

# Eye Tracking for Marketing Studies

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**Abstract.** Over the years, marketing companies have made researches to gauge consumer's preferences with the purpose to foster their products in the market, though, those tests have proven that the brand image could influence opinions by making them subjective and biased, nevertheless, the brand can really influence consumer's behavior.

Considering this context, after a state-of-the-art analysis, was designed a software engineering solution, consisting on creation of marketing campaigns/studies with randomly presentations of products on the screen to be seen by the consumers. It's an eye tracking oriented tool, that gauge objectively how consumers distribute their attention about products, giving metrics as outputs, and producing statistics in real time, to be the subject of analysis to future engaging the production process of the companies.

Thus, the tool can play an impactful and relevant role, helping companies to solve the biased behavior problem in marketing studies, supporting them on delivering innovative products in market.

Furthermore, empowering the vision sense in the selection of a product in marketing studies prior to production, fulfills one the objectives of the work;

Regarding the solution evaluation, in the first part were done the user interface/experience tests, each one of participants was selected to create a campaign/study; In second part, as a consumer, in a given time, each one saw a randomly presentation of images on the screen; In third part, they gave its opinion about which images took their attention the most; In the last part, the tests results were shown to all participants.

**Keywords:** Marketing, Consumers' Preferences, Eye-tracking.

## 1 Introduction

### 1.1 Article structure

This document is divided in seven parts, as follow:

**Abstract.** In the first part of the paper, is the abstract that presents briefly the theme, the main objectives and technologies, and the evaluation carried out;

**Introduction.** In the second part, is described the problem, the expected contributions, the marketing concepts, and the vision sense;

**State-of-the-art.** In the third part, are the technologies related to eye tracing, such as metrics, platforms, supporting technologies, and its limitations;

**Proposed solution.** In this part is the architecture, the solution design, and prototype requirements;

**Implementation of the solution.** In this part are the prototype main algorithms;

**Prototype evaluation.** In this part is the local of the tests, scope of tests, results, evaluation reflection, conclusion, and the future investigations.

**References.** In the final part, are the references introduced by the authors.

### 1.2 The problem

In marketing tests, several variables can influence consumer' preferences and its decision-making, resulting on consumer's bias responses. However, this problem of the subjectivity was considered in this study as a starting point to gather consumers' preferences more objectively possible.

### 1.3 The expected contribution

Creating an innovative solution for companies, to help them in the creation and monitoring the studies of marketing campaigns efficiently, with accuracy of the results, and to show objective conclusions of the consumers' preferences in order to meet their needs, and to deliver value to companies marketing campaigns.

### 1.4 The marketing concepts

The marketing has a set of activities, techniques and methods that are applied to needs studies, and desires of the consumers, through market segmentation and its brand positioning, as well as its main components, such as sales, products and services. According to the AMA (American Marketing Association) "marketing is the performance of business activities that drive the flow of goods and services from producer to consumer. "[1] Digital marketing differs from traditional marketing by using various actions and methods in online channels, which allow real-time analysis of results; It can be said that digital marketing brings together a set of actions of dissemination and communication of an entity through the Internet and digital media, adopting practices of promoting products or services to reach consumers quickly and efficiently in a personalized way.

There are some variables to consider, in a comparison between similar products of different brands, the final choice of the product that the consumer will buy, may not be what caught his attention the most. In fact, there are other factors that will influence the purchase, namely, the first impression of certain attributes such as brand image, price, popularity, as well as sensory expressions. From a quantitative analysis of consumers' perception, the multisensory experience, shows that all senses can be present in consumer's decision-making in buying products. Sensory branding is the application of the five human senses in the image and identity of the brand, contributing to an emotional relationship of the consumer with it and affecting their behavior in the purchase of a product/service. [2]

### **1.5 The vision sense**

Since the vision is usually the first sense to give information to the consumer about a particular product and considering that behind the present study. In practice, the term "eat with the eyes" is an example of this. Often, the consumer is led to choose something just because visually it is more appealing or stimulated his remaining senses leading him to make this option.

This is the focus of the present study. Basically, at the first impact and the selection of a product resulting from eye contact with the image of it.

Visual behavior consists of more than just looks and fixations. The visual system has five types of visual movements, such as Saccades [3], Smooth Pursuit [4], Vergence [5], Vestibule-Vision [3], and Optokinetic/Postrotatory Nystagmus [6].

## **2 State of the Art**

According to Tobii [7], combining eye tracking with other technological interfaces, user experiences (UX) will be more intuitive, natural, engaging, and efficient compared to other conventional interfaces. User experience (UX) and human-computer interaction (HCI) researchers use this methodology to evaluate interfaces for a better user experience. By studying what the user sees, a technician or an UX designer can identify the reasons that lead users to stop certain tasks and thus gather clues on how to fix the problem. These lead points are often easy to repair and have a high impact on improving conversion rates and sales in marketing. When combined with other biometric sensors, designers can use the data to measure emotional and cognitive responses.

