Eye-tracking Analysis: College Website Visual Impact on Emotional Responses Reflected on Subconscious Preferences

Dr Hedda Martina Šola[1], Dr Fayyaz Hussain Qureshi[2], Sarwar Khawaja[3]
Centre for Applied Research and Entrepreneurship, Oxford Business College, Oxford, UK[1, 2]
Oxford EducationGroup, Oxford Business College, Oxford, UK[3]

***Abstract*—This study examined students' behaviour on the college website and the content of information they were able to obtain. With the eye-tracking sensor, this study aims to investigate the university websites' effectiveness, satisfaction, and efficiency and collect data regarding users' visual impacts. The research was carried out using mobile phone neuromarketing tools of eye-tracking, facial coding, and supplementary short memory post-survey. The study was focused on two web pages, the homepage, and the CARE page. The analysis results from both web pages were then compared and further discussed. The results suggest that participants mostly elicited sadness (29.55%), neutrality (33.19%), and puzzlement (13.60%) while browsing the homepage, regardless of the areas of interest (AOI). They also elicited slight disgust (4.33%), fear (3.51%), joy (5.21%), and surprise (29.55%). The heat map for the CARE page reveals that the top of the CARE page was a point of attraction for participants. The study found that participants' negative feelings were more intense than good ones concerning homepage scrolling. Also, their pleasant mood intensity increased moderately when they looked at regions with only photos in a subdued color scheme or where brighter colors were used to emphasize essential textual information such as upcoming events and student blogs. This reveals that the website's complexity further affects the cognitive load. Therefore, making it more accessible will be beneficial to students. According to the student's responses, change such as the page's design, color, and text could be implemented.**

Keywords*—Neuromarketing; eye-tracking; student behavior; college website analyses; mood intensities; visual impact; website conversions

Abbreviation

HCI: Human-Computer Interaction

OSH: Workplace Safety and Health

OBC: Oxford Business College

CARE: Centre for Applied Research and Entrepreneurship

AOI: Areas of Interest

TTFF: Time to First Fixation

I. Introduction

A college's website is becoming an effective tool for students to collect information in the decision-making process for higher education. The first impressions of potential students are affected by the website. Thus, the digital presence of a college is crucial since it has been discovered that browsing the website first is a prelude to visiting the campus. Colleges and universities use websites to attract prospective students [1]. Every year, most students decide to pick the higher education institute that will have far-reaching consequences for the rest of their lives. This choice will impact their career, wages, and professional growth. In 2005, private schools spent approximately $2,073 per new student to apprentice, making communication and recruitment efficiency significant for institutions [2]. Where do awaited students go to learn about colleges and universities? They look through the websites developed by universities and colleges [2]. An appropriate Web-User communication system must be present to catch students' attention, thus, beginning with highlighting the specific users that extensively rely on web pages, the concerns on which the Web page focuses, or the message it wishes to convey to the users [3]. Therefore, it is crucial to investigate the whole process, for instance, how students approach a Web page and how they conclude it. This process must strive for an admiring emotional influence in visual content focused entirely on the student's experience. The basic scheme favors consumers' methods to develop an interactive web design. Eye tracking is an existing tool that allows for carrying out this task. Although its primary purpose has been the retail industry [4,5,6], it has applications in research and commercial grounds underlying human thinking and behavior. Eye tracking is heavily used in studying the influence of imaging to drive new consumers [7,8], but it also has wide use in clinical studies [9,10]. Understanding the visual impact from an emotional perspective is an attractive topic [11] and crucial to different disciplines. However, limited studies attempted to understand students' behavior in learning [12,13] and even lesser to website visual interpretation [14].

Since Students rely on visiting colleges' websites to help make their selection, the aspects influencing their decision are fundamental. Therefore, the current study analyzes the emotional responses to website conversion stimulated by visual impacts. Our main aim is to examine the effectiveness, satisfaction, and efficiency of university websites using eye-tracking analysis and collect data regarding the visual impacts of users. Eye-tracking recognizes the human pupil and traces and analyses the eye movement and fixation when viewing images or websites to allow the investigator to identify where a person is looking at a given period and the arrangement in which their eyes travel from one side to the following [15]. An

eye tracker is a device that measures the location of the eyes [16]. The software will then generate a so-called “heat map” through which the colors will identify the viewers' focused attention [15], permitting investigation of students' emotional reflections on websites.

Due to the development of sophisticated and economical technologies such as wearable sensor techniques, affective computing researchers are increasingly interested in emotion detection. Hence the current study emphasizes the following:

How visual impact can evoke emotional responses reflects website conversion and the eye-tracking analysis of college websites.

This research comprises several steps that initiated the creation of a public link on the OBC official website and served as an invitation to participate. The study was performed using online neuromarketing research technologies from mobile phones for their numerous uses by the students and everybody who visits their website. The experiments were performed in real-time operating neuro metrics combined with supplementary short memory post-survey questions. No additional hardware or application was required due to the advanced development of mobile cameras and machine learning algorithms. Tobii Sticky provided a way to acquire large-scale eye-tracking data.

II. Materials and Methods

A sample of 529 OBC students (both genders, 18-50) participated in the study, exploring how visual impact can evoke emotional responses and reflects on website conversions. Three hundred thirteen participants completed the entire experiment, from which we got one hundred eighty-six usable recordings whose gaze and/or emotion was trackable during their session (i.e., had proper lighting and did not move). One hundred twenty-four participants partially were involved in the study (participants who started the experiment but closed the browser or had timed out before reaching the end), zero participants were excluded from the study, and nighty two were screened out (participants that ended their session based on a screen out the question or did not meet technical requirements).

