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Neuromarketing and evaluation of cognitive and emotional responses of consumers to marketing stimuli.

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Abstract

The effect that certain publicity campaigns, brands and products have upon us, from a cognitive and emotional point of view, is being assessed, by measuring the attention, the encoding and the emotional engagement. This article has investigated the literature regarding the neuromarketing tools, methods and specific techniques. Given that neuromarketing has borrowed a series of neuroscience-specific methods and techniques, the neuromarketing or consumer's neuroscience represents a passing from marketing specific instruments, such as the focus group, the observation, the direct enquiry, the interview to a series of instruments which record both the brain's electrical activity and the metabolic activity.

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1. Introduction

Neuromarketing is an emerging interdisciplinary field, situated at the borderline between neuroscience, psychology and marketing; it focuses on assessing consumers' cognitive and emotional responses to various marketing stimuli (Karmarkar, 2011) Neuromarketing unlike traditional marketing methods such as focus group,

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uses a number of specific neuroscience methods, in which it records the brain's electrical activity and metabolic activity, such as the electroencephalography (EEG), Transcranial Magnetic Stimulation (TMS), Magnetoencephalography (MEG), Functional Magnetic Resonance Imaging or fMRI, Positron Emission Tomography (PET). Apart from all these, neuromarketing also uses the implicit associations' test and other biometric instruments, methods and techniques, such as eye-tracking, measuring the psychophysiological reactivity, measuring the electrodermal reactivity, assessing the heart rate and the respiratory rate. Consumer's neuroscience is increasingly becoming a field of interest both for researchers and for the business area, because it provides additional, better information than the traditional marketing methods; it also proves useful and effective in understanding the consumer's behavior and reasoning whenever making decisions. Neuromarketing emerged on the background of traditional marketing methods' not being deemed satisfactory any more, not only by scientists, but also by the business area. Therefore, the need to find a new, much more accurate, stricter and scientifically proven data collecting method for the business environment emerged. Measuring the brainwaves may reveal consumers' subconscious responses to marketing stimuli (Ariely & Berns, 2010; Calvert & Thensen, 2004; Kenning & Linzmajer, 2011; Morin, 2011; Pradeep, 2010).

By means of neuromarketing, several commercial effectiveness indicators can be measured. They are: emotional engagement, memory retention, purchase intention, novelty, awareness and attention. We make decisions based on our emotions. The emotional engagement level is triggered by the emotional excitement level. The more intense an experience is perceived, the greater our emotional engagement level is. This is only one accurate indicator of the way in which we respond to certain marketing stimuli and it can also help predict making the purchase decision. The marketing stimuli encoding level can influence the moment when we decide to buy a certain product. This process has been intensely studied and it can be pointed out by measuring brainwaves while stimuli are being presented. The brainwaves' pattern can indicate the success of memorizing that particular stimulus. A high level of emotional engagement and a high level of encoding process activation can predict the purchase intention. The purchase intention appears as a result of the effectiveness of the marketing stimulus, which proved to be persuasive enough to generate this intention. The innovation level of a marketing stimulus can ensure the success of a commercial campaign. Innovation is capable of increasing the attractiveness of a marketing stimulus, thus contributing to the purchase decision. A clear formulation and a good understanding of the message may predict the success or effectiveness of the commercial. The retention capacity will increase once the attention and emotion mechanism are being engaged (Pradeep, 2010).

At present, neuromarketing provides information which cannot be retrieved by means of classical marketing. The most obvious advantage neuroimaging techniques provide is related to the fact that these techniques which harvest quantitative data may also be used before launching a new product, thus increasing the chances of success for that particular launching. Classical marketing methods, such as, focus groups, preference questionnaires, simulated choice methods and market tests are methods which harvest qualitative, subjective data, which do not carry the same accuracy degree regarding the decision-making process as neuromarketing does (Ariely & Berns, 2010)

2. Neuromarketing techniques

Neuromarketing specific technology and methodology are based on some very accurate instruments. The electroencephalography, which is one of the most widespread instruments in use in neuromarketing, was used for the first time in 1920, by Hans Berger. The researcher thus managed to design an instrument capable of recording the electrical signals naturally issued by the brain. By means of this discovery, nowadays we manage to capture brainwaves' activity. The electroencephalography was the first instrument which allowed the researchers to understand and explore the internal functioning of the brain, once with the emergence of the digital era. This discovery essentially contributed to the increase of neurological knowledge. Measuring the whole sphere of activity of brainwaves emerging in various cortical areas is essential in order to understand the way the brain responds to various stimuli (Pradeep, 2010).

