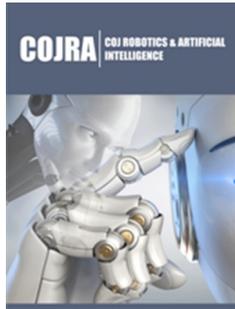


The Effect of Facebook Page Design on Emotion Change and Behavioral Engagement: Neuromarketing Research in Higher Education

ISSN: 2832-4463



***Corresponding author:** Martina Šola H, Research Coordinator at Oxford Business College, Director General at the Institute for Neuromarketing, UK

Submission:  July 21, 2022

Published:  October 18, 2022

Volume 2 - Issue 4

How to cite this article: Martina Šola H, Hussain Qureshi F, Khawaja S. The Effect of Facebook Page Design on Emotion Change and Behavioral Engagement: Neuromarketing Research in Higher Education. COJ Rob Artificial Intel. 2(4). COJRA. 000541. 2022.
DOI: [10.31031/COJRA.2022.02.000541](https://doi.org/10.31031/COJRA.2022.02.000541)

Copyright@ Martina Šola H, This article is distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use and redistribution provided that the original author and source are credited.

Martina Šola H^{1*}, Hussain Qureshi F² and Khawaja S³

¹Research Coordinator at Oxford Business College, UK

²Director of Research and Quality Assurance at Oxford Business College, UK

³Chairman of Oxford Education Group, UK

Abstract

Given the increased popularity of social media in current years, there has been an increase in Facebook (FB) advertisements in educational institutions. As students nowadays tend to use FB pages to attain more knowledge and improve their skills, the current research is focused on understanding how such pages can be improved using the advanced and emerging technique of neuromarketing. Tobii Sticky was used to evaluate obtained eye-tracking behavioral measurements assessing visual attention, emotional analysis via facial recognition, and survey questions providing insights into users' experience. While survey results suggested that subjects thought that the Oxford Business College (OBC) has well-designed visuals, the eye-tracking metrics showed otherwise - it took more than 20 seconds to notice the visuals, and subjects spent on average one second looking at the material. Majority of the subjects reported mostly feeling neutral while scrolling the FB page; however, an in-depth emotional analysis showed higher intensity of negative emotion and aversiveness toward the material. This study encourages marketers in Higher Education to reevaluate their traditional research methods focused on surveys and group discussions and implement neuromarketing methods for obtaining reliable and subconscious information.

Keywords: Behavioral engagement; Neuromarketing; Higher education; Emotion; Social media

Abbreviations: OBC: Oxford Business College; UK: United Kingdom; FB: Facebook; TTFF: Time to First Fixation; AOI: Area of Interest; LTIL: Long Text, Image, and Logo; STI: Short Text and Image; LTIT: Long Text, Image with Text; IL: Image and Logo; STIL: Short Text, Image, and Logo; SNSs: Social Networking Sites; EI: Emotional Intelligence; CBE: Cognitive Behavioral Engagement

Introduction

The explosive rise of social media and other Web 2.0 techniques has never been seen before. In current years, social media has exploded in popularity. Given the availability and ubiquity of social media, businesses must adapt to a new and complex context when it comes to interacting with consumers. Even though this topic has been hotly contested in recent years, experts have given social media a lot of attention as an important element of marketing communications [1]. Companies have become more reliant on social media platforms such as FB, Twitter, and Instagram for a number of reasons, including brand promotion, product promotion, and general exposure [2]. Facebook is a famous social network site that may be utilized for both personal and professional reasons. Instructors and learners may increasingly establish digital ties, erasing physical obstacles and facilitating the transfer of information, ideas, and many other instruments [3]. Facebook tries to create and sustain significant contacts with people, it's conceivable that connectedness demands may be met, which could improve scholastic engagement (including behavioral and emotional engagement). The

extent to which individuals, situations, or events can meet these emotional demands may help students achieve their highest levels of scholastic engagement and performances [4].

One of the major purposes of using Facebook and Twitter is to serve as a communication platform which connects businesses with others who are interested in buying the product while also making them recognizable for those that are confused with them. These companies use social media to spread awareness, learn about their own customers, as well as target them. That is the only marketing method which can identify clients at every phase of the purchase decision. (Wayback Machine, n.d.) Both these advantages of social networking business are as follows: social media is linked to 7 of the top ten aspects that corresponds with an effective Google organic search. This means that businesses that are less involved or non-active on social networks have a lower chance of occurring in Google searches. While sociocultural media platforms such as Twitter, Facebook, and Google+ have more monthly active users, mobile platforms based on visual content aggregation have a relatively high interaction rate, the biggest increase, and have altered how consumers to interact with digital marketing. Instagram has a 1.46 percent excitement and enthusiasm with 130 million monthly users, while Facebook has a 0.03 percent interaction rate with 210 million daily users. (Social Media Marketing: How Do Top Brands Use Social Platforms? [Charts], 2013) In contrast to other types, which can be extremely expensive for this many businesses, a social media presence does not require an exorbitant budget [5].

Twitter accounts provide far less information than Facebook pages. They allow a product to also include video content, photographs, lengthier characterizations, and testimonials, as well as allow believers to actually comment on product pages for others to see. Facebook can send the out occasion reminders while also linking to the company's Twitter page. As of May 2015, 93 percent of business marketers used Facebook to promote their brand. As per a 2011 study, Facebook ads accounts for 84% of all "engagement," or click - through and likes. By 2014, Facebook had limited the material that could be communicated from corporate brand pages. The viewer for non-paying business pages has shrunk from 16% in 2012 to 2% in 2013. (Ogilvy, n.d.) Emotions play a significant role in our lives, influencing our ideas and behavior, along with reasoning, making an opinion, and developing an attitude. It has been observed that social networking activity might cause emotional and sentimental reactions. Emotion self-reports were used to investigate the positive (joy) and negative (i.e., jealousy) emotional reactions when reading through the chats on FB [6].