This study lasted ten days and was accessed via a pop-up banner on the OBC's website specifically created for study purposes. To ensure that the desired level of power and significant results are achieved, the required sample size was calculated a priori using G*Power [17]. Based on the G*Power output to detect the effect with 95% power, a two-sided significance level of 5% and a sample size of n=23 for the OBC homepage and n=35 for the CARE page are required (see Appendix). Tested subjects were recruited from the database of Oxford Business College. Participation in the study was voluntary, and no incentives were given.

The Institute for Neuromarketing Ethics Committee approved this research and supervised the study to be underlined with local and international ethical guidelines officially posted on the official Institute’s website. Following the British Educational Research Association's ethical guidelines for educational research [18], all participants were informed about the study. They gave their written, informed consent in digital form before participating in the study. Participants' data were treated according to standard practice and in compliance with GDPR (General Data Protection Regulation).

The online platform for advanced quantitative research, 'Tobii Sticky,' was used to measure eye-tracking and facial coding. According to the results, Sticky's average gaze error in a real-world (non-lab) environment is 1.6 to 1.8 degrees (~5% of the screen width and 7% of screen height) on a laptop which is more than accurate to the vital outcome. Therefore, since this research is conducted outside the laboratory without physical control over the ISO eye-tracking standards, to avoid data obtained from participants who did not meet entirely technical requirements, only recordings labeled as "usable" in Tobii Sticky were utilized. Participants were also provided with a set of images with instructions to ensure compliance with the technical requirements of the eye calibration test. The task started with a 5-point-eye-tracker calibration, a standard procedure for eye-tracking devices. After the calibration, all participants looked for 25 seconds at the identical two website pages (main page and CARE page) at the domain https://oxfordbusinesscollege.ac.uk/ pre-recorded in the form of the scrollable image, presented in the same order as on the OBC’s website page. They could not skip a certain part of the research, but with mouse clicks, it was measured how many participants wanted to stop the research. Such data indicated the total number of participants interested in the content published on the official website of the OBC. While browsing through the two website pages as they usually do, participants' gazing activity and emotional expression were measured over time using webcam-based eye-tracking. After each website page was presented, participants were given five statements to rate, assessing their conscious preferences and opinions about the seen website. They had 10 seconds to do that. The total duration of the study was 1 minute and 93 seconds per link (See 3.1.3.).

Participants’ data were treated according to standard practice and in compliance with GDPR and the European Code of Ethics for Research. Since the study was conducted outside a controlled laboratory environment, participants received participation details with the html link. Participants received two ‘html’ links to participating in this study. One link led to the homepage of the OBC website, while the other led to a subpage related to the brand CARE. They were asked to exclusively access the study from their mobile devices with a working webcam due to the website analytics on how most visits are applied from the mobile phone. We have limited participants to access from mobile; according to the stats, the majority of OBC students participate in the website through mobile devices only.

In the first task, participants were asked to navigate through the OBC's homepage as they usually would, while in the second task, they were asked to browse through the CARE page to find more information about the research resources offered since the goal of the research was threefold: 1) to determine how much the content on the homepage is following the preferences of visitors; 2) how the website can be improved based on the obtained neurometrics; 3) to get an insight into participants' attentiveness levels leading to encoding and recall

of information based on the page design. During this website testing, participants' gazing activity was measured over time to calculate their attention distribution. Heat maps were utilized to observe the movement pattern around the website, and emotions were analyzed through facial coding to obtain insights into participants' behaviour and reactions to the website. In the end, participants were also asked to answer five questions to gauge their user experience, learn about their expectations and reasons for visiting the website, and test their attentiveness levels.

III. RESULTS

The experiment data obtained from participants were grouped into two subgroups: homepage and CARE page, each representing one website at the official OBC website link: www.oxfordbusinesscollege.ac.uk.

A. Homepage

The participants' results from the homepage test were investigated through the analysis of the eye tracking data, the facial coding, and the survey data.

1) Eye-tracking data: Regarding the eye-tracking measurements, a one-way repeated-measures ANOVA was performed for time to first fixation (TTFF), percentage of participants who fixated on the AOI, number of fixations within AOI, and time spent fixating on the AOI. The heat map for the OBC's homepage reveals that the top of the homepage was a point of attraction for participants (Fig. 1). This is not surprising as the top part is immediately visible once you open the webpage, while to see other information, one needs to scroll the website. The seen order indicates that participants first notice the part of the homepage in the middle of their screen and their eye level height (AOI 2), followed by the upper part of the homepage (AOI 1).

Based on the obtained heat map, in this browsing-only condition, gaze points were concentrated from left to center, meaning that most information presented on the right was not seen. For the quantitative eye-tracking analysis, the OBC's homepage was divided into five areas of interest (AOIs) (Fig. 2).

A one-way within-groups analysis of variance (ANOVA) was used to assess the impact of AOIs of the OBC's homepage page on the attention metrics (i.e., Number of fixations, time to the first fixation, time viewed, Number of visits, Fixating Percentage) (Table I, Table II).

