Applying Eye Tracking Technique to Evaluate Poster Design: A Study on World Peace Poster

Bhaskar Mishra and Anirban Chowdhury

Abstract In recent years, the world has been confronted with a myriad of difficulties as a result of the pandemic and the war conflicts that have broken out between countries. In this scenario, it is important to focus on world peace because world peace might influence the growth and prosperity of the entire global community. On the other hand, eye tracking is a relatively new technique for the study of visual attention and perception in poster design. This research work examines the effectiveness of design elements in world peace poster design using an eye tracking technique used for the measurement of attention, attractiveness, and understanding of the messages conveyed using posters. We designed three novel posters on the theme of world peace (using Photoshop and Illustrator), and the eye tracking was conducted using the GazeRecorder software and a questionnaire survey with 20 participants (age ranged from 23–43 years, 47.4% male, 52.6% female) was conducted to understand the users' reactions to the designed posters. Eye movements are used to provide a comparatively novel source of data about visual attention and evaluation of design elements. Creative poster designs that are eye-catching, have a brief message, and can be understood at a glance are more effective in the context of world peace message communication. The study highlights the use of eye tracking as an active area of research that is being applied to the study of world peace poster design. It was observed that poster 2 (P2) was more attractive as the design was significantly more original, aesthetically pleasing, and communicative to the target audience for the promotion of a world peace-related message. The study reports on people's perceptions of poster design, particularly different design elements, and their effectiveness, as well as people's attention to certain messages or information on design posters, which transmit the message and cause them to think in a certain way.

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N. Martins and D. Raposo (eds.), *Communication Design and Branding*,
Springer Series in Design and Innovation 32,
https://doi.org/10.1007/978-3-031-35385-7_10

Keywords Attention · Cognition · Eye tracking · GazeRecorder · Poster design · World peace

1 Introduction

In recent years, the world has faced several challenges due to the pandemic and the wars that have erupted between countries. The coronavirus pandemic has spread throughout the world, affecting many countries. In December 2019, the virus was discovered and reported in Wuhan, China [1]. Because of this, all countries' governments take action to combat the pandemic and establish rules and regulations, such as a lockdown for a period of time and people staying at home, wearing masks, and keeping a safe distance from one another [2]. Furthermore, there have been human casualties, as well as a global financial crisis [3]. Political tensions between major countries are also rising as a result of the pandemic [4]. The crisis between Russia and Ukraine is also currently involving the rest of the world. The outcome is that the world is dealing with many difficulties. In this scenario, it is important to focus on world peace because world peace might influence the growth and prosperity of the entire global community. The concept of world peace refers to a world free of violence. Peace is a basic requirement for humans and human societies.

Is there any new and interesting way to take more steps toward peace in these difficult times? The poster could be the answer. Before proceeding, it is important to understand what a poster is. A poster is an abstract [5]. It is used to promote the media. It is a single sheet with one face printed in two dimensions [6]. It is also used to communicate information, data, schedules, and offers to the public. Posters include text, graphics, and colour as elements. Posters that succeed in capturing the attention of the audience usually have one dominant and interesting element [7]. Graphics are the most important aspect of poster design. Photographs, designs, and patterns are examples of graphics. The text is the second element. The text contains both the main text and the complement text. The poster's main text is the title. The title should be short and simple [6]. Subtitles or taglines can be used as text complements for posters. Color is an element that should not be overlooked in posters. The use of contrasting colours in typography, designs, and so on is intended to increase the poster's appeal. The purpose of the world peace poster is to promote peace messages. All of the elements work together to support the peace message, causing the target audience to think in a specific way. On the other hand, eye tracking techniques have emerged as a potential way to record individual eye movements and assess visual attention in a number of study areas [9]. It is a relatively new technique for the study of visual attention and perception in poster design. The eye-tracking variables fixation duration and fixation count are more useful for determining visual attention [8].

This research work examines the effectiveness of design elements in world peace poster design using an eye tracking technique used for the measurement of attention, attractiveness, and understanding of the messages conveyed using posters.

