Can Automobile Brands Optimize their Print Advertisements through Eye-Tracking Analysis?

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Abstract:

Introduction: Eye tracking technology has become an essential tool for assessing the effectiveness of visual marketing strategies across various industries. By capturing eye movements, gaze points, and timing variations, it enables researchers to explore how people interact with visual stimuli like images and text. This technology offers valuable insights into which elements of an advertisement or visual content draw the most attention and the order in which they are observed.

Objectives: The purpose of this research is to explore the use of eye tracking in print advertisements and identify the most appealing images and designs for attracting consumers.

Methods :This qualitative exploratory study involved twenty participants who viewed six print advertisements for four-wheeler vehicles. Data was collected using Tobii eye-tracking technology, generating heat maps and gaze plots to analyse the impact of these advertisements on consumer behaviour.

Results :The findings revealed that viewers often overlook body copy in favour of the main image, advertisement headline, and celebrity endorsements. Most participants, especially men, preferred product specifications. Advertisements that achieved top-of-mind recall successfully utilized eye-catching visuals to break sensory adaptation.

This data can identify patterns in visual engagement and inform strategic marketing plans, enhancing the effectiveness of print advertisements. The implications are significant for automotive marketers, who may need to reconsider the style and format of their ads to capture consumer attention. By understanding how consumers interact with advertisements, marketers can create more engaging campaigns, ultimately leading to increased sales. As India emerges as a key player in the global automobile sector, these insights will be valuable for improving the return on investment in advertising.

Conclusion: The findings indicate that viewers frequently bypass body copy in favor of the main image, advertisement headline, and celebrity endorsements. Notably, many participants, particularly men, showed a preference for product specifications. Advertisements that effectively captured attention through striking visuals were more successful in overcoming sensory adaptation and achieving top-of-mind recall. These insights into visual engagement patterns can guide the development of strategic marketing plans, ultimately enhancing the effectiveness of print advertisements.

Keywords: Eye Tracking; Print Advertisements; automobile; Heat-Maps; Gaze Plots.

1. Introduction

Role of Eye Tracking Technology in Optimising Advertisement:

Eye tracking technology has emerged as a valuable tool for analysing the effectiveness of visual marketing strategies across diverse industries. By recording eye movements, gaze locations, and temporal variations, eye tracking allows researchers to delve into how individuals engage with visual stimuli such as images and text [1], [2]. This technology provides insights into which elements of an advertisement or visual content attract the most attention and the sequence in which they are viewed.

In the realm of neuromarketing, eye tracking serves as a powerful instrument for scrutinizing consumers' visual attention alongside their rational and emotional responses,[3]. It enables the tracking of viewer interactions with different elements within an image or text, including the duration of attention on specific components and the frequency of fixations on particular regions. Advertisers leverage eye-tracking data to compare the efficacy of various ad versions, refining their campaigns based on how viewers respond to different design elements, imagery, or messaging.

The utility of eye tracking extends beyond marketing, finding applications in academia, content analysis, education, design, human-computer interaction, medical research, retail experiences, and psychology 4, 2. Particularly in the domain of print advertisements, eye tracking has evolved into a robust methodology for investigating human engagement with media. It offers a rapid and straightforward means of evaluating the effectiveness of marketing tactics, enabling researchers to identify and discard strategies that fail to resonate with consumers. Thus, eye tracking technology empowers researchers to gain deep insights into how individuals interact with visual stimuli, thereby informing the optimization of marketing campaigns and enhancing understanding across various domains,[3]. By leveraging eye tracking equipment, researchers can discern how audiences respond to specific elements within advertisements, facilitating data-driven decision-making in marketing and beyond. Gender variation to response is possible. Therefore, will there be a significant difference in the way men and women view the automobile print advertisement? *(Rq.1).*

Automobile market segment

As of 2023, India is the 3rd largest automobile market in the world in terms of sales. India's passenger vehicle market, valued at Rs 450000 million, [5], has been outpacing volume growth. It has just passed a milestone as annual volumes of cars, sedans and utility vehicles breached the four million marks for the first time in 2023. As per industry estimates, about 4.1 million passenger vehicles were sold in the local market in the last calendar year, an increase of around 8.2% compared with sales of 3.79 million units in 2022, [5].Market is dominated by Maruti Suzuki(40.37%),Tata Motors(15%), Hyundai Motor India(14%)and Mahindra & Mahindra(11%) as per December,2023 market report,[5]. Print campaigns are an important form of advertising that automobile industry use to promote their brands products and increase sales. It incorporates images of products/services and detailed feature specifications into a lustrous design that is accompanied several times by celebrity-endorsed catchy headlines.