Null hypothesis: There are no significant differences between the number of fixations, number of visits, time to the first fixation, time viewed, and a fixating percentage between AOIs of the homepage.

The result of the analysis showed there was a significant difference within the number of fixations between the AOIs of the OBC's homepage ($F (5, 180) = 7.223$, $p = .000$). The post hoc analysis demonstrated that the total number of fixations of AOI 1 was significantly higher than that of AOI 3 (mean difference = 21.07), AOI 4 (mean difference = 30.70), and AOI 5 (mean difference = 29.83). The total number of fixations of AOI 2 was significantly higher than AOI 4 (mean difference = 28.30) and AOI 5 (mean difference = 27.43). The total number of fixations of AOI6 was not significantly higher or lower than any other AOIs on the homepage.

Fig. 1. Heat map and seen order for the OBC's homepage.

TABLE I. SUMMARISED STATISTICS FOR OBC'S HOMEPAGE

Number of Fixations		F (5, 180) = 7.223, p = .000	
AOIs		**Mean Difference**	**p-value**
AOI 1	AOI 2	2.40	.999
	AOI 3	21.07	.019*
	AOI 4	30.70	.000*
	AOI 5	29.83	.000*
	AOI 6	18.50	.058

AOI 2	AOI 3	18.67	.054
	AOI 4	28.30	.000*
	AOI 5	27.43	.001*
	AOI 6	16.10	.142
AOI 3	AOI 4	9.63	.682
	AOI 5	8.77	.762
	AOI 6	-2.57	.999
AOI 4	AOI 5	-.87	1.000
	AOI 6	-12.20	.428
AOI 5	AOI 6	-11.33	.513
Number of Visits		F (5, 180) = 9.082, p = .000	
AOI 1	AOI 2	-1.30	.705
	AOI 3	1.93	.274
	AOI 4	3.13	.009*
	AOI 5	2.80	.028*
	AOI 6	3.77	.001*
AOI 2	AOI 3	3.23	.006*
	AOI 4	4.43	.000*
	AOI 5	4.10	.000*
	AOI 6	5.07	.000*
AOI 3	AOI 4	1.20	.771
	AOI 5	.87	.931
	AOI 6	1.83	.333
AOI 4	AOI 5	-.33	.999
	AOI 6	.63	.982
AOI 5	AOI 6	.97	.894
Time to First Fixation		F (5, 180) = 16.205, p = .000	
AOI 1	AOI 2	1.26	.847
	AOI 3	-4.18	.002*
	AOI 4	-7.64	.000*
	AOI 5	-8.04	.000*
	AOI 6	-7.69	.000*
AOI 2	AOI 3	-5.44	.000*
	AOI 4	-8.90	.000*
	AOI 5	-9.30	.000*
	AOI 6	-8.95	.000*
AOI 3	AOI 4	-3.46	.030*
	AOI 5	-3.86	.008*
	AOI 6	-3.51	.058
AOI 4	AOI 5	-.40	.999
	AOI 6	-.05	1.000
AOI 5	AOI 6	.35	1.000
Time Viewed		F (5, 180) = 7.244, p = .000	
AOI 1	AOI 2	.09163	1.000
	AOI 3	1.38	.022*
	AOI 4	2.01	.000*
	AOI 5	1.95	.000*
	AOI 6	1.22	.059
AOI 2	AOI 3	1.29	.040*
	AOI 4	1.92	.000*
	AOI 5	1.86	.000*
	AOI 6	1.13	.101
AOI 3	AOI 4	.63	.693
	AOI 5	.58	.768
	AOI 6	-.15	.999
AOI 4	AOI 5	-.05	1.000
	AOI 6	-.79	.462
AOI 5	AOI 6	-.73	.544
Fixating Percentage		F (5, 180) = 0.896, p = .519	

TABLE II. AVERAGE VALUES OF EYE-TRACKING METRICS FOR OBC'S HOMEPAGE

Time to First Fixation (s)	
AOI	***M***
AOI 1	1.66
AOI 2	0.40
AOI 3	5.84
AOI 4	9.30
AOI 5	9.70
AOI 6	9.35
Number of Fixations	
AOI 1	1301
AOI 2	1229
AOI 3	669
AOI 4	380
AOI 5	406
AOI 6	746
Number of Visits	
AOI 1	188
AOI 2	227
AOI 3	130
AOI 4	94
AOI 5	104
AOI 6	75
Time Viewed (s)	
AOI 1	2.95
AOI 2	2.76
AOI 3	1.52
AOI 4	1.01
AOI 5	1.00
AOI 6	2.71
Fixating percentage (%)	
AOI 1	96.67
AOI 2	100
AOI 3	96.67
AOI 4	83.33
AOI 5	90
AOI 6	60

Fig. 2. AOIs for OBC's homepage.

A significant difference was observed within the time until noticed between the AOIs of the homepage F (5, 180) = 16.205, p = .000. The post hoc analysis demonstrated that the meantime, until notice of AOI1, was only significantly lower than that of AOI3 (mean difference = -4.18), AOI4 (mean difference = -7.64), AOI5 (mean difference = -8.04), and AOI6 (mean difference = -7.69) of the home page.

The mean time until noticed of AOI2 was only significantly lower than that of AOI3 (mean difference = -5.44), AOI4 (mean difference = -8.90), AOI5 (mean difference = -9.30), and AOI6 (mean difference = -8.95) of the home page. The mean time until notice of AOI3 was only significantly lower than that of AOI4 (mean difference = -3.46) and AOI5 (mean difference = -3.86).

