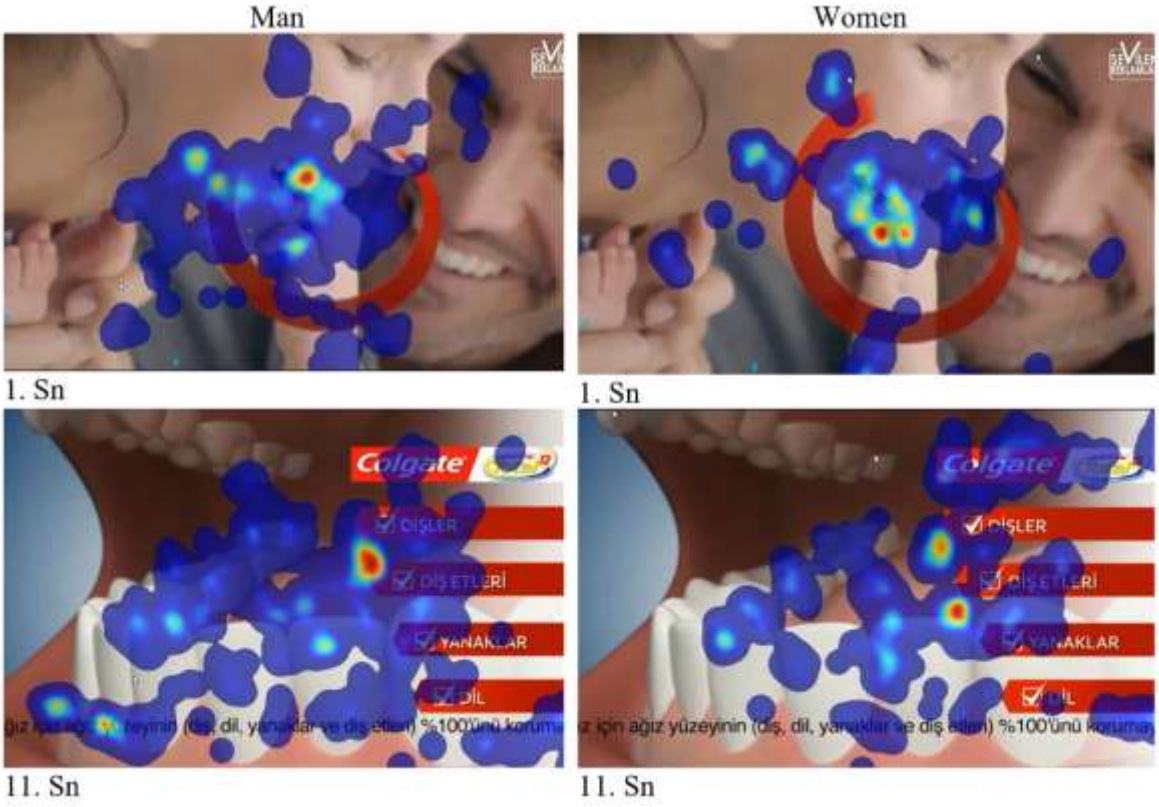


This stage of the research establishes a baseline by analyzing viewer interaction with "positive" or neutral informative segments [seconds 11, 15, and 24]. Utilizing neuroscientific metrics to decode these reactions is critical for identifying which creative elements sustain engagement across different demographic cohorts.

The empirical results reveal a significant reversal in Gaze Dispersion compared to fear-based sequences. While both genders identified the core product (toothpaste) as the primary AOI, male participants exhibited a significantly more scattered and non-collective fixation pattern. In contrast, female participants maintained a more structured and cohesive focus.

This finding suggests that in the absence of a high-arousal threat, the "attentional narrowing" typically seen in males dissipates, leading to decreased visual concentration. Conversely, women demonstrate more consistent attentional discipline regardless of the emotional valence of the advertisement. These results indicate that while fear appeals serve as a universal "visual anchor" for men, neutral or positive informative content requires more strategic placement to prevent attentional drift in male audiences.

Figure 7. Colgate Total Professional Active Effect Scenes of Kissing and Healthy Teeth Scenes with Heat Map Created by the Stopping Time of the Advertisement



Analysis of the informative sequences featuring healthy teeth reveals a shift in the hierarchy of visual attention. Unlike the high-arousal fear scenes, these segments elicited distinct gender-based patterns in fixation density and environmental scanning.