### **2.1 The eye tracking metrics**

The eye tracking metrics [8] quantify visual attention, as it objectively monitors where, when and what people look at, and valuable tools used to discover insights into participants' behavior and mentality during various situations, such as following:

Gaze points are the fixation points of the gaze constitute the basic unit of measurement - a point of the look, which is equal to a raw sample by the visual tracker; The Heatmaps are static or dynamic aggregations of look points and fixations revealing the

distribution of visual attention. The heat maps will help researchers to understand on what attracts participants' attention; Areas of interest are user-defined subregions. Extracting metrics can be useful for evaluating the performance of specific areas in the same video, images, and so forth; Fixing sequences are based on the fixing position and timing information, a fixing sequence can be generated; Time for first fixation (TTFF) indicates the amount of time it takes a person to look at a stimulus specific AOI (areas of interest); Time spent that users have been looking at an AOI; View count describes how many of the users guided their gaze to a specific AOI, a higher score shows that the stimulus is widely seen; Use in benchmarking compares the competitive offerings of established websites by using tasks metrics and allows researchers to statistically compare performance; A/B Test is a method of market study and usability. It is ideal for evaluating different versions of the same product.

## 2.2 The eye tracking platforms

Eye tracking captures the natural, unbiased behavior of the user and produces objective data to enable effective recommendations to be made and is a flexible technique that can be worked with a variety of research methods, including observations, interviews and Retrospective Think Aloud (RTA). [9]

Tobii Pro Lab software serves a wide range of studies, it works with devices manufactured by Tobii, namely screen-based eye trackers and wearables, as well as with virtual reality glasses with eye tracking technology integrated into the VR headsets.

iMotions Platform users can combine eye screening with other biometric data such as facial expressions, galvanic skin response, EEG, EMG and ECG. [10]; The platform can be used in various fields of use, such as in neuromarketing, in psychologies, in usability (UX), gaming, in neurosciences or in the medicine.

## 2.3 The supporting technologies

Some of the biometric sensors can be a perfect complement to eye tracking, with its combination can show exactly where people are looking (attention), how they are feeling a positive or negative emotion (valence), the intensity of that feeling (excitement), and the specific emotions at that time. Each sensor provides unique results on human attention, cognition, emotion, or actions. [3]. It is a new marketing field where researchers use medical technologies such as functional magnetic resonance imaging (fMRI) to study responses in different parts of the brain to gauge why consumers make decisions and what part of the brain is influencing their action.

Facial expression analysis is a non-intrusive technological method for assessing emotional reactions over time [11]. However, we are often tempted to use eye tracking because it is an innovative technology by itself. Due to its growing popularity, many observers see eye tracking technology as a valuable UX testing tool - it is not often that most people can see a "painted" image through a user's eyes looking at a website.

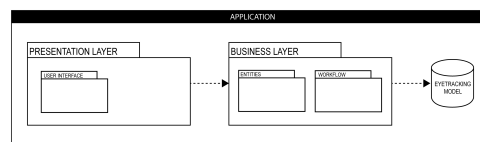
## 2.4 The eye tracking limitations

How technology limitations make eye tracking are closely linked between what we feel and what we see; The eyes movement is closely linked to visual attention. In fact, you cannot move your eyes without moving attention, however, you can move attention without moving your eyes. While eye tracking can tell us, what people look at and what they see, they cannot tell us what they understand.

## 3 Proposed Solution

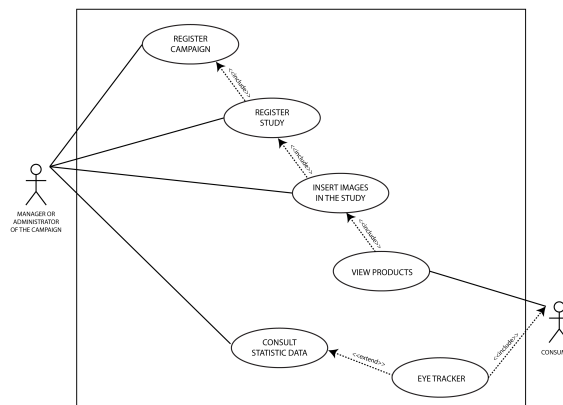
### 3.1 The architecture and the solution design

The solution that was developed, consists in a three-layer architecture, that's a graphical interface, a business logic and a database (fig. 1). The graphical interface shows the result to the user, receives the inputs and processes the user's actions.



**Fig. 1.** Simple three-tier architecture

The business logic layer, contains all the parts related to the capture of visual movements, such as entities, algorithms, and functions that processes real-time data calculations and send/receive them from the database. The use case diagram (fig. 2) represents a desktop software tool integrated with the Tobii Eye Tracker 4C.



**Fig. 2.** Use case diagram.

For the platform to work must have two key actors, which is the campaign manager and the consumer interacting with the platform; The manager will create a campaign,

then within that campaign will create several studies, then inserts in campaign several images of the products.

In the flow diagram (fig. 3) all user interactions must respect the order and requisites of the algorithm in order to work properly. To sum up, starting the app, in the first place, the manager should create the campaign, in the second place, should be created a study, after that, should insert images in the study; If all data inserted was succeeded, then the campaign is set up already, and the tool should seek for an eye tracker device, if it got succeed, then it can already do the measurements for the consumer to see the images presentation randomly on the screen, the platform will send the data from the eye tracker to the database; After a given time for duration of the test, this ends, and then can be generate the statistics results for the campaign manager to check.