The analysis result also showed a significant difference within the time viewed between the AOIs of the homepage F (5, 180) = 7.244, p = .000. The post hoc analysis demonstrated that the mean time viewed of AOI1 was only significantly higher than that of AOI3 (mean difference = 1.38), AOI4 (mean difference = 2.01), and AOI5 (mean difference = 1.95) of the home page. The mean time viewed by AOI2 was only significantly higher than that of AOI3 (mean difference = 1.29), AOI4 (mean difference = 1.92), and AOI5 (mean difference = 1.86) of the home page. Finally, the mean time viewed by AOI6 was not significantly higher or lower than any other AOIs on the homepage.

AOI 1 and AOI 2 have the highest number of gaze points (AOI 1 = 1301; AOI 2 = 1229), the shortest time to first fixation (AOI 1 = 1.66; AOI 2 = 0.40), and the longest dwell time (AOI 1 = 2.95; AOI 2 = 2.76), suggesting that they attract the most visual attention and all of the important information for visitors should be placed there.

A significant difference was observed within the number of visits between the AOIs of the homepage F (5, 180) = 9.082, p = .000. The post hoc analysis showed that the total number of visits of AOI1 was only significantly higher than that of AOI 4 (mean difference = 3.13), AOI 5 (mean difference = 2.80), and AOI 6 (mean difference = 3.77) of the home page. The mean number of visits of AOI2 was only significantly higher than that of AOI 3 (mean difference = 3.23), AOI 4 (mean difference = 4.43), AOI 5 (mean difference = 4.10), and AOI6 (mean difference = 5.07) of the home page.

No significant difference was observed in the fixating percentage between the AOIs of the homepage (F (5, 180) = 0.896, p = 0.519). While all of the AOIs had high fixating percentages (AOI 1 = 96.67%; AOI 2 = 100%; AOI 3 = 96.67%; AOI 4 = 83.33%; AOI 5 = 90%, AOI 6 = 60%), only AOI 1 (188) and AOI 2 (227) had the highest number of visits suggesting again that these AOIs attracted participants' visual attention the most.

2) Facial coding: Tracking of facial expressions elicited during the exposure to the website's homepage was used to pinpoint the emotional activity of the website.

The results suggest that participants mostly elicited sadness (29.55%), neutrality (33.19%), and puzzlement (13.60%) while browsing the homepage, regardless of the AOI (Fig. 3). They also elicited slight disgust (4.33%), fear (3.51%), joy (5.21%), and surprise (29.55%). When combined with survey responses, such emotions can be attributed to the colour scheme used, difficulties in reading the material due to inadequate text colour contrast, and a mismatch between presented information on the homepage and participants' motivation for visiting the page.

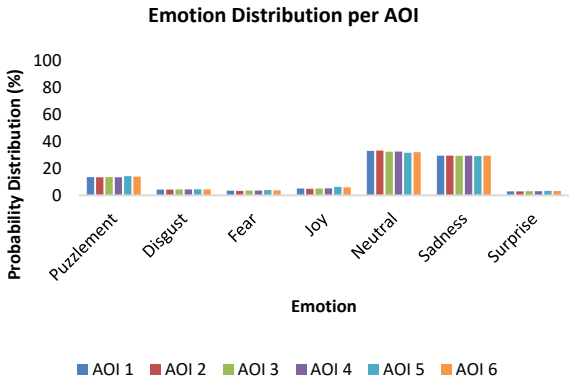


Fig. 3. Probability distribution of elicited emotions per AOI on the OBC's homepage.

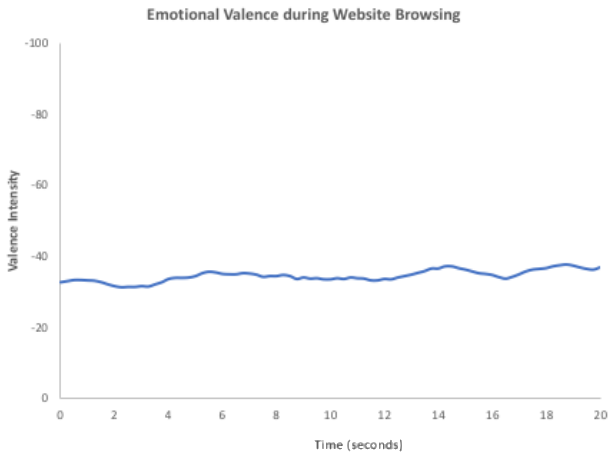


Fig. 4. Emotional valence intensity during OBC's homepage browsing.

During the 20-second interval of scrolling the homepage, the chart suggests that participants seemed to subconsciously show aversiveness towards the material presented on the website (Fig. 4). A slight decrease in aversiveness was observed between the second and fourth minute as, in that period, participants were looking at the images with the muted colour scheme. With the slight increase of aversiveness as time passed, it is possible that participants did not find the information they wanted and that the colour scheme used created a sensory overload.

Throughout homepage browsing, participants had relatively higher intensities of negative emotions than positive ones (Fig. 5). The most significant difference was observed towards the end of browsing. Scattered gaze points across the homepage in that period could be attributed to the fact that: 1) after the 12th second, nothing was interesting enough to capture their attention; 2) the page layout did not meet their expectations, and they did not find the information they were looking for; 3) the colour scheme used was overly stimulating to hold their attention for a more extended period.