According to Eye tracking studies, the location and design of advertisements have a significant impact on consumer attention; advertisements that are placed strategically on print media, such as the top half of a page or the centre spread, are more likely to be noticed by readers. However, the impact on

consumer behaviour is complicated. While consumer attention is required for effective advertising, it cannot guarantee consumer action. Consumers may spend time looking at an advertisement, but they may not remember its contents, according to Eye tracking research. Nonetheless, Eye tracking technology can provide useful information about the effectiveness of print advertisements. *Therefore. how media planners concentrate on creating visually appealing content with clear and concise text that is strategically placed within print publications? (Rq2).* Where is a significant difference in the way men and women view the automobile print advertisement.

 Researchers could use to Eye tracking equipment to determine how consumers respond to certain components of advertising. It is a quick and easy strategy for determining the success of marketing tactics and eliminating those that are ineffective through Eye tracking. Recent development patterns show that the eye-tracking approach, which has acquired prominence as a research methodology, is gaining popularity,[6]; [2] for measuring the impact of marketing. Recent developments in eye-tracking technology have made it increasingly popular among researchers and marketers alike. Its prominence as a research methodology is evident in the growing number of studies utilizing this approach to measure the impact of marketing efforts. In line with this trend, a specific eye tracking study was conducted to delve into the effectiveness of print advertisements in the automobile industry. The experiment aimed to address several key research questions: It seeks to identify the advantages of using eye tracking technology specifically for analysing print advertisements in the automobile industry. Understanding these benefits can justify the investment in such technology and inform its strategic application. Researchers aim to uncover the unique features or qualities of print advertisements within automobile industry which is growing industry in emerging markets like India. This knowledge could aid in crafting more effective and targeted advertising campaigns tailored to the preferences and expectations of the target audience. By identifying which visual elements draw the most attention from viewers, marketers could optimize their advertisements to maximize impact. Insights into preferred graphic styles, colour schemes, and layout designs could inform creative decisions in future campaigns. The next section relates to literature review.

2. Literature Review:

Application of Eye Tracking Technology in Research:

Advertisers and academics have analysed the key factors that influence effective print advertisement,[7]; [8]. In modern advertising, visual metaphors are widely used due to their effects such as improving advertising recall, enhancing persuasiveness, and generating consumers' positive attitudes. However, at present, there is no evidence of consumers' neurophysiological responses to visual metaphors included in advertising,[9]. Understanding the perspective of users *Eye Tracking technology* could be a useful technique for online research, particularly in web design and development, [10]. Ouzts [11] reported purchase decision as well as time spent observing packaging indicates that participants preferred established brands with respect to its private label competitor through *Eye Tracking technology.* By analysing visual attention or the duration of fixation on human brand images using an eye-tracking technique, Wook & Chang, [12] in their research concluded on the impact of consumers' decision quality in an online shopping environment. Though, *Eye Tracking technology* has been widely acknowledged as a valuable evaluation technique of analysing user experiences processes to comprehend better how users view and interact with technology its usage in

print media for automobile segment will be interesting study. Automobile use print media extensively for their brand promotion [13].

ET technology is widely used in the automotive industry to analyse consumer responses to print advertisements. This technology analyses the placement of the advertisement on the newspaper, its text, colour, format, and the effect of visual aspects. Pupil dilation could be caused by a variety of factors, including task difficulty, emotional response, and light variations, and it can be used to predict elements such as contrast, density, brightness, and movement that can automatically catch our attention [14]. Automakers gain invaluable insights by decoding the visual journey of potential buyers, allowing them to tweak advertising strategies and create more captivating campaigns. This marriage of technology and consumer psychology represents a paradigm shift, allowing the automotive industry to navigate the ever-changing landscape of consumer preferences with precision [15].

