Focusing Area on Advertising: An Eye Tracking Application

Araştırma Makalesi/Research Article

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Abstract— This study investigates the impact of eye-tracking technology in advertising, with a focus on gender-based analysis. Marketing strategies have evolved, adapting to technological advancements and shifting consumer behaviors. The current phase, Marketing 5.0, leverages technologies like artificial intelligence, augmented reality, and virtual reality to create data-driven and personalized marketing experiences. Human-computer interaction (HCI) has significantly benefited from these technological developments, particularly through the use of eye-tracking technology. This technology provides valuable insights into where individuals focus their attention on a target object or stimulus, revealing subconscious preferences and behaviors. The research presented in this article aims to determine the effectiveness of call-to-action elements in advertisements and whether there is a gender-based difference in attention to these elements. The study utilizes eye-tracking technology to measure viewer engagement with various components of an advertisement, including the human face, text, and call-to-action prompts. The findings suggest that there are indeed gender-based differences in how viewers interact with these elements, with males focusing more on call-to-action parts and females on the human face. The implications of this research are significant for advertisers and marketers, as understanding these differences can lead to more effective and targeted advertising strategies. By recognizing the distinct ways in which different genders process visual information, campaigns can be tailored to maximize impact and drive desired behavioral outcomes.

Keywords— eye-tracking, advertising, marketing strategies, consumer behavior, human-computer interaction

Reklamda Odaklanma Alanı: Bir Göz Takibi Uygulaması

Özet— Bu çalışma, reklamcılıkta göz izleme teknolojisinin etkisini, özellikle cinsiyete dayalı analiz üzerine odaklanarak araştırmaktadır. Pazarlama stratejileri gelişmiş, teknolojik ilerlemelere ve tüketici davranışlarındaki değişikliklere uyum sağlamıştır. Güncel aşama olan Pazarlama 5.0, yapay zeka, artırılmış gerçeklik ve sanal gerçeklik gibi teknolojileri kullanarak veriye dayalı ve kişiselleştirilmiş pazarlama deneyimleri yaratmaktadır. İnsan-bilgisayar etkileşimi (HCI), bu teknolojik gelişmelerden, özellikle göz izleme teknolojisinin kullanımı yoluyla önemli ölçüde yararlanmıştır. Bu teknoloji, bireylerin bir hedef nesne veya uyaran üzerinde dikkatlerini nereye odakladıklarına dair değerli içgörüler sağlayarak, bilinçaltı tercihleri ve davranışları ortaya çıkarmaktadır. Bu makalede sunulan araştırma, reklamlardaki çağrı-eylem öğelerinin etkinliğini ve bu öğelere yönelik dikkatte cinsiyete dayalı bir fark olup olmadığını belirlemeyi amaçlamaktadır. Çalışma, göz izleme teknolojisini kullanarak, bir reklamdaki çeşitli bileşenlerle, insan yüzü, metin ve çağrı-eylem yönlendirmeleri dahil, izleyicinin etkileşimini ölçmektedir. Bulgular, izleyicilerin bu öğelerle etkileşiminde gerçekten cinsiyete dayalı farklılıklar olduğunu göstermektedir; erkekler çağrı-eylem kısımlarına daha fazla odaklanırken, kadınlar insan yüzüne daha fazla odaklanmaktadır. Bu araştırmanın sonuçları, reklamcılar ve pazarlamacılar için önemlidir, çünkü bu farklılıkları anlamak, daha etkili ve hedefe yönelik reklam stratejileri geliştirilmesini sağlayabilecektir. Farklı cinsiyetlerin görsel bilgiyi nasıl işlediğine dair farklı yolları tanıyarak, kampanyalar etkiyi maksimize etmek ve arzu edilen davranışsal sonuçları sürmek için özelleştirilebilir.