A slight increase in the positive mood intensity was observed when participants looked at the areas with only images with muted colour schemes or used brighter colours to highlight crucial textual information such as upcoming events and student blogs (AOI 4 & AOI 5).

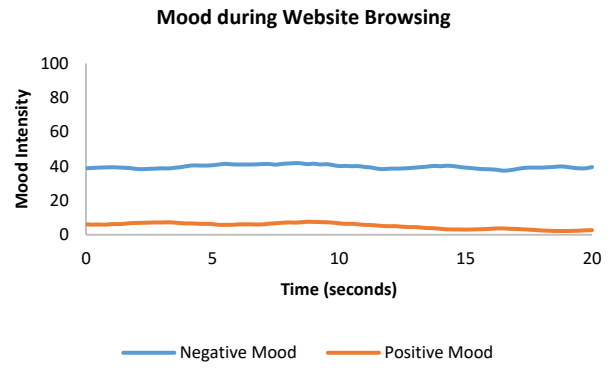


Fig. 5. Intensity of positive and negative emotions while browsing OBC's homepage.

3) Survey: Participants had different reasons for visiting the website: to learn more about different courses (25.5%), to get updates on events (21.8%), to read interesting news (16.4%), and to learn more about research opportunities (18.2%). Several participants (18.2%) also had other (unknown) reasons. While 34.1% of the participants said it was neither hard nor easy to navigate the OBC website, 25% found it somewhat easy, and 20.5% very easy. However, 15.9 % found it somewhat hard, and 4.5% found it hard (Table III).

Regarding the preferences on the website, 45.7% would not change anything, while 42.9% would change the design, colours used, and text. A few participants would change everything (2.9%), while 8.6 % needed to know what they would like to change (Table III). Some of the comments regarding changes were that the text colour on the slider makes the text unreadable, change text colour or background, the website does not look like a college website because of too many colours, and add courses on the homepage.

Most participants did not know the answer (81.6%). A few (15.8%) gave the wrong answer, while only 2.6% answered correctly. Taken together with the heat map, this result suggests that this vital information was not encoded despite being seen.

B. CARE Page

The heat map for the CARE page reveals that the top of the CARE page was a point of attraction for participants (Fig. 6). The seen order indicates that participants first notice the page's heading (AOI 1); however, the most significant point of attraction was the upper part of AOI 2, which is located in the middle of their screen and their eye level height. In contrast, the area dedicated to research resources was not seen at all (AOI 3).

TABLE III. WEBSITE VISITS, NAVIGATION EASINESS, AND PREFERENCES

Participants' reasons for visiting the website	
Learn more about different courses	25.5%
Event updates	21.8%
News	16.4%
Research opportunities	18.2%
Other	18.2%
OBC website navigation level of easiness	
Hard	4.5%
Somewhat hard	15.9%
Neither hard nor easy	34.1%
Somewhat easy	4.5%
Very easy	20.5%
Preferences	
Change nothing	45.7%
Change (design, colour, text)	42.9%
Change everything	2.9%
Unsure	8.6%

Fig. 6. Heat map and seen order for the OBC's CARE page.

Results also reveal that in this text-based webpage, participants used the 'F' pattern scanning of text where the first few words on the left of each line at the top of the page receive more fixations than subsequent words on the same line, while text towards the end is not seen.

The CARE page was divided into three AOIs to obtain quantitative eye-tracking metrics (Fig. 7). A one-way within-groups analysis of variance (ANOVA) was used to assess the impact of AOIs of the OBC's CARE page on the attention metrics (i.e., Number of fixations, time to the first fixation, time viewed, Number of visits, Fixating Percentage) (Table IV, Table V).

Null hypothesis: There are no significant differences between the number of fixations, Number of visits, time to the first fixation, time viewed, and the fixating percentage between AOIs of the CARE page.

Alternate hypothesis: There are significant differences within the Number of fixations, Number of visits, time to the first fixation, time viewed, and the fixating percentage between AOIs of the CARE page.

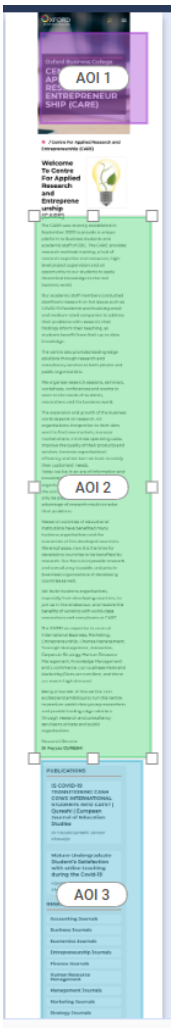


Fig. 7. AOIs for CARE page.