3. Method

Eye tracking equipment is a valuable tool for researchers studying consumer behaviour, particularly in response to advertising stimuli. By tracking eye movements, researchers could gain insights into which elements of an advertisement draw the most attention, how viewers navigate through the content, and how different demographic groups may respond differently. This method provides quick and easy access to data that can inform marketing strategies and help identify ineffective tactics. This is descriptive research because it elaborates on the variable 'benefits of eye tracking,' but it is also exploratory as the researchers investigated the variable 'prominent features' to gain a better understanding of which print advertisements in the automobile sector appeal the most to viewers. The primary sources consisted of first-hand information obtained from selected respondents using 'Tobii eye-tracking software.' The researchers used *heatmaps* and gaze plots

This is descriptive research experimental study because it elaborates on the variable 'benefits of eye tracking,' but it is also exploratory as the researchers investigated the variable 'prominent features' to gain a better understanding of which print advertisements in the automobile sector appeal the most to viewers. Secondary information was obtained from existing and credible published literature available in the library and on the web. The primary sources consisted of first-hand information obtained from selected respondents using 'Tobii eye-tracking software.' The researchers used heatmaps and gaze plots to analyse the prominent features in this qualitative study with 20 "qualified individuals."

Table-1

Four equal strata were formed based on the sampling technique, with five male and five female respondents from the Mumbai region and similar from Goa. *(Table No 1)* Researchers ensured that none of the participants had any visual impairment. Participants' eye movements were captured using Tobii Pro Nano as hardware and Tobii Pro Lab as analytical software. The participants were shown six print advertisements of various brands that closely matched the dimensions of newspaper advertisement. The researchers generated an AoI from the elements in these six advertisements using Tobii software.

The study includes all individuals between the ages of 25 and 40 who want to own a car. Respondents were identified from these cities because researchers were based in Mumbai and Goa. As the respondents needed to be 'qualified individuals,' i.e., those who own a car and are available at arm's length to reach for the eye tracking experimentation process, a non-probability sampling technique was used. To ensure that the data was not skewed, cluster sampling was used to ensure that the population samples had equal representation from both cities. Respondent received seven seconds of exposure time for each print advertisement. Tests were carried out under the same conditions for all participants, as each was individually eye-tracked on a single computer. Following the tests, the researchers asked each participant three open-ended questions about 'Top of Mind' recall of the print advertisements, their contents, and whether they would respond to any call to action. The researchers gathered qualitative data through interviews to gain insights into viewers' emotion, attitude, and motivation, allowing them to develop a highly nuanced understanding of print ads that could be extremely effective in engaging viewers in the automobile industry. To understand whether there is any significant difference between the perception and gaze views of the print advertisement of automobile brands among the men and women, following Hypotheses were tested:

H1:There is a significant difference in the way men and women view the automobile print advertisement.

Measurement is done using ET technology through Heat map, Gaze plot .

Heatmap

A heatmap [16]; [17]; [18], in the context of neuromarketing and eye-tracking, is a visual representation that illustrates the distribution and intensity of visual attention across a specific stimulus or area of interest. It is made by combining data from multiple eye-tracking sessions and assigning different colours to different levels of attention. Colours, such as red and yellow, are associated with higher levels of attention, whereas cooler colours, such as blue and green, are associated with lower levels. The result is a graphical map that researchers and marketers can use to identify "hotspots," or areas of the stimulus that attract the most visual attention. Heatmaps are useful tools for optimising design elements in advertisements, web pages, and other visual materials because they provide a quick and easy way to understand where people are likely to look and engage.

When a respondent is shown an advertisement, eye tracking devices are used to investigate their eye movements, which generates a heatmap that hints at the parts of the advertisement that pique a respondent's interest. Heatmaps are created by mapping the portions of the image on which participants focus during the experiment, with hotter colours denoting significant portions of an identified advertisement as shown in Figure-I.

Fig -I

Heatmaps provide useful information about various components of advertisements that are effective at attracting and retaining the attention of respondents. This data can be used to make data-driven decisions, allocate resources for advertising campaigns, and optimise the design of upcoming print

advertisements. Heatmaps are used in conjunction with other metrics such as time fixation and count fixation to provide critical information about how viewers interact with the advertisement.

Gaze Plot

Gaze plots are used to map out respondents' eye movements that gauges where and how long individuals stare at specific items on a print advertisement. In a gaze plot, the image is broken up into a grid of smaller regions known as "Areas of Interest" (AoIs), indicating certain portions of the advertisement / content, which the researcher investigates. For example, AoIs may comprise of headline, the product image, or the call-to-action. The eye tracker records a point on the gaze plot each time a participant makes eye contact on a particular AoI, with the point's location correlating to the AoI's location on the advertisement that eventually combines to form a visual depiction of a respondents' gaze path. Researchers can learn more about the visually absorption process by examining gaze plots which are a significant tool in eye tracking studies of content or print advertisements in this case as given in Fig.II

Fig .II

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The following method of administering Tobii software used.

