Neuromarketing in Market Research: Eye Tracking Application

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Abstract

The goal of this paper is to explore the benefits of neuromarketing, in general, and the eye tracking method, in particular, in market research, and to consider their ethical implications. In an example of a typical case study I will try to show how eye tracking can be deployed to analyse the unconscious visual perception of a TV commercial by the participants in the study. I analysed a TV commercial for readymade soups, in which five different readymade soups where advertised. The sample contains 21 participants. With the help of eye tracking method in "Gazepoint" software we have discovered that one scene drew attention much more than the others. In addition to this, I review the literature on benefits of eye tracking as a complement to more traditional methods. I also present an overview of ethical issues related with this method.

Introduction

To those familiar with the latest development in marketing, the world may seem like the one from a Spielberg's „Minority Report", where people's retinas are being scanned to predict their behaviour. It may seem like the commercials are going to talk to people approaching the marketing panel, combining data mining on their previous purchases. Facial recognition software is already used in some billboards that adapt their display to the viewer (Roth, 2015). Some panels in Japan can identify gender, ethnicity and approximate age of the approaching shopper (Fitzpatrick, 2010) and change the advertisement accordingly. One important culprit for such view of the marketing today is a fairly new marketing discipline called neuromarketing. Numerous studies question its' ethics but a large number of studies see more benefits than disadvantages of neuromarketing.

So what is neuromarketing? We can describe the term as a commercial application of behavioural psychology, economics and consumer neuroscience. Consumer neuroscience studies cognitive and affective sides of human behaviour (Ramsøy, 2014). It uses a variety of brain scan techniques (such as FMRI, PET and EEG), eye tracking and physiological measurements (heart rate, breathing rate and galvanic skin reaction) to understand the unconscious drivers of choice and preference(Ramsøy, 2014). Because consumers are not aware of these drivers, they cannot be detected by traditional techniques such as focus groups, interviews and questionnaires. One can think that this brings the end to the traditional methods in market research, but it is more appropriate to view them as "upgraded" with methods such as eye tracking. (Ramsøy, 2014)

This unprecedented access to consumers' consciousness raises many ethical questions: from issues of invasive strategies (medical equipment usage for discovering what consumer is not aware of), to preference and choice manipulation (free will and discovery of the "buy buttons") where marketing is trying to influence consumer decisions without consumers being aware of it, to exploitation of emotions to subliminal messages (consumers create emotional bonds with the brand as they are identifying with the marketing message). The fact that these techniques are used for profit-making, rather than scientific research, makes them even more ethically questionable (Jelić, 2014).

In the remaining text I present a typical eye tracking study in a market research agency and show the benefits of this method. I also address the ethical issues of neuromarketing. But first I provide an overview of the techniques used in neuromarketing and how they are used by researchers to gain knowledge about consumer preferences that is not available by more traditional methods.

Neurmarketing techniques

In all neuromarketing studies, participants are exposed to some sort of stimulus in form of different ads/commercials, still pictures, texts etc. and their response is observed/measured by one or more of the following techniques.

Functional magnetic resonance (FMRI) is an indirect measure of oxygen rich blood influx to an active part of the brain. It uses magnetic and radio waves to create brain images. (Krajnovic et al., 2010) Among its many medical applications, FMRI can also be used to study people's preferences and choices. By looking at brain scans it is possible to see which parts of the brain are active while receiving stimuli and/or making a decision. It is still very expensive and immobile, which means that it can be used only in a lab setting and an expert is needed to interpret results. This method also raises some ethical issues. First, if a medical condition (eg. tumour) is found during a marketing study, should the subject be informed about it? Second, who owns the brain scans? Also, strong magnetic field can have negative health effects (Jelić, 2014) and subjects should be informed about them.

Positron emission tomography (PET) scanner is a method where researchers inject radioactive ligands into the bloodstream of a subject and record how they accumulate in the brain. This method can be used to understand how substances that affect human behaviour (i.e. dopamine, glucose and serotonin) are distributed in the brain (Ramsøy, 2014) There are possible negative effects of radioactive material on subjects' health. (Jelić, 2014)

Electroencephalography (EEG) places electrodes on the outside of a skull and measures neurons' electrical activity. It is a second most popular neuromarketing method, partly thanks to its low price and small size, which makes it equally practical in lab and mobile settings. With the help of EEG we can measure things such arousal ("how relevant a person finds something"), cognitive workload (how much information is being processed) and motivation. (Ramsøy, 2014)EEG has the same ethical implication as FMRI in the domain of accidental discoveries. (Jelić, 2014)

Eye tracking method involves either eyeglasses (mobile) or a stationary tracker that uses infrared cameras to detect where a person is looking. They measure pupil dilation and some models can measure head movement. Pupil dilation can be caused by changes in brightness, emotional response and task difficulty. It can be used to predict

things that grab our automatic attention (contrast, density, brightness, movement). (Ramsøy, 2014) Eye tracker is often combined with EEG. Eye tracking is the least intrusive technique and the only ethical issue is whether subjects know that they are participating in a marketing study and not in a scientific one.