Their results show that people are happy when they have a deep relationship with the sender who sent the text [6]. Advertisement on social media such as FB tries to influence the consumers' attitude in order to promote the well-being of both people and the community. Because non-benefactory acts are seen as impalpable and are concerned with services, the problems for social marketing are to retaliate to the trading system from a social standpoint. Neuroscience, which is applicable to users' attitudes, is

an additional benefit as it provides aspects describing how people react to emotional material [7]. The institutions, where technology is changing the way students interact, cooperate, and study is not always visible on social media all the time. Moreover, the usage and effect of social media are changing according to the environment of students. The concept that social media may be an effective tool for education has recently been widely accepted for personal and corporate objectives [8]. As students are extensively involved in social media apps like Twitter, FB, and Instagram for entertainment and education purposes, these apps have brought emotional and behavioral changes in students, so it becomes easy to predict the academic success or failure of students by analyzing the change in behavioral or emotional engagement. Hence, the current study focuses on:

Significance of the study

The study will add to a plethora of information on Facebook addiction and its impact on college students' educational outcomes as an emergent and rapidly developing new tech, making it indispensable for decision-makers, development partners, telecommunications companies, regular clients, and potential users. As a side effect, the findings of this study can aid those efforts by trying to raise grassroots knowledge. This will, in particular, serve as just a showpiece for any intrigued body in charge of students' performance, especially in colleges. Aside from the aforementioned, everybody in academia sees social media as a diversion that allows students to procrastinate in their studies. However, some students say that using social media platforms during classroom time did help them deal with boredom throughout college. This study will explore the effects of Facebook on college students and how they can use that to supplement their research. Moreover, the study results seek to fill a gap in the current literature on the consequences of Facebook Page Design on Emotion Change and Behavioral Engagement: Neuromarketing Research in Higher Education."

How does a FB page affect the emotional change and behavioral engagement of students in Higher Education?

Social Networking Sites (SNSs), like FB, are the newest instances of students' widespread use of communication technology and thus have the efficacy to become an important resource in the reinforcement of educational communications and faculty cooperation. This technology may encourage teachers that such SNSs are a viable answer for the requirement for instructors to maintain a good connection with their students [9,10]. Particularly, the amount of Emotional Intelligence (EI) of a student may be a major influence, considering its links to academic success [11]. Student involvement is a relatively new concept in marketing, with evidence that it includes cognitive, sentimental, and behavioral elements that make up a Cognitive Behavioral Engagement (CBE) framework [12]. This paper is mainly concerned with:

The analysis of emotional change and behavioral engagement of students on the FB page using various techniques. For the analysis, the OBC's FB page (emotion and behavior) will be tested

using facial coding and eye-tracking. Eye movements are regulated by the brain, and Electroencephalography (EEG) may be used to identify brain activity. The process of acquiring information and determining significance relies heavily on visual attention to the textbook. In assessing textbook relevancy, understanding of words can be separated from other dominant cognitive processes [13]. Facial coding has been done by analyzing the activity of facial muscles on any advertisement or website. Moreover, Tobii Sticky has been used to test the eye-tracking and emotional response following a questionnaire.

Social media technology and higher education

Park et al. [14] studied that because of the growing popularity of online education for a variety of educational goals, it has become increasingly popular in current times. Most higher education institutions make use of the capabilities of online learning by including a range of learning settings. In the instruction of big groups, asynchronously online studying is chosen above other types of online education. The process of learning in asynchronous online education is often carried out via learning resources, assessments, projects, and conversation tasks, whereby learners often supplement their learning and perform tasks using their own ways. Depression, loss of enthusiasm in the subject, academic difficulties, and refusal to accept responsibilities are all examples of concerns that might hinder their student achievements [14].

Challenge of delineating social media had been made more difficult by the reality that it is in continual flux [15]. Moreover, SNSs change as innovators adds substitute or improved qualities to satisfy the needs of students. Some social networks cater to certain specialized markets; thus, specific features may be customized to specific consumers [15]. The quality of sharing any finding and the inter-relationship functionality of techniques is significantly connected to the students' good learning skills with the usage of social networks, as proven by Hung et al. [16]. Since the development of facts and communication processes in the e-learning context, most academics admit that the latter has been extensively examined and debated in many papers for years. Social webbing, as supplemental learning equipment, has the potential to improve students' feeling of classroom society, which adds to their classroom both in and out of the class [16].

Use of fb in higher education

Previous studies found that FB might be the confrontation of the internet's SNSs [17]. It is the "higher-level" social webbing site, founded in 2004 by Mark Zuckerberg, a Harvard undergraduate [17]. According to a study by Daniels et al. [18], Higher education institutions throughout the world were expected to implement revisions to their curriculum for students for the Winter 2020 educational term. Professors changed their teaching and evaluation procedures to remotely web presentations suddenly and inexplicably. This rapid transition gave investigators an unanticipated chance to look at student engagement for their coursework in diverse educational environments. Throughout COVID-19 and then in online teaching, researchers utilized a

unique questionnaire to obtain retroactive self-report information from a random group of Canadian university students on personal enthusiasm, engagement, and views of achievement and failure. Students' performance objectives, engagement, and views of achievement all went down, but their views of cheating went up. We also utilized regression studies to look for links between accomplishment objectives and involvement, achievement views, and cheating worries.

More involvement and stronger views of achievement were positively and significantly connected with achievement motivation. The success targets have nothing to do with cheating. Participants who were worried regarding cheating in big courses grew much more anxious in online learning. Our research revealed data to investigators and educators regarding the relationship between accomplishment objectives and student results in a variety of educational situations [18]. According to a study by Hyslop [19], assessing the effects of the move to online presentation on academic enthusiasm, engagement, and judgments of achievement and failure is critical for couple of reasons. Firstly, it appears that, at particularly in the immediate future, many programs will be given online, despite the intention of teachers and students to reconnect to face-to-face training [19].

For several years, the advantages of social media for learning in higher education institutions have been actively researched, with important study findings gained in several disciplines. Social networking may also help engage younger populations of students with institutions of higher learning, as well as enhance learning systems and social interaction in both official and unofficial settings. While there is still academic involvement in learning via a social platform, particularly those concentrated on Facebook, the latest report on current developments in educational technological advancements and design papers found that social media research, particularly those concentrated on Facebook, try to generate attention among scholars [20,21]. Even though computerized technologies continue to infiltrate every area of our daily life at an increasing rate, the educational system maintains its half a century fight to determine what part these advances should perform in successful academic activities [22].