Step-1

All the participants were informed the about the study and taken their consent. They were told that wire will be attached to their wrist and the eye movement will be measure. The participants were shown six print advertisements of various brands that closely matched the dimensions of newspaper advertisement. The researchers generated an AoI from the elements in these six advertisements of automobile -*Ciaz ; Renault Capture; Toyota Glanza ;Honda Ford and Zeep* using Tobii software. The print advertisement of these cars shown to respondents are given below in Fig.III

Fig -III

Measurement is done through Area of Interest (AoI) Analysis to define specific regions, allowing for more targeted assessments of metrics like dwell time and fixation count,[19]. Participants' eye movements were captured using Tobii Pro Nano as hardware and Tobii Pro Lab as analytical software. ET gauges where the person looks or gazes' point, the time that a person looked at a certain point, the movement of his eyes in relation to his head, pupil dilation, and the number of blinks. Pupil Size Variability provides nuanced insights into cognitive load and engagement by indicating changes over time. The software records the participant's gaze patterns, the amount of time spent on each AoI, and the total amount of time spent on the task. Research works conducted through ET instrument have offered several significant insights within neuromarketing in the recent past.

 Step-2

The researchers attempted to assess the effectiveness of the print advertisements identified. As a result, after the eye-testing process on Tobii Software was completed, all 20 participants were asked the three questions listed below.

Q1: Which print advertisements do you remember the most?

Q2 - What drew you in to these print advertisements?

Q3 - After seeing the advertisements, what is your call to action?

The first unaided question was designed to determine top of mind (ToM) recall in order to determine which brand's print advertisement piqued the viewer's interest. Jeep topped the ToM recall list with 15 respondents, closely followed by Ford with 12 respondents. Most respondents could easily recall celebrity-endorsed brands; however, the majority of male respondents could recall brand names such as Ciaz for Ranveer Singh and Renault for Ranbir Kapoor, respectively. As we know, celebrity endorsements have a significant impact on the recall of print advertisements, but female participants were unable to recall the brand names, indicating the need for strategic positioning of the 'brand name' within the print advertisement.

The second question asked which image and design of automobile print advertisements appealed the most to the viewers. According to ToM recall, the print copy of Red Jeep was very appealing to the participants. The background colour with limited information complimented the image very well, and they thought it was the easiest for brand recall because of the best colour combination, simplicity, and elegance. The Ford's Blue Smoke, font size used in the brand name inside the'smoke,' was unanimously agreed upon by all respondents as the most appealing element of the print copy. Male respondents praised the 'product specification,' while females praised the colour and background.

The third question asked which element prompted participants to respond to the 'call to action.' The majority of respondents preferred the Jeep advertisement because it was less cluttered than other images and focused on the car's design. The backdrop of a hilly track gave it a 'tough' brand personality; additionally, keeping the car's specifications to a minimum made viewers 'want to look for more information.'

Based on the feedback received from respondents, it is clear that Jeep's image and ground ratio provided clarity to the viewers. Respondents also mentioned the distinctive blue smoke of 'Ford,' as well as a variety of different car models that piqued their interest. Such print advertisements pique the interest of viewers, causing them to seek out product information and even go for a test drive. Furthermore, during the participant interviews, it was discovered that Ford and Jeep were successful in creating "top of mind awareness" in majority of the participants.

4.Results And Discussion

Eye Tracking (ET) is the process of observing fixations over a stationary object of interest, as defined by Duchowski,[10]. In this study, the researchers used Tobii software to develop the areas of interest (AoIs), as outlined by Pieters and Wedel, [20] and Puškarević, Nedeljković, Dimovski, & Možina,[21]. The AoIs created in each advertisement for this study are listed below. The AoIs were similar for all print advertisements, except in certain ones which either had a celebrity, price factor was missing or there was extra text.

Figure 4 depicts heatmaps of male respondents on the left and females on the right of Print Advertisement 1, i.e., Maruti Suzuki Nexa. In comparison to female respondents, male respondents had more red spots, i.e., warmer shades, indicating that they spent more time looking at specific features. While females focused on the celebrity's face and the little text content on the headline, men read the headline, smart hybrid, and focused on the celebrity's face, as seen below at the bottom of the advertisement. Females had more lighter shades of green and yellow, indicating that they only skimmed over AoIs. Researchers used the 'Total Fixation Duration Metric,' a statistical dataset obtained from Tobii software, to better understand the heatmaps; later, this metric was converted into a percentage for each AoI, validating the heatmaps. Figure 4.1 illustrates that the Car AoI accounts for 28.26 percent of total time, followed by the ATF with 25.69 percent. The brand name 'Ciaz' car has received the least attention as shown in Fig.4.1

Fig 4 and Fig.4.1

Hypotheses Testing

To determine whether there is a significant difference between how men and women perceive automobile print advertisements, the hypotheses were tested. The researchers collected data for this study by displaying six print advertisements to 20 respondents, yielding a total of 120 observations (6 x 20). 'Z' test is used because 'N' is greater than 30 in this case. The results of a test for hypotheses validation are shown in Table No. 2.Gender was an independent variable in Hypothesis 1 (HO1), and average fixation duration was the dependent variable.