In market research, eye tracking method can be used for various purposes such as product design tests, web pages and e-mail communications tests, and marketing communication tests (commercials, listings, leaflets, sponsorships and product positioning). It is usually combined with quantitative (questionnaires) or qualitative (focus groups, in depth interviews) techniques. Depending on a purpose of the study, analysts should ask questions such as: What was seen and what was not seen? Which part of the message draws the most attention? Does the end user see everything that the designers want him/her to see? Are the sponsorships recognized and how much? How much is the product recognized? How readable is the content and whichparts? What is being noticed? Is the message transferred? Which e-mails get opened more?

What does neurmarketing explore?

The techniques used in neuromarketing can detect the focus of our attention and measure sensory experience. They can probe our memory and process of learning. Perhaps most importantly, they can tap into our emotions and motivation which, arguably are the most important marketing target. In the rest of this section I give an overview of how the following processes in the neural system are measured: emotions, motivation, attention, senses and memory.

Emotions are instinctive responses that can be present before or without awareness. They shape our behaviour and the way we perceive the world. But how can we measure emotions? We can distinguish between arousal, the strength of an emotion (low to high), and valence, the direction of an emotion (positive vs. negative). We can make an emotion matrix that will rate these dimensions of emotions or we can track the subjects' respiration and pulse (arousal index), changes in activation in basial ganglia (part of the brain situated at the base of forebrain) and more specifically nucleus accumbens (reward centre and centre for negative emotions, a part of the basial ganglia) the insula (centre for both positive and negative emotions placed in cerebral cortex) and orbital frontal cortex (associated with people's enjoyment of food, music, faces, odours).

Participant's motivation (the reasons why people take actions, have desires and needs), consists of two systems: wanting and liking. Liking can be measured through what people say. For instance we can ask them to rate their liking of something with the grades from 1 to 5. On the other hand, wanting cannot be stated explicitly, but it can be measured through changes in work and effort, behavioural changes, changes in eye fixations and arousal. Changes in activation of basal ganglia and the nucleus accumbens show the activity of the wanting system while changes in activation of orbital frontal cortex show changes in liking.

An FMRI study by Martin Scov et al (2008) explored the liking system. It showed that when given contextual information, that is, when the subjects believed that the paintings they were looking at are from prestigious art galleries (meaning they are famous), as opposed to the ones taken from the internet (meaning they are unknown) was related to preference as they were rated much higher and a stronger activation of

medial orbitofrontal cortex was seen (although none of the paintings shown where from prestigious galleries).

An FMRI study by Knutson et al. (2007) finds that the stronger activation of nucleus accumbens (when looking at the product) predicts the choice: a stronger activation of this part of the brain indicates a higher likelihood of purchase; a stronger activation of the insula while looking at the price indicates a lower likelihood of purchase. This study also showed that all this happens several seconds before subjects have consciously made the choice.

Attention is another important process that selects a target of the mind's focus and suppresses all other stimuli. We can distinguish between bottom up (accidentally looking for something) and top-down (when looking for something particular) attention. What is important for bottom-up attention is that some things automatically grab our attention (movement, brightness, density, contrast) and just by changing the visual appearance of a product, people are more likely to look at it and also more likely to buy it (Milosavljevic et al., 2012). Ramsøy et al. (2014) use an experiment on the choice of paint brand (looking for a particular colour the subjects would like to paint their living room in) to study the top-down attention. They show how much we are unconsciously under the influence of advertisements while making a purchase decision. The subjects were shown a commercial for a particular brand of paint and then equipped with a mobile EEG and eye tracking glasses, and sent to a store. The authors report that 78% of the control group, who did not see the commercial, bought a particular brand of paint, 91% of the first target group, who sow a 50 second commercial, bought the paint, and 100% of the second target group, who sow a 30 second commercial, bought it. Both target groups declared later that they were not under the influence of the commercial. Eye tracker also recorded that the target groups explored the shelves much more than the control group, while EEG measured their emotional and motivation responses.