Anahtar Kelimeler— göz takibi, reklamcılık, pazarlama stratejileri, tüketici davranışı, insan-bilgisayar etkileşimi

1. INTRODUCTION

Marketing is defined as *"the science and art of exploring, creating, and delivering value to satisfy the needs of a target market at a profit. Marketing identifies unfulfilled needs and desires. It defines, measures, and quantifies the size of the identified market and the profit potential. It pinpoints which segments the company is capable of serving best and it designs and promotes the appropriate products and services."* [1]. Social marketing, unlike traditional marketing which prioritizes the target audience and profit, argues that marketing cannot be conducted solely with financial gain in mind [2]. Although they differ in their focus on profit, social marketing utilizes traditional marketing strategies to achieve social benefits. Campaigns aimed at eliminating or reducing undesirable behavior and promoting the maintenance of desired behavior are the behavioral outcomes sought in social marketing efforts [3], [4]. For marketing to contribute to the sustainability of organizations, it must adapt to current conditions. Accordingly, marketing has been divided into five key phases over time based on its focus. The phase where the main focus was on selling products is Marketing 1.0 [5]; Marketing 2.0 prioritized customer satisfaction [5]; Marketing 3.0 focused on the emotional needs and demands of customers [6]; Marketing 4.0 involved using technology to ensure customer satisfaction [7] and Marketing 5.0 is classified as the phase where the focus is on technology for humanity [8].

Marketing 5.0, with its technologies such as artificial intelligence, augmented reality, and virtual reality, enables data-driven, predictive, and agile marketing [8]. With the Marketing 5.0 approach, consumers are addressed through more individualized and experiential efforts.

With the development of technology, the field of human-computer interaction has also experienced a significant change. HCI is an interdisciplinary field that focuses on the interaction between computers and users, while also focusing on interface design to improve this interaction [9]. Studies in this field focus on improving user experience and developing more effective systems. In this context, eye tracking technology is seen as a powerful tool in the field of HCI as it provides data on where the individual focuses on the target object or stimulus and reveals various information about the points paid attention to in this process [10]. Thanks to eye movement data, it is possible to obtain information about which points the individual ignores and what disturbs him. By examining eye movements, it is possible to understand the processes taking place in the mind. In other words, eye movement is the most basic indicator of determining the target of visual attention in the element with which a person interacts [11]. Eye tracking method is used in a wide variety of fields such as psychology, medical diagnosis, graphic design, marketing, and usability.

The use of eye tracking in advertising is an increasing trend to measure the effectiveness of advertisements and ensure the creation of targeted advertisements. Various subconscious factors play a significant role in individuals' preferences. While traditional research methods are insufficient in uncovering the true thoughts lying in the subconscious, neuromarketing methods come into play at this point [12]. Thanks to research conducted with neuromarketing methods, it is possible to predict whether a product that has not yet entered the market will be successful or not, and thus significant expenses can be prevented. Additionally, advertisements, TV series, and movies can be measured using neuromarketing methods before they are broadcast, and it can be determined whether they will achieve their goals. Nonprofit organizations also run ads to attract donors and call for volunteers based on their needs. These advertisements must reach the target audience, and it is expected to provide maximum benefit if a part of the budget that should be used in line with the goals of the institution is spent on advertising. Nonprofit organizations' ads should include call-to-action elements supported by text and images that include information about the donation process, such as phone numbers, bank accounts, and websites. Potential donors need to pay attention to the areas where these items are located so that they understand how to donate and ensure that the ad achieves its purpose [13].

The study aims to determine whether donors pay attention to the channels that prompt them to take action. In this context, the research questions of the study have been determined as follows:

Research Question 1 (RQ1): Do the call to action elements in the advertisement of the non-governmental organization attract attention?

Research Question 2 (RQ2): Does the salience of the call to action element in a non-governmental organization's advertisement differ according to gender?

In this study, the potential of eye tracking technology to measure and increase the effectiveness of advertisements and whether there is a gender-based difference in the view of call to action elements will be examined.

2. PREVIOUS WORK EXAMINING ADVERTISING BY NONPROFIT ORGANIZATIONS

Attitude towards advertising is related to the individual's thoughts about advertising. For this reason, the more positive the attitude towards the advertisement, the more positive the result. There is a relationship between attitude towards advertising and behavioral intentions. If an advertisement creates emotional arousal in an individual, it is thought to stimulate the individual behaviorally [14], [15]. When the content of the advertisement is compatible with the expectations of the target audience, the message will reach the recipient and the individual will be

persuaded to the desired behavior [16]. For this reason, advertisements that appeal to charity must be persuasive for individuals seeking altruistic motivation to donate. In addition, an advertising strategy should be created taking into account the individual differences of donors and it should be ensured that as many people as possible are reached [17].

Attitudes towards non-profit organizations are based on whether individuals' donations benefit society. For this reason, individuals want to see where their donations are spent and for what purpose they are used [18].