Effect of FB on behavioral engagement and attitude in educational institutions

Mayer et al. [23] studied that there are three major components to student engagement: behavior, emotional, and cognition. All the other characteristics of student involvement are drawn from behavioral, cognition, and emotional connection, that is how all the three particular elements of student participation have been defined. Humorous actions that cause students to experience pleasant sentiments might be used in this setting to create a favorable studying environment. Positive activities can assist to kick-start cognitive activities by raising enthusiasm and aiding comprehension by keeping people focused throughout studying. This might imply that emotions are a necessary component of behavioral and emotional engagement. Detrimental attitudes also

have a negative impact on academic achievement, emotional and behavioral engagement [23]. According to the studies of Erdogdu et al. [24] on engagement, it is feasible to improve the learning experience by establishing initiatives and engaging strategies that use a variety of techniques.

Humor, according to research, improves the student's engagement with the aspects of the learning procedure simple and enjoyable. Humor can pique students' enthusiasm, alleviate tiredness, boost enthusiasm and engagement, promote contingency, and make challenges easier [24]. Shahbaznezhad et al. [25] in their study figured out how social media platforms effects on behavioral engagement of consumers. Researchers looked at the straightforward impacts of structure and framework on consumers' emotional and behavioral engagement, and the mediating influence of contextual material on the relationship among every content category (intellectual, emotive, and commercial data) and consumers' involvement. The findings showed that contextual data influences the impact of social network material on consumer involvement. The results added to a better framework of digital media participation and consumer experiences. This study utilized a dualistic social networking site to experimentally test the concept of social media engagement behavior through the impacts of information kinds and contextual data [25].

Emails, instant messaging, and blogging have all been popular internet interaction apps a few years ago, making the internet a significant social relevant for adolescents and students' development. Nevertheless, some behaviors can happen due to students' everyday use of social networking sites, resulting in less time for those other actions such as academic, physical, and social pastimes that necessitate face-to-face interplay. The scheduled behavior theory underpins the psychosocial component of regular social networking websites. As per research, whenever an individual has a strong desire to engage in certain behaviors, the probability of engaging in those behavior patterns increases. Normative beliefs and soul are two critical factors of reasoned action theory about using social networking websites. Students who perceive social networking sites to be prescriptive among their peers are more likely to be using them commonly. A crucial component is self-esteem, which would be a behavioral result of interaction, innovation behavior, and attitude.

Young people with low self-esteem use electronic communication more commonly than those with good self. Positive feedback obtains better, while negative criticism decreases it. That is why socialization youngsters use online communication apps, which provide more positive interactions with others, investigate Perceptions and their effect on students' academic performance. For conversation, engagement, and participation, college graduates regularly use social network sites. Students can communicate with one another through social media sites depending on common activities, hobbies, or qualities. Facebook is the largest social online platform today, with the ability to form and sustain personal interactions, especially in educational environments. Because of

Facebook's increasing prominence, many academics and instructors are looking into its probable implications on educational and non-educational results amongst student populations. Several studies have connected Facebook have used to greater academic levels of accomplishment and engagement, as well as greater time invested in extracurricular activities, while some have connected it to poorer academic levels of achievement and student involvement [26,27].

Because of its universal popularity, Facebook has now been recognized as a powerful tool for higher education. In a study using survey methodology in such an independent group static correlational research design, the reactions of 586 enrolled students in Facebook-enhanced business schools were compared to others who were not. Two lecturers taught the courses from 2 distinct universities in the United States. The use of Facebook in educators' classes is the output factor. Facebook groups and discussion groups were found to be useful for educational purposes. In research of 35 postgraduate way away students who joined an extra Facebook group to talk about academic content, participation in the conversations enhanced learning and perceptions. Interplay with other student participants benefited students, particularly when they went further than the assigned learning resources and made a significant contribution to their ideas. Students, to this research, have favorable views on social video classes. (European Proceedings | Home, n.d.)

Emotional and behavioral changes due to FB page

Digital media such as FB may elicit both positive and negative emotions and found that research on the psychological consequences of social media use has shown conflicting results [28]. In the long run, using social media has advantages such as the ability to build and sustain social capital and social connection [28,29]. Facebook may also have negative consequences such as social overburden, an overly optimistic view of the life of others, and a reduction in life contentment [30]. In the short term, using FB can induce a state of flow, which is characterized by highly admiring valence and electrification, and the most prevalent good sensations expressed by users when using FB are "joyful and enjoyable" [30]. Engagement may be a synonym for the association with content, which is the result of psychological methodologies and is also conceptualized as a psychological condition [31]. Research has highlighted five key characteristics of student engagement behavior, including the valence of the answer (positive or negative response) and contextual variables, e.g., when and how the response is given [12].

Following the concepts of Van Doorn et al. [12], it can be stated that using psychological systems such as attitudes and behavioral intents in the creation of engagement behaviors are critical for a complete settlement of the informal method in the back of the content/engagement connection, with the focus on behavioral outcomes being more significant than factual connection (such as Likes). Real actions are quite easy measuring point for organizations than casualty of actual behavior, according to the major rationale for this approach [12]. It is especially challenging to describe

“feeling” because it overlaps with other emotional notions like preferences and moods. Emotions was defined as a psychological condition of ready for action that promotes behavioral triggers and aids in prioritizing and organizing activities in ways that maximize students’ responses to environmental demands [32]. Thus, emotions have unique referents, and they develop in reaction to an individual’s assessment of an event that is meaningful and important to them [32]. In the marketing environment, emotions have long been acknowledged as having a significant impact on human behavior.

With the introduction of web 2.0, advertisers now have access to useful information about the success of their social media advertising. Advertising is more successful when placed in media with less editorial content, such as FB or niche blogs [33]. The researchers showed that using celebrities as claims in these sorts of advertisements attracts potential customers’ attention [33]. Further, emotions have been important in the field of information technology for quite some time. For example, Schreiner et al. [34] extended the TAM (technology acceptance model) to emphasize the influence of emotion on technology adoption. The researchers employed self-reports to collect data on categorical emotional reactions in three longitudinal field investigations. The findings demonstrated that discerned contentedness influences perceived comfort of use, which in turn influences behavioral intention to use. Similarly, an analysis was conducted to gather categorical emotional responses [34].