2 Literature Survey

Eye movements and fixations were tracked using an eye tracker. A minimum gaze duration of 300 ms reliably indicates interest as a fixation [9]. Frequently, fixation patterns are analysed using heat maps, which depict the length of time participants fixated on each area. Heat maps analyse fixation trends using data from multiple participants [10]. The colour coding system used in heat maps is simple and easy to read. Fixations occurred in the coloured areas; longer fixations in red indicate longer times spent there, while shorter fixations in green and yellow indicate decreasing times spent there. The areas that have no colour are the ones that did not have any fixations performed on them [11–14]. Fixation data can also be used to visualize information for targeted areas. Fixation duration, frequency, timing, and percentage of viewers reveal targeted viewing behaviour. A subject\stimulus is divided into regions in order to generate a map of fixation information for specific areas. These regions are referred to as areas of interest (AOIs), and they can be created in a variety of ways. AOIs in the gaze recorder indicate dwell time, first view, and viewed by. The amount of time respondents spent looking at a specific AOI is referred to as dwell time. The Time to First Fixation (TTFF) indicates how long it takes a respondent (or all respondents on average) to look at a specific AOI after the stimulus is presented [13].

Eye tracking techniques have been used in an increasing number of research studies in recent years, such as interaction design, packaging design, advertising, user experience, media, and so on [15]. It can be used to study selective exposure in all types of media. One of them is the analysis of political posters and advertisements from various parties to determine which elements are highlighted. People also spend more time on political advertisements that reflect their own political beliefs [16]. It is also used in hospitality research to investigate customers' visual attention on the frontage of street vendor stores, restaurant banners, menu labelling, and so on. In this study, performance parameters included (a) average fixation duration, (b) fixation counts, and (c) revisit counts for the area of interest [17]. Another study employs eye tracking to track and analyse the poster for the well-known Korean beverage Jinro Soju. The outcome demonstrates that the advertising model's face received more visual attention than her body. Furthermore, the advertisement image takes precedence over text elements [18]. In addition, the celebrity of the endorser had a significant impact on attention to ad elements [19]. Another research study emphasises the use of eye movement monitoring devices in the education/teaching of students. Students use heat maps and analytics to adapt the viewers' thinking process and learn which element dominates the viewer's choice [20]. An intriguing study in which depressive symptoms are linked to an attentional bias toward socio-emotionally charged memes rather than neutral memes. As a result, there are more fixations with depressive memes than with neutral memes [21].

3 Methodology

This experiment was designed to evaluate the effectiveness of design elements in world peace poster design using an eye tracking technique used for measurement of attention, attractiveness, and understanding of the messages conveyed using posters. Using Photoshop and Illustrator, we designed three novel posters (see Fig. 1) on the theme of world peace for the study. Twenty randomly selected male and female research scholars from a variety of disciplines from the anonymous university at Dehradun, India, volunteered for this experiment. Their ages ranged from 25 to 40. The research scholar's vision was either normal or corrected. The eye tracking was conducted using the GazeRecorder software. Before starting the experiment, participants were asked to sit in front of the system. The distance between the system and the participant was approximately 18 inches. Then click the experiment launch button and begin tracing your eyes. Gaze calibration is the initial stage in eye tracing. So, check a few conditions before beginning the gaze calibration. Your face is visible, your room is well-lit, there isn't a bright source behind you, and there aren't any light refractions on your glasses. Following the calibration process, three posters with the theme of world peace are displayed on the system for 5 s each.