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Table-2

As the significance value (P = 0.0012) obtained from the two-tail Z test was less than alpha (0.05), the null hypothesis was rejected. As a result, H1 is confirmed. Furthermore, the 'Z' cal. is greater than the 'Z' critical, i.e., 3.22 > 1.96, indicating that H1 is rejected and HO2 is correct. A significant difference in mean exists for both genders, with 1.679 = Variable 1 = Female and 0.863 = Variable 2 = Male. *As a result of the 'Z' test and the significant differences in gender averages, it can be concluded that there was a significant difference in male and female respondents' viewing patterns.*

By applying the classical attention ,interest desire and action (AIDA) model alongside Eye-Tracking analysis, automobile brands can gain valuable insights into how consumers interact with their print advertisements at each stage of the decision-making process. This understanding allows brands to optimize their advertisements to better capture attention, generate interest, stimulate desire, and ultimately drive action.

5. Conclusion

This research paper provides an in-depth analysis of advertisement viewing patterns and various personality traits that may be important for campaign designers. Based on the findings, the researchers attempted to make a few recommendations for the selected print advertisements. Print advertisement of Nexa car , because its' AoI' Brand Name' received the least attention, it is recommended that the campaign designer focus on making the brand visible and attention grabbing to the viewers. According to analysis, attributes such as colour, font used in print advertisements, product placement and features could have a significant impact on gaze point and attention. To entice the sensory appeal of a potential buyer, campaign designers should keep the above recommendations in mind when crafting an advertisement. Researchers discovered through examining the ET data and personal interviews that customers frequently disregard the body copy and other supporting parts in favour of the main picture of the car, advertisement headline, and celebrity image. Product specifications were also preferred by most participants, particularly men. Print advertisements with top-of-mind recall had broken the sensory adaptation by incorporating eye-catching visuals

6. Managerial Implication: The research paper highlights several important managerial implications for automotive marketers and campaign designers based on the analysis of advertisement viewing patterns and personality traits. Summary of the key points is given below:

Enhancing Brand Visibility: Since the brand name of the Nexa car received minimal attention, it is crucial for campaign designers to ensure that the brand is prominently displayed in advertisements. This might involve redesigning the ad to make the brand name larger or more visually appealing.

Visual and Textual Elements: The study indicates that attributes like color, font, and product placement significantly affect viewers' gaze and attention. Managers should invest in creating visually striking advertisements that utilize bold colors and fonts to capture interest.

Sensory Appeal: To attract potential buyers, advertisements should appeal to the senses. This could involve using high-quality images that showcase the car in a dynamic setting, appealing to the emotions and desires of the target audience.

Focus on Key Components: Given that viewers often overlook body copy in favor of visuals, it is essential for marketers to prioritize the main image, headline, and any celebrity endorsements. These elements should be designed to capture attention quickly and convey key messages effectively.

Targeted Messaging: Understanding that product specifications resonate more with certain demographics (e.g., men), campaign designers should tailor content to highlight technical details and performance features in a way that engages this audience.

Breaking Sensory Adaptation: Advertisements that achieve high recall utilize eye-catching visuals. Marketers should experiment with innovative design approaches to break through sensory adaptation and maintain viewer engagement over time.

Reevaluating Advertising Formats: The findings suggest that marketers may need to reconsider their current formats and styles for print advertisements. Emphasizing strong graphics and concise, impactful headlines can enhance viewer engagement and brand recall.

Overall, the study underscores the importance of designing advertisements that not only attract attention but also resonate with the target audience's preferences and behaviours, ultimately leading to more effective marketing strategies in the automotive sector.

7. Limitation: Since the researchers were based in Mumbai and Goa, the data was gathered in both Mumbai and Goa. This methodology could be applied to other geographies to gain a better understanding of the impact of Eye Tracking on print campaigns. Furthermore, capturing data with Tobii software is a time-consuming process, as the apparatus must be transported to the site of research.