Previous studies outlined the social motivations that lead to utilizing social networks and offer methods for their usage in their study on social cognitive mechanisms and brain systems [35]. Associating with others and controlling the indentation they leave on any other user are two major reasons why people use social media. These social media opportunities help students meet their fundamental social requirements and embrace behaviors depending on social cognition, which involves thinking about other users’ psychological conditions and encouragements [36]. The authors showed in their study that when users react to attain self-reputation rather than seeing the gains of others, the intensity of their FB participation can be anticipated [35].

Analysis of effects of the FB page on students

Webpages such as FB have become an acceptable and frequently used communication medium as Information Technology (IT) has advanced rapidly [37]. Understanding how people interact with a webpage is critical in designing to drive behaviors, as student experience becomes increasingly essential in producing competitive and creative goods. Excessive usage of the web pages results in the emotional change of the students as they use FB for a variety of purposes, including interacting with friends and for study purposes. In the current study, the change in emotions and behavior has been studied. Emotion recognition has been the subject of a growing number of studies in recent decades, owing to its importance and wide range of applications, particularly in human-machine interaction systems [38]. Emotion recognition has

a wide range of potential uses, whether on a professional, personal, or social level. An effective user interface can be built to monitor students’ emotional and cognitive states and respond to their attempts to manage their emotions while surfing web pages. Their early research relied heavily on non-physiological cues, including text, facial expressions, voice, and gestures.

Physiological signals, such as EEG, Pupillary Diameter (PD), Electromyogram (EMG), and Electrocardiogram (ECG), have recently been used in more studies because they appear to be more effective and trustworthy. Electroencephalography, which records brain activity in the central nervous system, has been shown to provide useful information on emotional reactions [39]. A consumer self-dependent emotion identification technique based on EEG, pupillary response, and gaze distance has the highest accuracies of 68.5% for three valence labels and 76.4 % for three arousal labels [38]. Because websites are a digital explosion, being able to look at a website through the eyes of a consumer gives a lot of information on how that user interacts with a website. Eye tracking is a promising technique that permits one to physically look at a website from a consumer’s perspective. An eye-tracking gadget can help attain how people see web pages by marking a non-stop stream of gaze points. Our eyes are continuously moving in order to choose a set of accessible data in our visual field and deliver it to the brain for further operation.

A subset of data that a consumer’s eye is ready for the brain to understand can be collected by tracking eye movements on a website [37]. Commercially, accessible eye-tracking systems now use a non-intrusive approach known as a video-based corneal reflection to collect eye movements. The visualization of fixation sites on a stimulus is referred to as fixation design. Fixation design can reveal a lot about a person’s spatial division and sequence of foveal snapshots on a stimulus. While gaze maps are effective for displaying a consumer’s fixation pattern, they become crowded when many consumers’ fixation patterns need to be tracked. Heat maps are a more user-friendly approach to visualize many consumers’ eye-tracking data. For example, heat maps, like gaze plots, may depict not only what items were recorded by consumers’ eyes, but also how intently they gazed at them [40]. Brand-related UGC(s) elicited emotional and cognitive reactions in customers and that these internal situations affected their behavior [41]. That is, when a user sees brand-related UGC on FB, the UGC(s) triggers the consumer’s internal information mechanism and, as a result, brand-related behavioral actions when the consumer analyses the information [41].

Another technique for analyzing emotion change and behavioral engagement is facial coding. Facial coding finds and quantifies micro-expressions that code non-conscious emotions (using a video camera) [42]. Facial expressions are natural and give real-time data; however, they rely on subjectivity to determine when an action has occurred or fits the coding criteria. Facial Electromyography (Facial EMG) is another test in which conscious and unconscious facial muscle motion represent conscious and unconscious displays

of emotions since each emotion is defined by a unique set of facial activities. Tiny surface electrodes capture activity from particular muscles that play a major role in the presentation of elementary emotions. Each of the neuromarketing approaches has its own set of strengths and drawbacks, making them more or less suited for particular study scenarios. Certain approaches in amalgamation appear to be more suited for developing more accurate and successful neuromarketing research [42].

As per countless studies, Facebook is becoming one of the most excellent prevalent social websites between teenagers and university students. Wollega University studied regular grads seeing how socioeconomic sites such as Facebook affect academic achievement. A survey was prepared to analyze the effect of Facebook addiction on students, and 384 students were selected and used a stratified sampling method. Among independent variables were Facebook usage, Addiction issues, and educational achievement. The Pearson product-moment relationship between two variables was used to analyze the correlation between Facebook usage, Facebook time spent, and student performance. Multiple regression was used to estimate the distinct charity contributions of Facebook addiction and time spent on Facebook to students' student ability. The SPSS software package was used for the analysis. Time spent using social media and addictive personality to them has a powerful impact on students' academic achievement in several different ways, as per the findings.

Neuromarketing is the advanced and emerging technique used in higher education that modifies and improves the level of learning for students. Importantly, during the literature survey, the authors observed that not much research describes the use of neuromarketing in higher education because the implementation of neuromarketing for analysis in higher education is not in common practice so author did not find much literature. As various websites and FB pages are used for learning by students, which assist them in attaining more knowledge and improving their skills, this research is focused on making the quality of webpages better. For this purpose, authors of this study analyzed students' emotional and behavioral changes using various techniques as discussed in detail, such as facial coding and eye tracking.

Material and Methods

Participants

The Institute for Neuromarketing has conducted a neuromarketing study in the UK with a sample of 90 OBC students, and followers of the official OBC's FB page (18-50, both genders) to determine why OBC, which has 410 000 FB followers, has a very low number of likes per post and published an average of 1.6 new posts per day (calculated on a sample of 54 posts in the period between July and August 2021). Based on the G*Power output (Faul et al. 2007) to detect the effect with 95% power, a two-sided significance level of 5% and a sample size of $n=31$ is required. All of the subjects were informed about the study and gave their written, informed consent in digital form via "Tobii Sticky" prior to taking

part in the study. Otherwise, they were not able to participate. Their participation was voluntary, and no incentives were given. Subjects' data were treated according to standard practice and in compliance with GDPR and the European Code of Ethics for Research. The Ethics Committee of the Institute for Neuromarketing approved this research and supervised the study in order to be underlined with local and international ethical guidelines which are officially published at the official Institute's website.