TABLE IV. SUMMARISED STATISTICS FOR CARE PAGE

Number of Fixations		F (2, 180) = 21.347, p = .000	
AOIs		**Mean Difference**	**p-value**
AOI 1	AOI 2	-128.43	.000*
	AOI 3	-9.33	.869
AOI 2	AOI 3	119.10	.000*
Number of Visits		F (2, 180) = 29.372, p = .000	
AOI 1	AOI 2	-10.80	.000*
	AOI 3	.13	.995
AOI 2	AOI 3	10.93	.000*
Time to First Fixation		F (2, 180) = 33.249, p = .000	
AOI 1	AOI 2	-2.48	.243
	AOI 3	-11.72	.000*
AOI 2	AOI 3	-9.24	.000*
Time Viewed		F (2, 180) = 22.024, p = .000	
AOI 1	AOI 2	-8.60	.000*
	AOI 3	-.63	.860
AOI 2	AOI 3	7.96	.000*
Fixating Percentage		F (2, 180) = 0.171, p = .848	

TABLE V. AVERAGE VALUES OF EYE-TRACKING METRICS FOR THE CARE PAGE

Time to First Fixation (s)	
AOI	**M**
AOI 1	0.16
AOI 2	2.63
AOI 3	15.49
Number of Fixations	
AOI 1	1715
AOI 2	5568
AOI 3	1995
Number of Visits	
AOI 1	148
AOI 2	472
AOI 3	144
Time Viewed (s)	
AOI 1	3.77
AOI 2	12.37
AOI 3	5.75
Fixating percentage (%)	
AOI 1	100
AOI 2	100
AOI 3	76.67

A significant difference was observed within the number of fixations between the AOIs of the CARE page (F (2, 180) = 21.347, p = .000), where the total number of fixations of AOI 2 was significantly higher than that of AOI 1 (mean difference = 128.43) and AOI 3 (mean difference = 119.10)). The total number of fixations of AOI 3 was significantly lower than that of AOI 2 (mean difference = -119.10).

A significant difference was observed within the time to first fixation between the AOIs of the CARE page (F (2, 180) = 33.249, p = .000), where the average time to first fixation of AOI 1 was only significantly lower than that of AOI 3 (mean difference = -11.71) and the average time to first fixation of AOI 2 was significantly lower than that of AOI 3 (mean difference = -9.24).

A significant difference was also observed for the time spent looking at a particular AOI (F (2, 180) = 22.024, p = .000), where the average time viewed of AOI 2 was significantly higher than AOI 1 (mean difference = 8.59) and AOI 3 (mean difference = 7.96). No significant difference in the average time viewed was observed between AOI 1 and AOI 3.

Taken together, AOI 2 has the highest number of gaze points (5568) and the longest dwell time (12.37 s) when compared to AOI 1 (1715; 3.77 s) and AOI 3 (1995; 5.75 s), suggesting that it attracts the most visual attention. Since AOI 1 has the shortest time to first fixation (0.16 s), followed by AOI 2 (2.63 s) and AOI 3 (15.49 s), the information about research resources from AOI 3, to be seen, should be placed between AOI 1 and AOI 2, as it is the vital point of the CARE.

A significant difference was observed within the total number of visits between the AOIs of the CARE page (F (2, 180) = 29.372, p = .000). The post hoc analysis demonstrated that the total number of visits of AOI 2 was significantly higher than that of AOI 1 (mean difference = 10.80) and AOI 3 (mean difference = 10.93). In contrast, no difference was observed in the total number of visits between AOI 1 and AOI 3.

No significant difference in the fixating percentage was observed (F (2, 180) = 0.171, p = .848).

IV. DISCUSSION

Eye-tracking behaviour neurometrics from OBC's homepage suggest that the top parts of the webpage are noticeable, especially those in eye-level height. Since gaze points were concentrated on the webpage's upper left and center positions, it is suggested to position all the vital information regarding offered courses, events, and research opportunities (Fig. 4) there. In that way, not only will visitors' attention be grabbed, but most importantly, they will also be given the requested information and will even be motivated to scroll down the page afterward.

A comparison between the homepage and the CARE page suggests that the time to the first fixation, the number of fixations, the number of visits, and the time viewed highly depend on the visited page. In contrast, the fixation percentage is the only observed metric varying in the same range regardless of the visited page (Table VI). Moreover, all the metrics were higher for the CARE page, indicating that the latter requires higher visual attention than the homepage.

TABLE VI. COMPARATIVE TABLE FOR OBC'S HOMEPAGE AND CARE PAGE

M (OBC's homepage)	M (CARE page)
Time to First Fixation (s)	
0.40-9.70	15.49-0.16
Number of Fixations	
1301-746	5568-1715
Number of Visits	
277-75	472-144
Time Viewed (s)	
2.95-1.00	12.37-3.77
Fixating percentage (%)	
100-60	100-76.67

Observed sadness, puzzlement, and neutrality regardless of the AOI within the homepage, together with survey answers, could be attributed to the colour scheme used (overly stimulating), difficulties reading the material due to inadequate colour-text contrast, and mismatch between the order of presented information on the homepage and participants reasons for visiting the page. This was also supported by an observed increase in the intensity of positive mood and a decrease in the aversiveness in the page areas where images with the muted colour scheme were used. In the future, it is suggested to use neutral colours for backdrops and one or two stimulating, bright colours to highlight materials of interest [19].

Based on the eye-tracking behavioural neurometrics, emotion analysis, and survey answers, a re-design is recommended as information of interest for visitors needs to be optimally positioned on the website, and most of it goes unnoticed. Even if noticed, it does not get encoded and recalled due to inappropriate colour-text contrast(as seen in the survey on slide 13) [20].