Sensory neuromarketing deals with processing of senses (smell, sound, taste, sight and touch). Smell, for example, travels much faster to the brain, and this is related to the phenomenon of Proustian memory where a scent can bring up a lost childhood memory. That is why some stores use smells to increase the likelihood of buying the product. For example, added citrus scent that is sometimes used in produce department increases risk taking, which increases the likelihood of purchasing. Or the smell of leather in a shoe store gives the shoes added value as customers are convinced it is a real leather.

Finally, one of the most important processes in the brain is memory. There are different kinds of memory such as sensory, working memory (we measure cognitive load), intermediate and long term memory. Long term memory is then divided into declarative memory (episodic and semantic) and non declarative memory. They all have different structures of the brain and neuromarketing tracks their activations. Simon McClure et al. (2004) conducted an FMRI study on effects of memory on consumer preference by giving the participants a blind test of Pepsi and Coca-Cola. They found that the more the subjects enjoyed cola (it didn't matter which one of the two) they were tasting the stronger the activation of ventral medial prefrontal cortex (region for subjective pleasure experience). But if they were told that it is a Coca Cola, there was a stronger activation of hippocampus and the dorsolateral prefrontal cortex (memory structures). They did not get this when subjects were told they were drinking Pepsi although the two are hard to distinguish and Pepsi is also slightly sweeter. So this shows us that memory and the value of the brand has a significant effect on preference.

Other studies have shown that preference and knowledge are strongly correlated. The more people know about the brand the more they like it. Positive words and associations increase the liking as well, while the more people dislike something, the more negative things come to their minds. (Ramsøy, 2014)

Methodology

Two of my colleagues from Hendal d.o.o. and I have designed a typical study of a TV commercial that shows how the eye tracking method is implemented in a market research agency. The commercial was downloaded from www.youtube.com. It is 32 seconds long and it advertises 5 readymade soups from Podravka. The commercial consists of a dynamic and a static part. It presents three soups in the dynamic part and five soups (including the three already shown) in the static part. Only the static part is of the interest in this study. The static part of the commercial contains images of five different readymade soups along with five other elements: a slogan, a logo, a link to Podravka web page, a word "New" and a tree.

The study was conducted with the help of a stationary eye tracker and the Gazepoint software in a market research agency (Hendal d.o.o). We asked 21 subjects (15 women and 6 men; age 20 to 65) to volunteer in this study. The subjects were seated in front of a monitor on which the stationary eye tracker was mounted. After a short calibration, the commercial was shown to them, while the eye tracker was recording their eye movements. The results were exported to MS Excel and data was analysed. With the help of heat map, bee swarm and fog map we were able to visualise eye movements of the respondents both individually and as a group.

Results

We uploaded the commercial into the eye tracking software (Gazepoint) and defined areas of interest. An area of interest is a result of an analyst's subjective assessment of what is interesting in a scene. An area is selected with the cursor and every fixation of a participant's eye that falls in this area is recorded (repeated fixations as well). Eye tracker can measure eye movement in a matter of mili-seconds. Area of interest (AOI) is usually defined in consultation with the client but for the purpose of this paper we have defined ten of them. The material itself could have been a web site, a still picture or a simple text, depending on the aim of research. After the initial setup was completed, we asked the subjects to sit in front of the monitor and watch the commercial. During the exposure time, gaze movements are recorded. After all the subjects went through the same routine, we generated a heat map, afog map (the inverse of heat map), bee swarms and fixation maps.The heat map uses a scale of colours to show where people were looking. "Warm colours" (e.g. red, yellow) indicate an area with a higher share of fixations, while "cold colours" (e.g. blue, green) indicate lower share of fixations. Most of the AOIs in our experiment are blue but there is a yellow and red spot on the AOI "Okruglica" soup. It should be noted that the "Okruglica" AOI is positioned in the middle of the picture, which is likely to affect the number of fixations. A more robust study would perform multiple measurements with different positions of AOIs.

Numerical datais also available for detailed analysis in external statistical packages. These numbers include: AOI duration (in seconds), Number of viewers, Total viewers, Average time to first view (how much time has passed since the appearance of AOI till the fixation on this AOI occurred, in seconds), Average Time Viewed (what is the

average viewing time in seconds), Average time viewed (%), Average number of fixations, Number of repeated fixations (respondents can come back and look at the AOI again) and Average number of revisits (how many times did the respondent looked at the AOI again). From there, we can calculate the share of viewers of that particular AOI; average time from the first appearance of the AOI till noticing the AOI andAverage share of watching the AOI in total duration of the AOI. The table with the figures of interest are shown inTable 1.