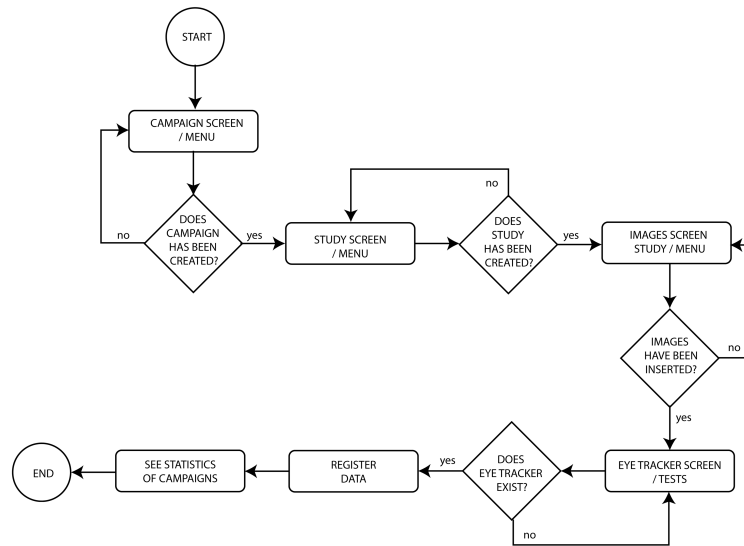


Fig. 3. Flow diagram.

### 3.2 The prototype requirements

The prototype was developed in C# using a Universal Windows Platform (UWP) design model, which allows the prototype to run on any type of Windows10 device; The database management system (DBMS) was Microsoft SQL Server; A Tobii Eye Tracker 4C device.

## 4 Implementation of the solution

### 4.1 The algorithms

The main algorithm developed was divided in four parts, as follow:

**First part, “images coordinates”:** This methodology fetches each image name from directory, as well as its coordinates (x and y), and determines the width and height size of images by passing its index as parameter;

**Second part, the “images random presentation”:** The images will be presented randomly through a loop process, and reads the names of the existing images in the directory and loads it all in an array, while less than the size of the array, should present the images randomly on the screen;

**Third part, the “timer”:** A methodology for counting time begins counting the time;

**Fourth part, the “eye tracking”:** The eye tracker data will be stored in variables of the coordinates of the eye tracker created dynamically in real time. Then, the eye tracker inputs are sent to the database using a methodology.

## 5 Prototype evaluation

### 5.1 The scope, evaluation, conclusion, and future investigations

**The local of tests.** The tests were at Instituto Superior de Engenharia do Porto – ISEP in October 7<sup>th</sup> and 10<sup>th</sup> of 2019; The tests were carried out by computer graduates; The participants were divided in two groups: 12 in 7<sup>th</sup> day, and 11 in 10<sup>th</sup> day, in total of 23 participants, between 20 and 42 years old; 22% were female; 61% owned more than 5 years of experience in IT.

**Scope of tests.** Participants were selected to take usability tests and functional tests, so in the first part, were done UI/UX tests, each one of participants was selected to create a campaign/study; In second part, as a consumer, in a given time, each one saw a randomly presentation of images on the computer screen; In third part, they gave its opinion about which images took their attention the most, through a QUIS, using the Likert scale, and also about the (UI/UX); In the last part, the tests results were shown.

**Results.** According to the final survey, here are the results as follows: Is the solution input screen enlightening? Answer: 100%; Have you managed to create a new campaign? Answer: 100%; Have you managed to create a new study? Answer: 100%; In the eye tracking test were you able to see the random presentation of the images in the study? Answer: 100%; Rate your experience of use on e2m (from 0 to 5): Answer: 4.34; Advises e2m solution to your friends? Answer: 100%; Does the prototype have the potential to contribute to marketing campaigns? Answer: 100%.

**Evaluation reflection.** In the first part of the evaluation, was given by the quality/accuracy of the eye tracking results through metrics and graphical statistics recorded and showed in real time, and by confirmation by all participants of the veracity of the results; In the second part of evaluation, was given by the satisfaction of the participants, considering the usability and experience of the creation and monitoring of campaigns/studies, which meets of quite good usability and user experience (UI/UX).

**Conclusion.** The identified objectives were achieved by the tool, with accurate results that gauge objectively how consumers distribute their attention about products. Thus, the tool can play an impactful and relevant role, helping companies to solve the biased behavior problem in marketing studies, supporting them on delivering innovative products in market. It can contribute to optimize and speeding up the industry production

processes related to placing of new products on the market; For example, if a company is going to produce shoes for the ladies and want to analyze the market before starting its production, will seek to know what the potential customers like in their prototypes and carry out a study presenting these prototypes to gather information.

**Future investigations.** There are some considerations of features that could be developed in the future, such as, facial recognition that intend to automate the process of registering consumers on the platform; The functionalities could be expanded for other areas of business, i.e., where the tool captures the visual movements of local passengers, in various means of advertising inside or outside, as well as in digital solutions.

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