V. CONCLUSION

The findings of this research showcased the importance of college websites and their crucial role in attracting regional and international students. Colleges must build better, more user-friendly websites as current and prospective students increasingly rely on technology. The gaze activity was assessed over time to determine their attention distribution. The heat maps were essential in observing the movement pattern around the website. Emotion analyses using facial coding to gain insight into their behaviour and reactions to the website played an imperative role during this website testing. The results showed that participants' negative feelings were more intense than their good emotions when the content required page scrolling, while a difference was noticed near the end of the browsing session. However, looking at regions with just photos in a subdued colour scheme or where brighter colours were used to emphasize essential textual information such as forthcoming events and student blogs, the participants' pleasant mood intensity increased somewhat. Lastly, participants employed the 'F' pattern monitoring of text on the text-based homepage, where the first few words on the left of each line at the top of the page received more fixations than other words on the same line, while text near the end was not viewed. According to these lines, this research demonstrates how with the help of neuroscientific research tools, an insight into students' behaviour and their subconscious preferences. Despite the use of online study with the webcam-based eye tracking solution (15Hz), the obtained results are an example of how very accurate and valuable marketing insights of the consumer's subconscious on the website's perceived process and preferences can be obtained. The limitation of the study was the big screenout (92 subjects) and 124 participants who partially were involved in the study (participants who started the experiment but closed the browser or had timed out before reaching the end), where we presume this is due to the reason what participants did not receive any incentives for attending to this research. In addition, the software used is susceptible and discredits the participant at a slight shift of the head, which gives us merit results at the very end. Since the research was limited to the mobile device based on the website stats of visitors per device, to achieve the best results possible, the total sample size needed to be increased on other devices, too, which will result in a better percentage of quality recordings.

A. Recommendations

In this age, where everything relies on technology, providing students with appropriate websites they can depend on to find the needed information is necessary, as they often need an alternative. Both homepage and CARE required a certain amount of attention with varying magnitude depending on the website's content.

B. Homepage

For this case, enhancing the user's experience by:

- keeping the text clear and concise and avoiding complex language.
- using bright colours.
- using text alternatives such as images, videos could be used.

C. CARE

The higher metrics (Number of fixations, time to the first fixation, time viewed, number of visits) compared to the homepage reveal that further action should be taken to reduce the page complexity and the cognitive load and to make it more accessible to students. Such action includes changing the page's design, colour, and text since over 42% opted for such changes.

Similar suggestions to the homepage can enhance the number of fixations, and time to the first fixation, time viewed. Moreover, the higher number of visits can be improved by providing ways to help the visitor get around the website, identify the main content, and where the navigation is.

ACKNOWLEDGMENTS

This study was done in collaboration with the Institute for Neuromarketing, Zagreb, Croatia, which provided support for neuromarketing equipment and data analysis. The research was conducted exclusively for development and scientific advancement. The authors would like to acknowledge the

support of Oxford Business College in paying for the Article Processing Charges (APC) for this publication and the Institute for Neuromarketing for covering all neuromarketing research costs.

REFERENCES

[1] Poock, M. C., & LeFond, D. (2001). How college-bound prospects perceive university websites: Findings, implications, and turning browsers into applicants: college and University, 77(1), 15.

[2] Schimmel, K., Motley, D., Racic, S., Marco, G. and Eschenfelder, M. (2010). 'The importance of university web pages in selecting a higher education institution', Research in Higher Education Journal, Vol.9, 1.

[3] Alstete, J.W. and Beutell, N.J. (2004) 'Performance indicators in online distance learning courses: a study of management education, Quality Assurance in Education, Vol.12, pp.6-14 doi:10.1108/0968488 0410517397.

[4] F. Espigares-Juradoa. F. Muñoz-Leiva, M. B.Correiac, C. M. R. Sousad, C. M. Q.Ramose, L. Faíscaf, 'Visual attention to the main image of a hotel website based on its position, type of navigation and belonging to Millennial generation: An eye tracking study', Journal of Retailing and Consumer Services, vol 52, January 2020.

[5] I. Michael, T. Ramsoy, Me. Stephens, F. Kotsi, 'A study of unconscious emotional and cognitive responses to tourism images using a neuroscience method', Journal of Islamic Marketing, January 2019.

[6] Y. M. Hwang, Kl C. Lee, 'Using an Eye-Tracking Approach to Explore Gender Differences in Visual Attention and Shopping Attitudes in an Online Shopping Environment', International Journal of Human–Computer Interaction vol 34, Issue 1, April 2017, pp.15–24.

[7] E. A. V. Reijmersdal, E. Rozendaal, L. Hudders, I. Vanwesenbeeck, V.Cauberghe, Z. M.C. V. Berlo, 'Effects of Disclosing Influencer Marketing in Videos: An Eye Tracking Study among Children in Early Adolescence' Journal of Interactive Marketing, vol 49, Issue 1, February 2022.

[8] K. Keib, C. Espina, Y.I Lee, B. W. Wojdynski, D. Choi, H. Bang, 'Picture This: The Influence of Emotionally Valenced Images, On Attention, Selection, and Sharing of Social Media News' Media Psychology, vol 21, October 2017, pp 202–221.

[9] A. Duque, C. Vázquez, 'Double attention bias for positive and negative emotional faces in clinical depression: Evidence from an eye-tracking study' Journal of Behavior Therapy and Experimental Psychiatry, vol 46, March 2015, pp 107–114.

[10] J. Zhang, A. B. Chan, E. Y. Y. Lau, J. H. Hsiao,'Individuals with insomnia misrecognize angry faces as fearful faces while missing the eyes: an eye-tracking study', Sleep, vol 42, Issue 2, February 2019.