In the absence of a threat, male participants demonstrated a high Fixation Intensity specifically centered on the product-relevant AOIs [the mouth and teeth]. This suggests that for men, positive informative content acts as a narrow focal point. Conversely, female participants exhibited a significantly more diffuse scanpath, with eye movements distributed across the broader cinematic frame rather than being anchored to a single element.

These findings indicate that gender serves as a primary mediator of "remarkability." While fear appeals create a "universal anchor" for both genders, positive content allows for a wider divergence in cognitive prioritization. This suggests that in positive messaging, men require a singular, central focal point to sustain attention, whereas women are more likely to process the advertisement through an integrative, holistic lens.

GSR: Analysis of the Changes in the Electrical Properties of the Skin (Emotional States and Physiological Stimulation) Obtained from the Participants by Galvanic Skin Response Method

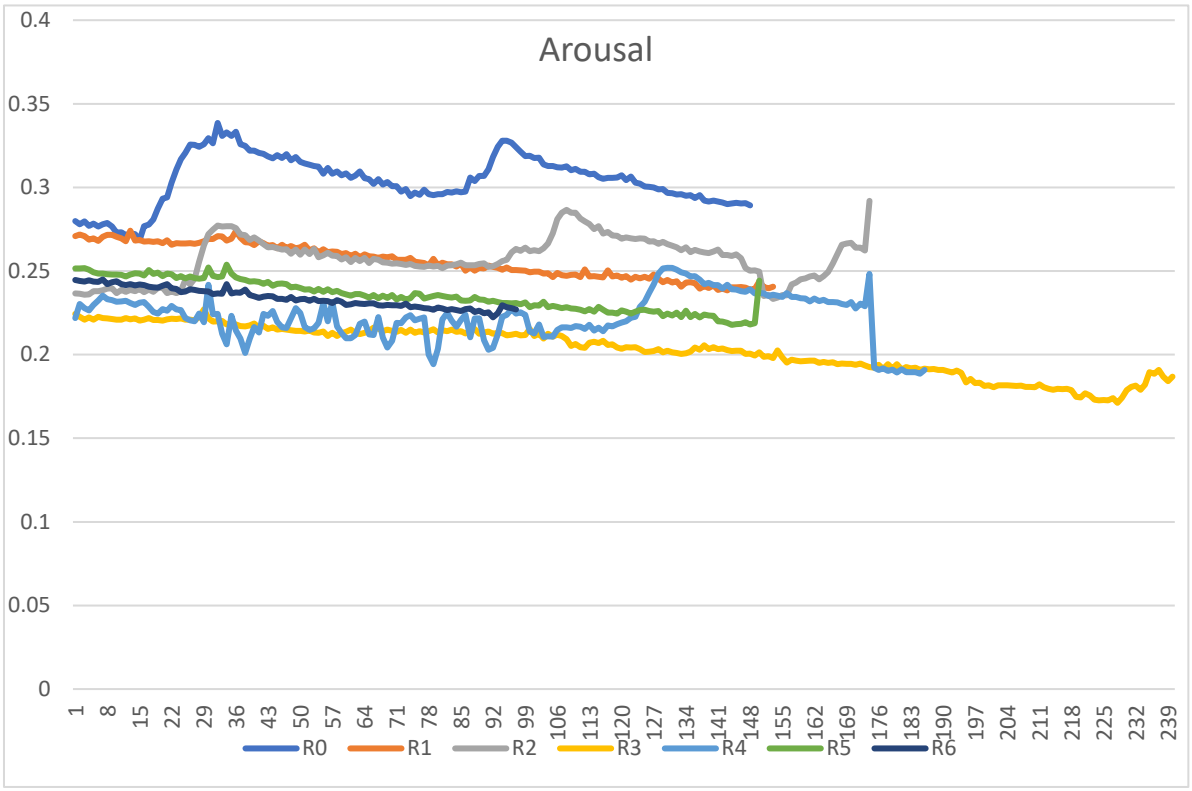
This section quantifies physiological arousal by measuring fluctuations in eccrine sweat gland activity [GSR]. These metrics identify the precise moments where fear appeals bypassed conscious appraisal to trigger an autonomic nervous system response.

The analysis revealed significant arousal spikes across the participant pool during high-intensity sequences. Due to high inter-subject baseline variability, the study focused on aggregate arousal trends rather than gender-stratified comparisons to ensure the findings reflect the universal biological efficacy of the stimuli. Key GSR Findings:

- Peak Arousal: Corresponded directly with visceral imagery [e.g., "bloody spitting"], validating these as high-arousal triggers.
- Arousal Decay: A marked decrease occurred during informative, low-threat segments, distinguishing neutral processing from emotional engagement.