The eye tracking method was used in the study, whose aim was to determine whether the individual's willingness to donate was affected by emotional appeal, advertising, helping others, and attitudes towards charities. Three areas of interest were identified: logo, face, and text. Results showed a positive relationship between the emotion evoked by an ad and the participant's interaction with that ad, depending on selected interests and attitudes toward the ad. In addition, significant relationships were obtained between attitudes toward advertising and identified interests and willingness to donate. When looked at from the field of interest, it was seen that the text in the image created the most meaningful relationship, and the text was followed by the face and logo, respectively [19].

Studies show that prior brand usage affects attention and recall, where non-users or light users recall ads better when visually engaged, highlighting the importance of designing ads that attract these groups [20]. Eye-tracking metrics such as fixations, saccades, and pupil size effectively gauge emotional arousal and cognitive load, with machine learning enhancing these assessments. A comprehensive review underscores how these visual attention metrics relate to emotional and cognitive processes [21].

In advertising effectiveness research, eye-tracking studies reveal consumer attention patterns and their impact on cognitive, affective, and behavioral responses, suggesting significant potential for mobile and VR applications [22]. A model examining gaze in decision-making shows that gaze allocation influences choices by weighing different attributes, indicating complex choice dynamics through eye movements [23]. Additionally, a framework categorizing eye movements into search and choice tasks provides insight into how these patterns support complex decision-making [24]. Collectively, these findings present a strong case for the application of eye-tracking in understanding consumer behavior and refining targeted advertising, with particular promise for real-world contexts and advanced technological integration.

It is frequently seen in the literature that emotional appeal elements are effective persuasive elements [25]. However, no consensus has been reached regarding the direction and impact of emotional images. In the study conducted on donations, it was found that strong and negative emotions triggered the feeling of empathy and aroused the individual's desire to help [26]. Similarly, in the study conducted by Burt and Strongman, it was observed that negative images of children encouraged donation [27]. On the other hand, advertisements containing high levels of positive emotional elements have also been shown to encourage individuals to donate [28]. Sharma et al. performed eye-tracking measurements on unknown nonprofits to avoid bias due to nonprofit recognition. Images of children with sad, happy and neutral facial expressions were used in the research. Logos associated with sad faces were found to be fixed faster, more frequently, and for longer periods of time than logos associated with neutral or happy faces [29]. In the study investigating the effect of advertising content on the donation decision, text, face and logo were determined as areas of interest. The findings showed that the longer they focused on the face in the advertisement, the more likely they were to donate [30].

In the study where eye tracking and electroencephalogram methods were used together, it was concluded that negative images attract more attention than text and logos. In addition, there was no difference between genders in terms of interest in advertising images [31]. In the study where the difference in focus between visual and verbal elements in advertising was examined using the eye tracking method, it was observed that the average focusing time on the visual element was higher than the focusing time on the verbal element [32]. In another study conducted on visual and verbal elements, it was determined that the focus did not alternate between visual and verbal elements. After focusing on a visual element, 78% of the time the other element focused on was the visual element; Similarly, after focusing on the verbal element, it was observed that 77% focused on the verbal element [33].

5 social aid posters of the Türk Kızılay containing aid and donation contents were examined by eye tracking method. Poster content includes text, human faces and call to action elements. In the study, in which 15 women and 15 men participated, there was a focus on text and human face, but no focus on call to action elements and logo. Additionally, no differences were found between genders in the results [34].

In order to determine the visual and message effect of social marketing themed visuals, current visuals published by the United Nations and its affiliated organizations were selected and these visuals included "science", "education", "energy saving", "safe food consumption", "climate crisis", "women" and violence against girls", "cancer", "fighting against hate", "social media sharing" and "no tobacco" concepts were determined as the main topics. 9 out of 10 posters contain the logo, four of which attract no attention and the others have low attention. In all posters, the texts attracted medium and high levels of attention, while the visual elements attracted medium and low levels of attention [35].

In order to increase the effectiveness of public service announcements, 48 volunteer subjects participated in the

study in which 10 advertisements were used together with EEG and eye tracking methods. When examined through packshot, attention to the logo is low in all advertisements containing the logo. In terms of text, it is seen that the focus is on the name of the institution, but there is no focus on texts containing slogans. When examined through call to action elements, it was seen that it attracted attention if it was under the name of the institution [36].

3. METHODOLOGY

3.1. Data Collection

A total of 38 participants, consisting of university students and scholars, 55.3% male and 44.7% female, voluntarily participated in the research. Their eye movements were recorded in a controlled environment while they watched the advertisement. Data collection from all participants was carried out within one week.