Materials

The study was set up on the last 20 FB posts in the period from July 22 to July 30, 2021, which were pre-recorded in the form of a scrollable image with a duration of 35 seconds due to Facebook's security system which limits the access from third parties when used for software measurements. The scrollable image most authentically illustrated the original FB platform, as subjects could click on a post, they wanted to take a closer look during the study, skip a post they did not care about, and return to posts they wanted to inspect more closely (they had the ability to scroll the mouse upward downward). Since the official FB site is primarily intended for students, the measurements were made on a realistic sample of daily posts related to student life, student events held at OBC, charity initiatives organized by OBC. The FB posts were grouped into five conditions based on the image used and the length of the post to test in detail whether the problem is in the length of the texts, or the designed posts published on the FB page.

The online platform for advanced quantitative research, "Tobii Sticky," was used to create the experiment and measure webcam-based eye-tracking (15 Hz) 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 get the strong outcome when differentiating what subjects are looking at for elements of a website and image. Given that this platform can be utilized for conducting research outside the laboratory without the physical control over the ISO eye-tracking standards, only recordings labeled as "usable" in Tobii Sticky were utilized since they suggest that these subjects met entirely technical requirements.

General procedure

Since the study was conducted outside a controlled laboratory environment, subjects received participation details with the "HTML" link. They were asked to exclusively access the study from their computer devices with a working webcam due to the technical limitation from the software where the stimulus images would have low quality due to lower optical resolution if presented on the mobile phone. Subjects were also provided with a set of images with instructions to ensure compliance with the technical requirements of the study before the 5-point eye calibration test. After the calibration, all subjects looked for 35 seconds at the identical 20 FB posts pre-recorded in the form of the scrollable image, presented in the same order as on the OBC's FB page. They were not able to

skip a certain part of the research, but with the mouse clicks it was measured how many subjects actually wanted to stop the research. Such data indicated the total number of subjects who are interested in the content published on the official FB pages of the OBC. While they were browsing through the FB posts as they usually do, subjects' gazing activity and emotional expression was measured over time using webcam-based eye-tracking. In the end, subjects were asked to answer a set of four multiple-choice questions in order to learn about their conscious preferences and opinions (See Appendix A).

Result

The OBC's FB posts were divided into the following five Areas of Interest (AOI) in order to evaluate in detail behavioral and emotional experiences: Long Text, Image, and Logo (LTIL); Short Text and Image (STI); Long Text, Image with Text (LTIT); Image and Logo (IL); Short Text, Image, and Logo (STIL). Following eye-tracking metrics were used as indicators of visual attention: Time to First Fixation (TTFF) (average amount of time needed for subjects to notice specific AOI from the stimulus onset), percentage of subjects who fixated on the AOI (percentage of how many of the subjects that saw the stimulus actually saw the AOI), number of fixations within AOI, and time spent fixating on the AOI (average amount of time subjects spent looking at the specific AOI). In

the end, a comparison of cognitive testing (questionnaire) with neuromarketing testing was conducted, in order to determine the relationship between cognitive and subliminal responses since in traditional marketing questionnaires are more often used, but following numerous neuromarketing research we have conducted, large discrepancies in cognitive and subliminal research results were found.

Evaluation of behavior

To inspect which FB posts attract more visual attention, a heat map was used. With these color gradient overlay visualizations, an insight into the general distribution of gaze points was obtained. The red color depicts a higher number of gaze points, while the green color represents a lower number directed towards specific parts of the FB posts. Some gaze points were concentrated on the FB posts and concentrated from left to center, suggesting that most of the information presented on the right was not seen, and older posts did not attract any attention (Figure 1). A possible explanation for such behavior can be attributed to the current FB page design, where recent posts do not motivate visitors to continue scrolling. Regarding the eye-tracking measurements, a one-way repeated-measures ANOVA was performed for Time to First Fixation (TTFF), percentage of subjects who fixated on the AOI, number of fixations within AOI, and time spent fixating on the AOI.

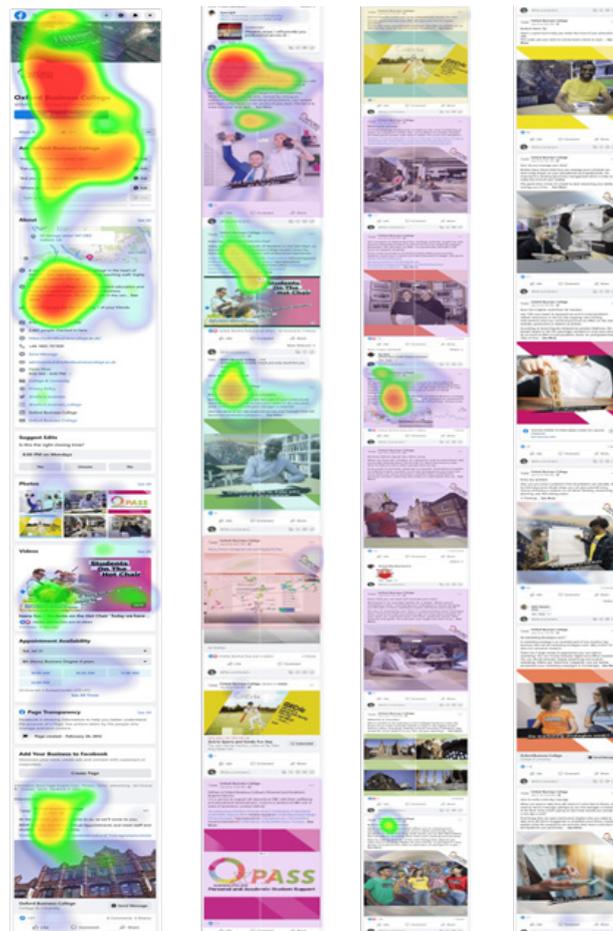


Figure 1: Heat map showing general distribution of gaze points.