Triangulating these GSR peaks with eye-tracking data provides a biological map of how "frightening" content converts visual attention into physiological stress.

Figure 8. Arousal Levels of Participants' Emotional States Measured by GSR Method in Seconds



Analysis of GSR Stimulation Levels of Television Advertising Films

This section analyzes how various visual and sensory stimuli influence participant attention and arousal levels across seven advertisements. By examining physiological fluctuations, the study identifies "arousal peaks" correlating with specific narrative triggers.

High-Arousal Fear Appeals

In advertisements utilizing fear-based elements, attention levels fluctuated significantly in response to threatening imagery:

- Parodontax Ultra Clean: A significant upward trend occurs at 3s, triggered by depictions of social discomfort and bad breath. A second peak at 17s coincides with the transition from dental problems to the clinical solution, reaching equilibrium by the advertisement’s conclusion.

- Parodontax Malkron Technology: Substantial spikes are observed at 3s [visceral imagery of bloody saliva] and 19s [explicit depiction of tooth loss]. These findings demonstrate that consequence-based fear serves as a powerful attentional anchor.
- Colgate Sensitivity Pro Solution: Increasing trends at 6s and 23s correlate with medicalized models of dental pain and expert intervention, followed by a stabilization of arousal as the expert provides a resolution.

Informative and Neutral Controls

In contrast, no significant upward trends were observed in Sensodyne Quick Relief [R3], Signal White Now [R1], Colgate Total [R5], or Sensodyne Iso Active [R4]. Throughout the duration of these commercials, attention levels remained stable. This indicates that informative content lacking high-arousal triggers fails to elicit the "autonomic spikes" characteristic of fear appeals.

The data confirms that stimuli such as bloody saliva, tooth loss, and physical pain significantly enhance attentional hold. While fear-free advertisements follow a linear physiological path, fear appeals utilize anxiety-inducing triggers to capture and maintain cognitive resources. Notably, while GSR measures arousal intensity, it does not distinguish between specific emotional valences [e.g., fear vs. disgust]. However, the correlation between these physiological spikes and high-arousal scenes confirms that these elements effectively command viewer focus. The results suggest that the "remarkability" of a commercial is intrinsically linked to its capacity to trigger physiological stimulation.

Limitations of the Study

This research was conducted within the framework of certain limitations. The research was limited to television adverts only. In terms of the methods applied, skin conductance and eye tracking methods, which are considered as neuroscientific methods, were used. The study was limited to 28 participants, 4 fearful adverts and 3 informative adverts. Participants were selected from individuals aged 20-35 years, university graduates and having an active business life.

Conclusion, Discussion and Implications

The shifting media landscape, characterized by the proliferation of online platforms, has not rendered television obsolete; rather, recent evidence suggests that television advertisements maintain a superior capacity to command attention and elicit emotional resonance compared to digital alternatives [39]. However, the traditional assumption of guaranteed viewability in

television is increasingly fallacious [2]. This study addresses the critical challenge of "attentional decay" by examining how high-arousal fear appeals as a biological tether, anchoring the viewer to the screen through involuntary neurophysiological mechanism. Our findings provide a nuanced counterpoint to existing literature. While Damião et al. [40] suggested that fear appeals decrease visual attention to human faces in favor of branding elements, our data reveals that the pain face, specifically in the context of dental sensitivity, serves as the primary visual anchor for both genders. This suggests that certain visceral expressions of distress possess a biological salience that overrides purely commercial elements. Furthermore, we identified a significant gender dimorphism in "Attentional Breadth." Male participants demonstrated "Attentional Narrowing" [tunnel vision], exhibiting high-intensity, collective fixations on threat-related stimuli. Conversely, female participants displayed more dispersed scanpaths, integrating the broader environmental context while maintaining engagement. This suggests that while both genders are "captured" by fear, men experience a foveal lock on the threat, whereas women engage in a more holistic surveillance of the scene.

The integration of Galvanic Skin Response [GSR] data reinforces the superiority of biometric measures over subjective self-reports. As noted by Pessiglione et al. [2008], the subconscious emotion often precedes and dictates the conscious feeling and subsequent behavior. Our results indicate that fear-based stimuli, such as bloody saliva and tooth loss, trigger significant autonomic spikes that are notably absent in informative, positive-valence advertisements. This physiological arousal confirms that the peripheral nervous system serves as a critical indicator of media impact [41].