[11] U. Bhandaria, K. Changa, T. Nebenb, 'Understanding the impact of perceived visual aesthetics on user evaluations: An emotional perspective', Information & Management, vol 56, Issue 1, January 2019, pp 85–793.

[12] A. T. Stulla, L. Fiorellab, R. E.Mayera,'An eye-tracking analysis of instructor presence in video lectures', Computers in Human Behavior, vol 88, November 2018, pp 263–272.

[13] P. Klein, J. Viiri, S. Mozaffari, A. Dengel, J. Kuhn, 'Instruction-based clinical eye-tracking study on the visual interpretation of divergence: How do students look at vector field plots?' Phys. Rev. Phys. Educ. Res. vol 14, March 2018.

[14] M. Azimzade, F. Nobakht. Z. Aminiroshan, M. S. Sotoode , 'Employing Eye Tracking in Quantifying and Qualifying Visual Attention of Web Site Viewers (Physical Education Faculties)', Journal of Advanced Sports Technology, vol 4, Issue 1, June 2020, pp 9–19resources/ publications/ethicalguidelines-for-educational-research-2018/.

[15] Mestre, L.S. (2012). ' Assessment of learning objects. Designing Effective Library Tutorials, pp.205–201, https://doi.org/10.1016/B978-1-84334-688-3.50009-3.

[16] Sungkur, R. K., Antoaroo, M. A. and Beeharry, A. (2016). 'Eye tracking system for enhanced learning experiences, Education and Information Technologies, Vol.21, pp.1785-1806 doi:10.1007/s10639-015-9418-0.

[17] Faul, F., Erdfelder, E., Lang, A.-G. and Buchner, A. (2007). 'G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences, Behavior research methods, Vol.39, pp.175-191 doi:10.3758/BF03193146.

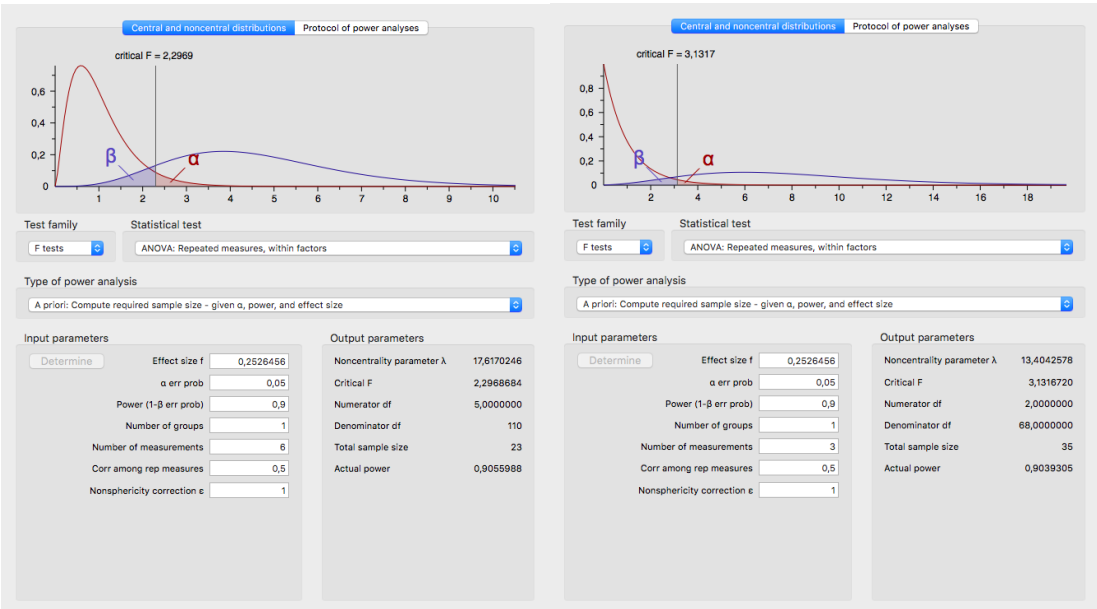
[18] British Educational Research Association [BERA] (2018), Ethical Guidelines for Educational Research, fourth edition, London. https://www.bera.ac.uk/researchers.

[19] Wenham, D. and Zaphiris, P. (2003). 'User interface evaluation methods for internet banking websites: a review, evaluation and case study, Human-Computer Interaction, Theory and Practice, pp.721-725.

[20] Heimlich, J.E. and Wang, K. (1999) Evaluating the structure of web sites.

APPENDIX

G*Power output for OBC homepage and CARE page.



Based on the G*power output [16], to detect the effect with 90% power and a two-sided significance level of 5%, a sample size of n=23 for the OBC homepage and n=35 for the CARE page is required.

Survey questions used in the study:

1) How often do you visit this website?

2) Never / Very Rarely (once per month) / Rarely (2-3 times per month) / Occasionally (2-3 times per week) / Frequently (1-2 times per day) / Very Frequently (more than three times per day)

3) Why are you visiting this website?

To learn more about the offered courses / To read interesting news / To get updates on events / To learn about research opportunities and resources / Other (please specify)

4) How easy was it to navigate this website?

Very Hard / Somewhat Hard / Neither Hard nor Easy / Somewhat Easy / Very Easy

5) What would you like to change on this website?

6) What is the name of the recent award that OBC got?