A significant statistical difference within the number of fixations within the 5 AOIs ($F(4,36) = 4.442$, $p = 0.005$ was found, where a post hoc Tukey test revealed that the total number of fixations within an area with long text, image, and logo (predominately posts with various business tips) was significantly higher than within image and logo area (research results) (mean difference = 74.250, $p = 0.043$) as well as than within short text, image, and logo area (charity announcement) (mean difference = 98.250, $p = 0.023$). A significantly higher number of fixations was also observed within the long text, image with text area (predominately announcements

of activities at OBC) when compared to image and logo (research results) (mean difference = 43, $p = 0.037$) and short text, image, and logo area (charity announcement) (mean difference = 67, $p = 0.020$) (Appendix B). However, the results also suggest no significant differences in time spent fixating ($F(4,16) = 2.113$, $p = 0.127$), time to first fixation ($F(4,16) = 0.393$, $p = 0.811$), and percentage of participants who fixated on the AOI ($F(4,16) = 0.563$, $p = 0.693$) (Table 1). Taken together, these results suggest that none of the FB posts is eye-catching enough to attract and keep visual attention.

Table 1: Obtained eye-tracking metrics.

	Areas of Interest					
	LTIL	LTIT	STI	IL	STIL	
Number of Fixations	159.25	128	99.33	85	61	$F(4,36) = 4.442$, $p = 0.005$ *
TTF (s)	20.34	21.27	21.04	28.6	21.77	$F(4,16) = 0.393$, $p = 0.811$
Dwell Fixation Time (s)	1.2	1.14	0.75	1.4	0.99	$F(4,16) = 2.113$, $p = 0.127$
Percentage Fixating	41.18	41.18	41.18	22.93	22.93	$F(4,16) = 0.563$, $p = 0.693$

Evaluation of emotions

For pinpointing the emotional activity of the OBC's FB page, tracking of facial expressions elicited during the exposure to the FB page was used. The results suggest that participants mostly elicited neutrality (42%) and sadness (25.6%), followed by puzzlement (15.8%), disgust (7.2%), surprise (3.1%), joy (2.9%), and fear (1.6%) regardless of the AOI. During the 35-seconds interval of scrolling the OBC's FB page, participants subconsciously showed higher intensity of negative emotion and aversiveness towards the material presented on the FB page (Figure 2). A noticeable increase

in the aversiveness was observed, especially in the beginning when participants were looking at the general information about the OBC and in the period around the 20th second when they were looking at the FB post consisting of long text and image with text (announcement of the new video episode where students share their academic and professional experiences). An increase in the intensity of a negative mood was also observed within the 30-34th second interval when subjects mostly looked at the short text and image of FB post and image and logo FB post (post announcing the personal and academic student support). Such findings suggest that the FB page is not optimally designed.

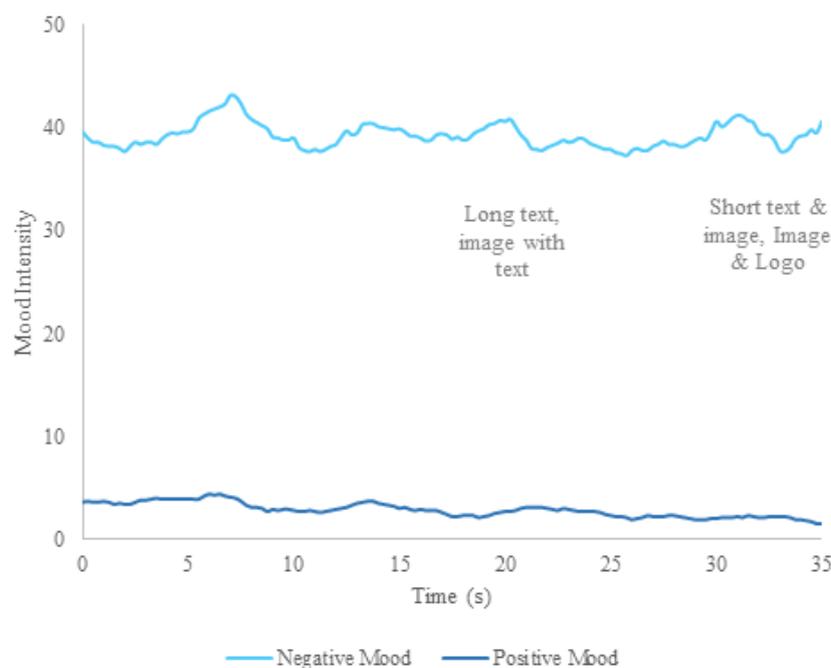


Figure 2: Mood during OBC's FB scrolling.

Survey result

More than half of subjects (57.9 %) prefer visuals with text, whereas 36.8 % prefer visuals without text, and 5.3% have no preference. Some subjects also prefer visuals containing logo (42.1%), while 31.6% prefer visuals without logo, and 31.6% have no preference. A number of subjects cannot decide if OBC's FB has well-designed visuals (42.1%). Some subjects think the visuals are not well-designed (10.5 %), while 31.6% agree, and 15.8% strongly agree with the statement that OBC's FB has well-designed visuals. When looking through OBC's FB page, subjects reported to mostly feel neutral (78.9%), followed by puzzlement (10.5%), joy (10.5%), surprise (10.5%), and fear (5.3%). Therefore, these conscious results, when compared with eye-tracking metrics, highlight a discrepancy between the subconscious and conscious preferences.

Discussion

A few specializations within social media marketing study the frequency of posting content on the social media such as Facebook, in order to achieve maximal post visibility and engagement. Facebook, as well as other social networks, primarily lives from paid digital advertising, meaning that posts published on the official FB pages which are not posted through digital advertising are not visible to all followers of the page, but rather a part of them. Such visibility is dependent of the FB algorithm, which is constantly changing. As no owner of the official FB page, including the Oxford Business College, pays for each post in paid advertising, it is extremely important to find the optimal number of posts that should be published daily, in order to achieve maximum reach and visibility as well as higher engagement (greater number of likes, comments). Although FB offers statistics and analytics of each post and page in general, which records the daily number of views, visits and likes of a particular post, such analytics fail to show how followers feel when visiting a particular FB page, what parts of the posts are more salient and the overall impression of the FB page, which can be assessed by neuromarketing measurements.