Also, participants in the eye-tracking experiment were asked to complete a basic questionnaire based on a seven-point Likert scale about the three posters with the theme of world peace, including if they were original (indicates that the idea has never been presented or considered before), innovative (consists of coming up with new ideas or things.), aesthetically pleasing (includes color balance, visual balance, graphics, font, size), and whether they effectively conveyed the message. Based on the GazeRecorder software's heat map (Fig. 2) and analytics (dwell time-time viewed, time to first fixation-time to first view at areas of interest, as presented in Fig. 3) the eye tracking data were analysed. In addition, the data is further statistically

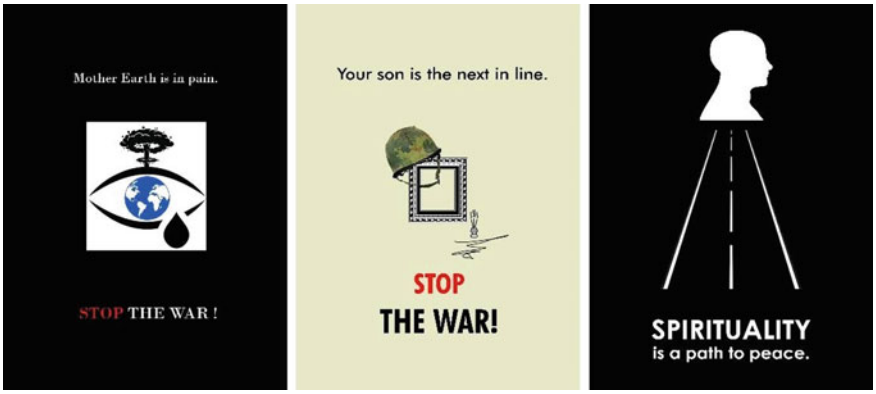

Fig. 1 The three novel posters on the theme of world peace were designed using Photoshop and Illustrator

Fig. 2 Depicts three novel posters on the subject of world peace, along with aggregated heat maps from the GazeRecorder

Fig. 3 Depicts three novel posters on the theme of world peace with analytics (dwell time-time viewed, time of first fixation-time to first view) in the GazeRecorder

analysed using SPSS 20.0 software, and the eye tracking data was compared with the questionnaire results.

4 Results and Discussion

From the questionnaire-based user responses, it was observed that Poster 2 is better in terms of Originality, Innovativeness, and Aesthetic Pleasantness Perception as mean values on the seven-point scale were higher for these aforesaid parameters. On the other side, participants perceived Poster 1 as the least original, innovative, and aesthetically pleasing. Please see Table 1 for the detailed results. All the mean

Table 1 Poster wise mean variations of Originality, Innovativeness, and Aesthetic Pleasantness Perception

Measure	Poster	Mean	Std. error	95% confidence interval	
				Lower bound	Upper bound
Originality	1	5.750	0.403	4.906	6.594
	2	6.700	0.105	6.480	6.920
	3	6.350	0.264	5.797	6.903
Innovativeness	1	5.500	0.432	4.595	6.405
	2	6.400	0.134	6.120	6.680
	3	5.800	0.268	5.240	6.360
Aesthetic	1	5.050	0.413	4.185	5.915
	2	6.000	0.290	5.393	6.607
	3	5.600	0.373	4.820	6.380

variations for perceive Originality [$F(1) = 4.333$; $p < 0.05$], perceive Innovativeness [$F(1) = 8.143$; $p < 0.01$], and perceive Aesthetic Pleasantness [$F(1) = 5.651$; $p < 0.05$] were found significantly different as per quadratic model. The univariate analysis (when sphericity assumed) also revealed significant differences in perceive Originality [$F(1) = 3.978$; $p = 0.027$; effect size = 0.173; observed power = 0.678] and perceive Aesthetic Pleasantness [$F(1) = 3.397$; $p = 0.044$; effect size = 0.152; observed power = 0.605]. Poster 2 is also the most effective and significantly [$F(1) = 9.531$; $p = 0.006$] communicating the message of world peace. Among all the design elements (text, graphics, and colour) of the poster, audiences perceived colour as the most important and significant element [$F(1) = 7.080$; $p = 0.015$], when observing the results of within-subjects contrast (Quadratic model of estimate).