The confirmation of Hypotheses H1 and H2 indicates that fear elements do not merely scare; they biologically force the involvement of deep brain structures, ensuring that the message is encoded amidst the noise of modern media consumption [42]. In a marketplace where channel-switching is effortless, these "neuro-shocks" appear necessary to secure the cognitive resources of the viewer.

The following table summarizes the quantitative results of the study, highlighting the neurophysiological impact of fear appeals.

Hypothesis	Analysis Focus	Status	Critical Finding
H1.a	GSR & Fear Appeal	Confirmed	Universal arousals increase across all participants during fear-inducing scenes.
H1.b	Subjective Fear vs. GSR	Confirmed	A significant arousal gap exists between participants who perceived fear and those who did not.
H1.c	Gender vs. GSR	Not Confirmed	No statistically significant difference in arousal intensity between men and women.
H2.a	Fixation Count [Gender]	Confirmed	Significant divergence in fixation frequency: Men [concentrated] vs. Women [dispersed].
H2.b	Fixation Count [Fear]	Confirmed	Higher fixation counts were recorded for participants who found the scenes frightening.
H2.c	Fixation Count [Attraction]	Confirmed	Significant correlation between perceived ad attractiveness and fixation density.

Based on the findings of the study, the following theoretical and managerial implications can be considered for future research directions:

- Gender-Specific Creative Calibration: Advertisers should adopt neuro-segmentation. For male-targeted campaigns, essential branding must be placed in the direct foveal path of the fear stimulus to avoid the vampire effect caused by tunnel vision. For female-targeted campaigns, branding can be positioned peripherally, as women maintain a higher Gaze Dispersion Index [43].

- Arousal-Based Media Planning: Traditional post-campaign surveys should be supplemented with biometric heatmaps. Since positive-valence content showed a baseline of attentional drift [particularly in males], purely informative ads should be reserved for high-loyalty audiences, whereas fear appeals should be utilized for breakthrough objectives.

All in all, this research suggests that the human eye does not merely look; it reacts to a biological hierarchy of threats that predates modern marketing. In an era where "skip" buttons and "infinite scrolls" dominate, the most valuable currency is no longer the consumer's conscious click, but their involuntary physiological response. As neuroscientific tools become more accessible, the industry must transition from asking consumers what they *think* to measuring what their bodies feel.

Supplementary Information

Author contributions

Study conception and design: B.T., N.Ö. Data curation, preprocessing and imaging review: B.T., N.Ö. Graph pipeline evaluation: N.Ö, B.T., T.Ç. Statistical analysis and interpretation of results: N.Ö, B.T., T.Ç. Manuscript drafting and critical revision: M.A.E., N.Ö, B.T., T.Ç, A.B. Final approval of the submitted version: All authors.

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Data availability

The data supporting the findings of this study are available in the master's thesis published in the Turkish Council of Higher Education (YÖK) National Thesis Center, accessible at https://tez.yok.gov.tr/UlusalTezMerkezi/. The raw data are not publicly available but may be obtained from the corresponding author upon reasonable request.

Decleration

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Gumushane University Rectorate. All methods were carried out in accordance with relevant guidelines and regulations and complied with the Declaration of Helsinki. Written informed consent was obtained from all participants before participation. All reflective narratives were anonymized before analysis, and no identifying information was reported.

Competing interests

The authors declare no competing interests.

Consent for publication

We confirm that we have read the Brain Informatics journal's position on ethical publication and affirm that this manuscript complies with those guidelines.

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Appendix [AB3]**1.** Advertisement Films Used in the Research Scare Ads and Links to be Considered[AB4]

K1-Parodontax Tooth Ultra Cleaning	Https://Www.Youtube.Com/Watch?V=tsBZM9ı2Cbg
K2-Parodontax Malkron Technology	https://www.youtube.com/watch?v=OE1BSrMldsM
K3-Colgate Sensitivity Pro Solution	https://www.youtube.com/watch?v=l9MLAnYLzs8
K4-Sensodyn Fast Relief	https://www.youtube.com/watch?v=lXraEsWWRJ0

Non-scary Adverts and Links	
B1- Signal White now	https://www.youtube.com/watch?v=pJnvXJxcRSM
B2- Colgate Total Profesyonel Aktive Effect	https://www.youtube.com/watch?v=4JIzDUuy0Qw
B3- Sesodyn Iso Active	Https://Www.Youtube.Com/Watch?V=H6uXAo0cMBW

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