Hence, in this study, the neuromarketing measurements of the FB page helped to get the missing answers and to identify whether neuromarketing can be a quality tool to determine what needs to change on the FB page to have greater reach. By means of the eye-tracking behavioral measurements, emotional analysis, and survey questions, a greater understanding of the current position of the OBC FB page on cognitive, emotional, and subliminal levels from their followers was obtained as well as how a FB page affects emotion change and behavioral engagement. The results suggest that a small number of likes is conditioned by the wrong choice of design, which arouses predominately negative emotions in visitors and/or induces some negative events stored in long-term memory. Based on the eye-tracking behavioral neurometrics and emotion analysis, results have the content is unattractive to the followers as it takes more than 20 seconds to notice any post on the OBC's FB page. Regardless of the post type, subjects spent on average 1 second looking at any post, which is particularly not enough for posts that combine image and text.

A higher number of fixations within the FB posts containing longer text and image when compared to posts with shorter text and image are attributed to the fact that naturally, people need more fixations for reading a longer text. Furthermore, a relatively small number of subjects who fixated on the post actually saw the content. Such results suggest that the current FB page design is not as visually appealing to effectively catch one's attention immediately. Hence, most of the important information goes unnoticed. One particularly interesting conclusion is that, while a number of subjects thought that OBC has well-designed visuals, the eye-tracking metrics showed otherwise. Such discrepancy in results highlights the issues of traditional research methods focused on surveys and group discussions, including acquiescence bias where subjects choose to answer what they think others would like to hear, the use of survey question answer options which could lead to unclear data due to the differences in personal interpretations of the answers, etc. [12]. Along the same lines, despite a majority of the subjects reporting to mostly feel neutral while scrolling the FB page, the in-depth emotional analysis showed higher intensity of negative emotion and aversiveness towards the available material, particularly when looking at the general information about the OBC FB posts with long text and image as well as FB posts with short text and image and posts with only image.

This is an important bias because traditional marketing techniques often rely on FB stats, which cannot provide emotional data, unlike neuromarketing, which uses a simple observation of the subject's immediate reaction to reveal which design is the most useful for the OBC. Triangulation, or the combination of different methods or different types of data used in this research (emotion, behavior, and survey metrics) with different types of data analysis (Time to First Fixation-TTFF with one-way repeated measures with ANOVA, percentage of subjects fixating on AOI, number of fixations within AOI and time spent fixating on the AOI with post hoc Tukey test and are with long text, image and logo area) improves the quality of the research and achieves a greater depth from the data obtained. Detected emotions of sadness, puzzlement, surprise, and fear can be attributed to the design of the OBC's FB page and color choice. Several research in both psychology and marketing have shown that design and colors evoke certain emotions which are associated with the induction of a particular memory and/or emotionally charging (positive or negative) event of the respondent [4].

While 'Sticky by Tobii Pro' is reliable tool in evaluating design, attention patterns and emotions, it is important to highlight its technical limitation when reading the text. Namely, its average gaze error in real world (non-lab environment) of 1.6. to 1.8. degrees provide limited insights into reading patterns. Hence, in the future, it is suggested to use such neuromarketing measurement with various other marketing methods to obtain reliable results on the readability of the content. In addition, although this research was conducted via computer, and statistical visit to the FB page is the largest via mobile phone, the technical limitation we encountered was that if we set up a research on the mobile phone, a small

number of quality images would be obtained because the optical resolution from the mobile phone is smaller and subjects need to be more calm throughout the data collection than when conducting the research from computer.

Conclusion

Since the analysis of the emotional change and behavioral engagement conducted with the webcam-based eye-tracking device showed that students elicited higher levels of negative emotion and low behavioral engagement towards the material presented on the FB page, the present study suggests the need for a redesign of the OBC FB page in the future, with special emphasis on creating short-texted FB posts with complementary visuals in order to visually attract followers to notice the content faster and spend more time looking at it. Despite the technical restrictions of using the user's webcam (15 Hz) instead of a stationary eye tracker for this experiment, FB page testing with neuromarketing can give good accuracy with the use of online neuromarketing software to differentiate what people are looking at for elements on the FB page and how they behave, with an average gaze error in real world (non-lab environment) of 1.6. to 1.8. degrees. This research method is very easy to adopt in higher education marketing departments, where behavior can be recorded in real-time, tested on a larger audience, and in turn to have a causal effect on new student enrollment as well to create and design social media content that can be stored in the long-term memory of their visitors. It is advisable to always include with this type of neuromarketing research questionnaires to determine the merits of the results and correlate cognitive and subliminal responses with the brand interaction.

Acknowledgment

This study was done in collaboration with the Institute for Neuromarketing, Zagreb, Croatia, which provided support with the neuromarketing equipment and data analysis. Research was conducted exclusively for the purpose of development and scientific advancement.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

Funding Information

The authors would like to acknowledge the support of Oxford Business College for paying the Article Processing Charges (APC) for this publication and Institute for Neuromarketing for covering all neuromarketing research costs.