3.2. Procedure

During the session, participants were notified that their eye movements would be tracked while they observed the advertisement. Consent was secured from each participant prior to the session. The advertisement was displayed on a flat-screen monitor configured with a resolution of 1920x1080 pixels and a refresh rate of 100Hz. This setup was managed by a PC equipped with Windows 10 OS and iMotions software [37]. The EyeTribe desk-mounted eye tracker, which boasts a 20 ms response rate and is operated by iMotions software, was utilized to record the eye movements of participants. They were positioned at an approximate distance of 60 cm from the screen. The eye tracker underwent a standard nine-point calibration to ensure accuracy. Following the calibration, the eye-tracking software determined the coordinates of the user's eye gaze with an average precision of about 0.5º to 1º of visual angle. This level of accuracy translates to an on-screen average deviation of 0.5 to 1 cm at roughly 60 cm from the screen/tracker. After the calibration was successfully completed, participants proceeded to watch the advertisement.

3.3. Results

Eye-tracking data for each participant was recorded as x and y coordinates on the screen, while they watched the advertisement. Since we were particularly interested in the call-to-action part located at the end of the addendum, only the eye-tracking data from this part was used in the analysis. This part takes approximately 5500 milliseconds. A screenshot of this scene is shown in Figure 1.

Figure 1 A screenshot from the call to action part of the video

The human face, hashtag, logo, title, phone number, web address, and finally the call-to-action part (consisting of title, phone number, and web address) were determined as area of interest (AOI) for analysis. Those AOIs are highlighted via rectangles in Figure 2.

Figure 2 Area of Interests

For this scene, which is shown in the last 5500ms of the advertisement, the total duration of all users looking at those AOIs was summed in milliseconds and used in the analysis.

The non-parametric Mann-Whitney U test was performed to compare the total gaze durations between the male and female participants. The non-parametric Mann-Whitney U test is used to determine if there is a significant difference between two independent groups when the data does not meet the assumptions of normality required for a t-test. It evaluates whether one group tends to have higher or lower values than the other, making it useful for comparing distributions that might have similar shapes but different central locations. There was a significant difference in the average total gaze duration to the call-to-action part between male and female participants, $z=-2.305$, $p<0.05$. Male participants looked at the call-to-action part significantly longer than females. There was a significant difference in the average total gaze duration to the face of the girl between male and female participants, $z=-2.235$, $p<0.05$. Female participants looked at the face significantly longer than males. Analysis results for all AOIs are reported in Table 1. These results show that males and females concentrate on different points in the final part of the advertisement; males focus on the call-to-action part, while women focus on the human face.

Table 1 Female-Male AOI Gaze Duration Comparisons

	Z	Asymp. Sig. (2-tailed)
Title	-1.865	.062
Phone	-1.453	.146
URL	-.470	.638
Logo	-.309	.757
Hashtag	-.474	.636
Face	-2.235	.025
Call to Action	-2.305	.021

The Wilcoxon Signed Ranks Test was conducted solely with female participants to explore potential differences in gaze durations across various elements of the advertisement. The Wilcoxon Signed Ranks Test is a non-parametric test used to compare two related samples or paired observations to determine whether their population mean ranks differ. It's often applied as an alternative to the paired t-test when the data does not meet the assumption of normality. This makes it useful for evaluating changes due to treatments or conditions in the same subjects over time, without assuming a specific data distribution.

The results unveiled statistically significant variations in gaze duration for different elements. Specifically, for the "Face - Title," "Face - Phone," "Face - URL," "Face - Logo," and "Face - Hashtag" elements, negative Z-values (-3.337, -2.533, -3.077, -3.006, -3.516) were observed, indicating that female participants tended to allocate longer gaze durations to the face than the other elements on the screen. Additionally, associated p-values of .001, .011, .002, .003, and .000, respectively, underscore the statistical significance of these differences.

However, for the "Face - Call to Action" and "Phone - URL" elements, the Z-values were not statistically significant (-.213 and -.639, respectively), suggesting that gaze durations did not significantly differ among female participants in these instances. Correspondingly, the associated p-values of .831 and .523 further validate the lack of statistical significance. Test results are summarized in Table 2.

Table 2 Wilcoxon Signed Ranks Test for Female Participants based on negative ranks. Only face – Call to Action comparison is based on positive ranks.