8.Contribution: The study gives an insight on the importance of understanding consumer behaviour and preferences in order to develop successful advertising strategies. Marketers can develop a deeper understanding of how consumers view and interact with advertisements to create more focused and interesting campaigns that ultimately result in higher sales and income. Study provided an in-depth understanding of consumer viewing patterns and traits for Automobile Print Ads, offering a vital new understanding of how consumers read print advertisements for automobile products.

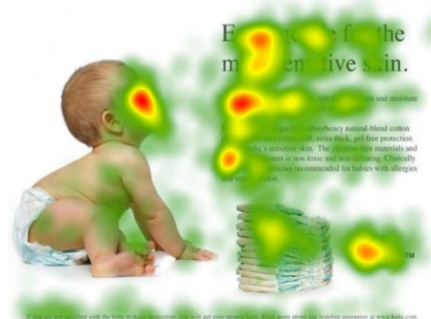**Conflict-of-Interest Statement:** There is no conflict-of-interest statement in the manuscript.

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Annexure

Fig 1: Heatmap

Source:https://www.ashokcharan.com/Marketing-Analytics/~bm-eye-tracking-applications.php#gsc.tab=0

Fig.II: Gaze Plot

Source: https://www.tandfonline.com/doi/full/10.1080/0144929X.2018.1551933

Fig.III

Print Advertisement 1 and Area of Interest of consumers

Source: https://www.advertgallery.com/newspaper/maruti-suzuki-nexa-ciaz-car-the-pioneer-of-smart-hybrid-ad/

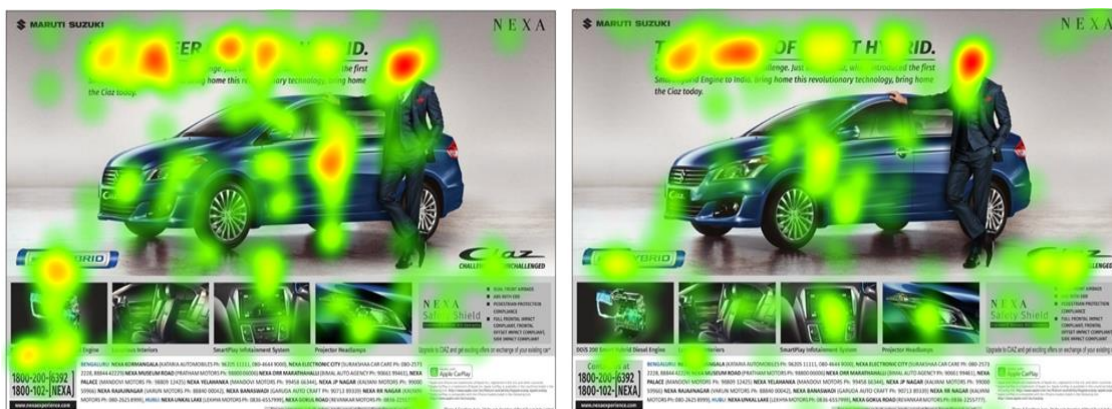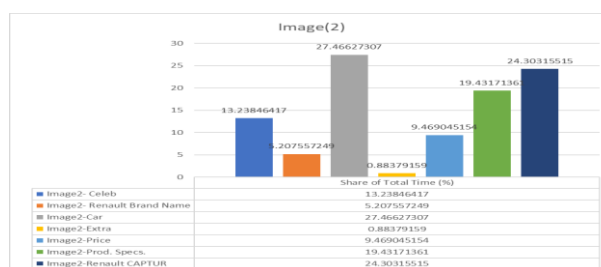Figure 4: Male Heatmap (left) Vs Female Heatmap (right) on Image

Figure 4.1 Total Fixation Duration Graph (Statistical Data)

Source: Authors' compiled data

Table No 1 Sampling Design

Strata	Description of Respondents	Strata	Approached	Qualified
Mumbai	Males who own car in Mumbai (MM)	1	6	5
	Females who own car in Mumbai (FM)	2	9	5
Goa	Males who own car in Goa (MG)	3	7	5
	Females who own car in Goa (FG)	4	10	5

z-Test: Two Sample for Means

	Variable 1	Variable 2
Mean	1.6797856	0.863861367
Known Variance	3.750283	0.098501
Observations	60	60
Hypothesized Mean Difference	0	
Z	3.221541186	
P(Z<=z) one-tail	0.000637516	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0.001275031	
z Critical two-tail	1.959963985	

Table2: Z Test Results-