When qualitative analysis of eye-tracking data was done through heat-map analysis, it was observed that participants fixated on most of the areas (graphics, text, complement text) for poster 2. This suggests that the clearer visual hierarchy of poster 2 retained more impact in attracting participants' attention. These kinds of results indicate that poster 2 is more attractive. Poster 3 received a more scattered viewing pattern meaning a scattered fixation pattern. This is particularly because poster 3 receives little attention from participants. Poster 1 has a more intense fixation on the graphics, as evidenced by a strong shade of red, but the complementary text is green. Therefore, some areas of Poster 1 receive little attention from participants (see Fig. 2).

All three posters have separate AOIs for their graphics, text, and complementary text areas. The yellow shaded area represents the AOIs area, with dwell time in seconds, dwell time percentage, the first view in seconds, and viewed in numbers. It was observed that the first AOIs for poster 1 are graphics, with a dwell time of 3.07 s and a dwell time percentage of 62%, the first view being 0.35 s, and 20 of 20 participants viewing it. The text then has a dwell time of 0.92 s and a dwell percentage of 11%, a first view time of 0.79 s, and is viewed by 12 of 20 participants. The dwell

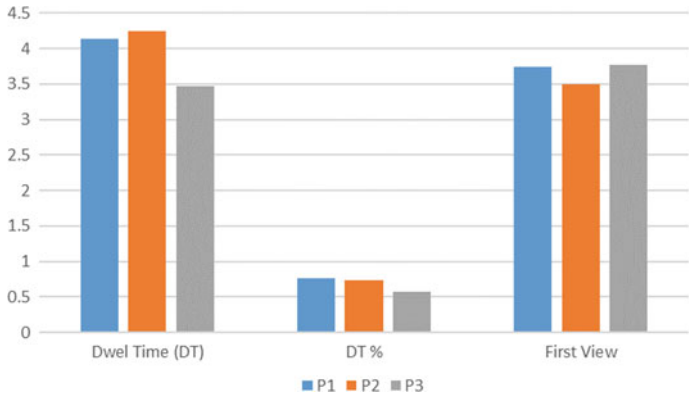

Fig. 4 Poster-wise overall eye-tracking parameters dwell time (DT), DT %, and first view time variations

time for the complement text is 0.24 s and a dwell percentage of 2%, the first view is 2.68 s, and 9 of 20 participants view it. The first AOI for poster 2 is graphics, with a dwell time of 2.32 s and a dwell percentage of 45%, the first view being 0.44 s, and 19 of 20 participants viewing it. The text then has a dwell time of 1.22 s and a dwell percentage of 17%, the first view is 0.85 s, and 14 of 20 participants view it. The dwell time for the complement text is 0.71 s and the dwell percentage of 12%, the first view is 2.2 s, and 16 of 20 participants view it. For poster 3, the first AOI is graphics, with a dwell time of 2.93 s and a dwell percentage of 60%, the first view being 0.08 s, and 20 participants viewing it. The text then has a dwell time of 0.72 s and a dwell percentage of 10%, the first view is 1.53 s, and 14 of 20 participants view it. The dwell time for the complement text is 0.52 s and a dwell percentage of 5%, the first view is 2.04 s, and 10 of 20 participants view it (see Fig. 3).

From the eye-tracking area of interest study, it is revealed that there are poster-wise variations of dwell time, dwell time percentage, and first view time. Overall dwell time (in seconds) and dwell-time percentage were higher for poster two (P2) and the first view (in seconds) was lower for poster two (P2). These results indicate that poster two (P2) was more attractive (Figs. 3 and 4).

5 Conclusion

When we compared the eye-tracking results with the questionnaire-based responses, it proved that poster 2 (P2) was more attractive as the design was significantly more original, aesthetically pleasing, and communicative to the target audience for the promotion of a world peace related message. Therefore, poster two (P2) is communicating the message effectively and can be recommended as an initial material for the promotion of world peace. Furthermore, their distribution would have to be

global with extensive reach and the role of social media is significant. In addition, the approach taken in this study can also be applicable for poster design evaluation in near future. There is a limitation to this study; it is possible to achieve some interesting results if a better composition of poster samples is used with the same methodology as used in the study or as used in an eyetracking study by Chowdhury et al. 2013 and 2018 [22, 23].

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