	Z	Asymp. Sig. (2-tailed)
Face - Title	-3.337	.001
Face - Phone	-2.533	.011
Face - URL	-3.077	.002
Face - Logo	-3.006	.003
Face - Hashtag	-3.516	.000
Face – Call to Action	-0.213	.831
Phone - URL	-0.639	.523

Overall, the outcomes of this test highlight significant variations in gaze behavior towards distinct elements of the advertisement among female participants, offering valuable insights into their attentional engagement patterns.

A similar analysis is also done for male participants. The analysis of the test results using the Wilcoxon Signed Ranks Test reveals significant differences in four comparisons: Face - Hashtag (Z = -3.432, p = 0.001), Face – Call to Action (Z = -3.458, p = 0.001), and Phone - URL (Z = -2.242, p = 0.025). The comparison for Face - URL (Z = -1.860, p = 0.063) is significant at 0.10. These low p-values indicate that there are statistically significant differences in these areas. In contrast, the comparisons for Face - Title (Z = -0.224, p = 0.823), Face - Phone (Z = -0.434, p = 0.664), and Face - Logo (Z = -1.195, p = 0.232) show no significant differences, as their p-values are greater than the 0.05. Therefore, the significant differences observed in Face - Hashtag, Face – Call to Action, Phone – URL, and Face - URL suggest meaningful impacts in these areas, while the other comparisons do not provide substantial evidence of a difference. The test results revealed that male participants looked at the face longer than the hashtag, the call to action longer than the face, and the phone number longer than the URL. Test results for mele participants are summarized in Table 3.

Table 3 Wilcoxon Signed Ranks Test for Male Participants based on negative ranks. Only face – Call to Action comparison is based on positive ranks.

	Z	Asymp. Sig. (2-tailed)
Face - Title	-0.224	.823
Face - Phone	-0.434	.664
Face - URL	-1.86	.063
Face - Logo	-1.195	.232
Face - Hashtag	-3.432	.001
Face – Call to Action	-3.458	.001
Phone - URL	-2.242	.025

4. CONCLUSION

The findings of this study provide valuable insights into the effectiveness of advertisements by nonprofit organizations, particularly in relation to the call-to-action elements. Utilizing eye-tracking technology, the research revealed significant differences in how male and female participants engage with various elements of an advertisement. Specifically, males tended to focus more on the call-to-action elements, while females were more attentive to human faces.

The analysis provides a comprehensive understanding of gaze behaviors among male and female participants in

response to the final 5500ms of an advertisement. Using the non-parametric Mann-Whitney U test, significant gender differences were identified, with males focusing more on the call-to-action and females concentrating more on the face of the girl in the advertisement. This indicates distinct attentional patterns based on gender, which could be leveraged to tailor advertisements more effectively to different audiences.

Further examination using the Wilcoxon Signed Ranks Test revealed nuanced insights into the attentional focus within each gender group. Female participants demonstrated a significant preference for the face over other elements, including the title, phone, URL, logo, and hashtag, highlighting the importance of human elements in capturing female viewers' attention. However, no significant difference was found for the call-to-action and phone-URL elements among females.

Similarly, male participants showed significant differences in gaze duration for the face compared to the hashtag, the call-to-action compared to the face, and the phone number compared to the URL, indicating specific elements that resonate more with male viewers.

These differences suggest that gender-specific strategies may enhance the impact of advertisements. For instance, incorporating more emotionally resonant images may better capture the attention of female viewers, while ensuring that call-to-action elements are prominently featured and engaging could be more effective for male audiences.

The results also underscore the importance of employing advanced technologies, such as eye-tracking, in marketing research. This approach enables a deeper understanding of consumer behavior, which can inform the design of more effective advertisements. Furthermore, the study highlights the potential of integrating neuromarketing methods to uncover subconscious preferences and improve the predictive success of marketing campaigns.

In conclusion, this research emphasizes the need for tailored marketing strategies that consider gender-based differences in visual attention. By leveraging eye-tracking technology, marketers can create more engaging and effective advertisements that not only capture attention but also drive desired actions, thereby maximizing the impact of their campaigns.

This research has limitations due to the small sample size, which may affect the generalizability of the findings. Additionally, the study focuses on a specific aspect of advertising and may not account for other factors that influence consumer behavior and engagement. It's important for future research to address these limitations by including a larger and more diverse sample size and considering a broader range of factors that may impact the effectiveness of advertising elements.

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