At a first glance we can see that "Okruglica" has significantly better result than other AOIs and that the "Logo" hasn't been seen by any of the subjects. A key indicator is the share of viewers of that particular AOI in total viewers. "Okruglica" has 62% share of viewers, and "Tree" and "Slogan" follow with 48%. It took the subjects much more time to spot "Tree" and "Slogan", but they spent more time looking at the "Tree" and they were revisiting it. In this case we were interested only in share of viewers and average time from the first appearance of AOI till noticing the AOI because there was nothing specific we were looking for.

Table 1
Key indicators of the eye tracking method

AOI	The share of viewers of that particular AOI in total viewers	Average time from the first appearance of the AOI till noticing the AOI	Average share of watching the AOI in total duration of the AOI	Average time viewed (sec)	Share of repeated fixations	Average number of revisits
Okruglica	61,90%	0,505	14,40%	0,302	1	1
Tree	47,60%	1,043	28,50%	0,571	3	1
Slogan	47,60%	0,694	13,80%	0,277	2	1
Pričalica	42,90%	0,524	21,70%	0,455	1	1
Mljacketi	23,80%	0,942	17,40%	0,365	2	1
Smazolina	23,80%	0,669	8,70%	0,182	0	0
Zvjezdica	14,30%	0,726	10,40%	0,219	1	1
Link	14,30%	0,82	8,50%	0,171	0	0
Novo	4,80%	0,017	15,20%	0,304	0	0
Logo	0,00%	0	0,00%	0	0	0

Source: Hendal d.o.o. (2015.)

This data can be combined with demographic information (age, gender, number of children, working status, income, region and settlement size) about the participants, and further analysis can be performed.

Discussion

Every consumer is affected by brands, social connections, context, price etc., either on a conscious of a subconscious level. Consumers are saturated by the commercials It is estimated that the average consumer sees about 2.000.000 commercials in a life time (Krajnovic et al. 2012) and the average American is offered about 3.000 commercials a day (Foley, 2010). Consumers run on autopilot when making purchase decisions most of

the time (as we have more options and less time to decide). Some authors even joke that along with the id, ego and superego there is an ad – advertisement (Foley, 2010).

It might be spooky to use medical equipment for marketing purposes and that is why marketers need to inform consumers what kind of research it is, to make a clear cut between scientific and marketing research and to warn them of the hazards. They should educate consumers about developments in marketing so they do not feel invaded by neuromarketing techniques. Furthermore, there should be a legislative regulation of the advertisements and neuromarketing research in a sense that they cannot mislead the customer. Such regulations do exist in European Union and USA for instance(Jelić, 2014). Neurmarketing can save millions of dollars spent on the wrong campaigns such as hazardous pictures on cigarette boxes. (Krajinović et al., 201). Eye tracking is the least invasive technique and therefore legitimate to use if the subjects are well informed of its' purpose.

The eye tracking clearly gives an insight into where people are looking. Although they might be thinking about something else when looking at the image, they can be asked about their experience after the session with the help of traditional methods and compare these results. In the case of Podravka commercial, one readymade soup popped out – "Okruglica". This is probably one of the most popular soups in Croatia, made with grits dumplings that reminds people of their family meals (with homemade soups). Also the image is centred in the middle of a crowded picture and it is red, so it is not that surprising to see that 62% of subjects viewed this particular image, and should be asked later about their experience. As the density of details in the image is pretty high, some AOIs did not get noticed at all (e.g. the "Logo") and some were noticed very little, (e.g. "Novo" AOI). These are important findings as the client can reduce the length of the commercial (as to save the costs of broadcast) or remove some less visible elements.

Conclusion

The goal of this paper is achieved in two ways. I have presented neuromarketing and its' ethical implications through literature review, and demonstrated the benefits of eyetracking method in a real world environment (market research agency). One of the limitations of this study is the small sample of respondents which is not representative (age, gender). This is due to not setting the marketing goal of the study apart from showing a typical market research eye tracking study and how the eye tracker works. In other words, we did not know what was of interest to the potential client, so the population and therefore the representative sample were not set (the sample could have been consisted of several groups of the respondents such as parents, working mothers, children etc.). Also the colour and positioning of the images was fixed and this introduces a potential bias. It could be addressed in the future research by conducting the same experiment with multiple permutations of the products and their colours.

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