References

- Constantinescu M, Orindaru A, Pachitanu A, Rosca L, Caescu SC, et al. (2019) Attitude evaluation on using the neuromarketing approach in social media: Matching company's purposes and consumer's benefits for sustainable business growth. *Sustainability* 11(24): 7094.
- Ashley C, Tuten T (2015) Creative strategies in social media marketing: An exploratory study of branded social content and consumer engagement. *Psychology & Marketing* 32(1): 15-27.
- Hussain S, Ahmad N, Quddus A, Rafiq M, Pham TP, et al. (2021) Online education adopted by the students of business science. *Academy of Strategic Management Journal* 20(2): 1-14.
- Datu JAD, Yang W, Valdez JMP, Chu SKW (2018) Is facebook involvement associated with academic engagement among Filipino university students? A cross-sectional study. *Computers & Education* 125: 246-253.
- Hanna R, Rohm A, Crittenden VL (2011) We're all connected: The power of the social media ecosystem. *Business Horizons* 54(3): 265-273.
- Lin R, Utz S (2015) The emotional responses of browsing Facebook: Happiness, envy, and the role of tie strength. *Computers in human behavior* 52: 29-38.
- Zito M, Fici A, Bilucaglia M, Ambrogetti FS, Russo V (2021) Assessing the emotional response in social communication: The role of neuromarketing. *Frontiers in Psychology* 12: 1-14.
- Tess PA (2013) The role of social media in higher education classes (real and virtual)-A literature review. *Computers in human behavior* 29(5): A60-A68.
- Stansbury M (2009) Coach sued for requesting Facebook logins. *ESchool News: Technology news for today's K-20 educator*, p. 20.
- Young JR (2009) College 2.0: How not to lose face on Facebook, for professors. *The Chronical of Higher Education* 55: p. 22.
- Mortiboys A (2013) Teaching with emotional intelligence: A step-by-step guide for higher and further education professionals. *Routledge* 18(3): 300-302.
- Van Doorn J, Lemon KN, Mittal V, Nass S, Pick D, et al. (2010) Customer engagement behavior: Theoretical foundations and research directions. *Journal of service research* 13(3): 253-266.
- Park H, Reder LM (2012) Moses illusion. In *Cognitive illusions*, Psychology Press, UK, pp. 287-304.
- Park T, Lim C (2019) Design principles for improving emotional affordances in an online learning environment. *Asia Pacific Education Review* 20: 53-67.
- Quan-Haase A, Young AL (2010) Uses and gratifications of social media: A comparison of Facebook and instant messaging," *Bulletin of science, technology & society* 30(5): 350-361.
- Hung HT, Yuen SCY (2010) Educational use of social networking technology in higher education. *Teaching in higher education* 15(6): 703-714.
- Lenhart A, Purcell K, Smith A, Zickuhr K (2010) Social media & mobile internet use among teens and young adults Millennials. *ERIC* p. 51.
- Daniels LM, Goegan LD, Parker PC (2021) The impact of COVID-19 triggered changes to instruction and assessment on university students' self-reported motivation, engagement and perceptions. *Soc Psychol Educ* 24(1): 299-318.
- Hyslop K (2020) What's university going to look like this fall? A look at UBC's choices and challenges could offer insights into post-secondary education in a prolonged pandemic. *The Tyee, Canada*.
- Bodily R, Leary H, West RE (2019) Research trends in instructional design and technology journals. *British Journal of Educational Technology* 50(1): 64-79.
- Greenhow C, Askari E (2017) Learning and teaching with social network sites: A decade of research in K-12 related education. *Education and information technologies* 22: 623-645.
- Roblyer MD, McDaniel M, Webb M, Herman J, Witty JV (2010) Findings on facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *The Internet and higher education* 13(3): 134-140.

23. Mayer RE, Estrella G (2014) Benefits of emotional design in multimedia instruction. *Learning and Instruction* 33: 12-18.
24. Erdođdu F, akirođlu U (2021) The educational power of humor on student engagement in online learning environments. *Research and Practice in Technology Enhanced Learning* 16: 1-25.
25. Shahbaznezhad H, Dolan R, Rashidirad M (2021) The role of social media content format and platform in users' engagement behavior. *Journal of Interactive Marketing* 53: 47-65.
26. Junco R (2012) The relationship between frequency of facebook use, participation in facebook activities, and student engagement. *Computers & education* 58(1): 162-171.
27. Junco R (2012) Too much face and not enough books: The relationship between multiple indices of facebook use and academic performance. *Computers in Human Behavior* 28(1): 187-198.
28. Grieve Rachel MI, Witteveen K, Tolan GA, Marrington J (2013) Face-to-face or facebook: Can social con-nectedness be derived online? *Computers in Human Behavior* 29(3): 604-609.
29. Sheldon KM, Abad N, Hinsch C (2011) A two-process view of facebook use and relatedness need-satisfaction: Disconnection drives use, and connection rewards it. *J Pers Soc Psychol* 100(4): 766-775.
30. Kross E, Verduyn P, Demiralp E, Park J, Lee DS, et al. (2013) Facebook use predicts declines in subjective well-being in young adults. *PLoS One* 8(8): e69841.
31. Gavilanes JM, Flatten TC, Brettel M (2018) Content strategies for digital consumer engagement in social networks: Why advertising is an antecedent of engagement. *Journal of Advertising* 47(1): 4-23.
32. Beaudry A, Pinsonneault A (2010) The other side of acceptance: Studying the direct and indirect effects of emotions on information technology use. *MIS Quarterly* 34(4): 689-710.
33. Muňoz F, Hernandez J, Gomez D (2018) Measuring advertising effectiveness in travel 2.0 websites through eye-tracking technology. *Physiology & Behavior* 200: 83-95.
34. Schreiner M, Fischer T, Riedl R (2019) Impact of content characteristics and emotion on behavioral engagement in social media: Literature review and research agenda. *Electronic Commerce Research* 21: 329-345
35. Meshi D, Morawetz C, Heekeren HR (2013) Nucleus accumbens response to gains in reputation for the self relative to gains for others predicts social media use. *Frontiers in Human Neuroscience* 7: 439.
36. Meshi D, Tamir DI, Heekeren HR (2015) The emerging neuroscience of social media. *Trends Cogn Sci* 19(12): 771-782.
37. Djamasbi S (2014) Eye tracking and web experience. *AIS Transactions on Human-Computer Interaction* 6(2): 37-54.
38. Zheng WL, Dong BN, Lu BL (2014) Multimodal emotion recognition using EEG and eye tracking data. In 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Chicago, IL, USA, pp. 5040-5043.
39. Soleymani M, Pantic M, Pun T (2011) Multimodal emotion recognition in response to videos. *IEEE Transactions on Affective Computing* 3(2): 211-223.
40. Djamasbi S, Siegel M, Tullis T (2012) Designing noticeable bricklets by tracking users' eye movements. In 2012 45th Hawaii International Conference on System Sciences, pp. 525-532.
41. Kim AJ, Johnson KK (2016) Power of consumers using social media: Examining the influences of brand-related user-generated content on Facebook. *Computers in Human Behavior* 58: 98-108.
42. Bercea MD (2012) Anatomy of methodologies for measuring consumer behavior in neuromarketing research. In Proceedings of the Lupcon Center for Business Research (LCBR) European Marketing Conference. Ebermannstadt, Germany.