A major difference between the various neuromarketing specific methods derives from spatial resolution's accuracy and temporal resolution accuracy. Hereunder, we will present direct and indirect methods of measuring the neuronal activity. The brain's electrical activity is measured with the EEG, at a time when a group of neurons issue signals. A weak point of this method is, as per Baars and Ramsøy (2007) that the electroencephalography provides

little information on the areas underneath the cortex. The EEG also easily records the data provided by the surface neurons. The electroencephalography is a non-invasive instrument, which uses sensors which are capable of capturing the electrical signals produced by the brainwaves' activity. The electroencephalography's sensors are capable of recording very low frequency signals of brain activity. The more sensors there are, the better the monitorization of the whole brain activity. Given that various areas of the brain are responsible for various functions, depending on the type of the stimulus, certain cortical areas will be activated. We should mention that the electroencephalography's sensors are sensitive to a certain amount of artefacts, when they process the signal issued by the brain. In order to eliminate these artefacts, we need to consider eliminating some signals which could corrupt the results of the brainwaves' recording. For instance, if one of the sensors was located on the forehead of the subject, then muscle contraction and blinking would generate a large quantity of artefacts which could corrupt the results recorded by the electroencephalography. Synching the electroencephalography with other instruments may provide far more accurate results on a subject's response to a marketing stimulus (Du Plessis, 2011; Calvert & Thensen, 2004; Pradeep, 2010).

Another neuromarketing specific instrument is fMRI (Functional magnetic resonance imaging or fMRI). By means of the fMRI, we can measure the increase of the oxygen level in the brain's blood flow. As part of an experiment, the subject is scanned while lying on their back in a narrow, long tube. This tube is surrounded by magnets; once activated, the magnets generate electric fields. This instrument is capable of very accurately identifying increased activity in a certain brain area while a stimulus/stimulus situation is being presented. During the experiment, the subject must remain still throughout the testing, in order not to compromise the collected data. We should also mention that unlike the electroencephalography, which is capable of recording the brain's responses in milliseconds, the fMRI has a 5 seconds delay, caused by the time that the blood required by the brain needs to get in the area recently activated by a marketing stimulus being presented. The fMRI is not accessible technology. Using it is very costly, since it involves specially-trained personnel. The fMRI's purchase price is rather sour, compared to the other neuromarketing specific instruments (Pradeep, 2010).

According to Zurawicki (2010) the fMRI concept was based on the traditional tomograph. In order to understand how the fMRI works, it is imperative to mention that our blood contains iron. This is part of the haemoglobin which transports the oxygen throughout the bloodstream. Iron atoms are capable of generating changes in the magnetic field around them. Beyond this, we should also mention that once the area is activated, the vasodilation occurs. This allows the blood to accumulate in the activated area and also allows, by entering the structure of the active cells, the decrease of the amount of oxygen- less haemoglobin. As a result of this mechanism, the fMRI detects the active cortical regions. The signal provided by the fMRI on the computer screen is shaped like a stain and is called BOLD (Blood Oxygen Level Dependent); it is to be analyzed using 3D technology.

Hereunder, we will provide a short description of the instruments which could be used in neuromarketing. The EEG, by means of the electrodes placed on the scalp measure the brainwaves, recording the changes of the brain bio currents. CT (Computerized Tomography): provides - by means of several images, tomographies collected by rotating the X-ray tube - images of the brain structure. PET: by means of the radioactive isotopes injected in the blood stream; they are identified as X-rays and thus the radioactive chemicals emission in the blood stream can be observed. MRI: By means of the magnet, a powerful magnetic field, which can align the molecules, is generated. This method helps with noticing shifts in the brain's electric current. MEG (magnetoencephalography), records the magnet fields generated by the brain's electrical activity. With the help of this instrument we can notice changes in the brain's electrical activity. fMRI, by means of this method, we can record the increase of the oxygen level in the blood stream. The instrument is based on the blood's magnetic property, which can provide information regarding the functioning of the brain (Pirouz, 2004).

The MEG (magnetoencephalography), has the same temporal resolution as the EEG (a few milliseconds), but it has better spatial resolution. By magnetoencephalography, the magnetic fields generated by the electromagnetic fields are being measured. Just like the electroencephalography, the Magnetoencephalography does not cover subcortical brain activity. The Transcranial Magnetic Stimulation (TMS) is based on applying short electromagnetic impulses at the scalp level. By means of this instrument, a particular cortical area can be stimulated or inhibited. This type of instrument may be unpleasant and sometimes inappropriate to the neuromarketing specific research (Du Plessis, 2011). MEG, as a neuromarketing specific instrument, has an advantage over the EEG. This consists in

the fact that the magnetic field is not influenced by the tissue, like electricity. Furthermore, the magnetic field provides more accurate information than electricity in relation to the study of cognitive processes. MEG rejoices good spatial accuracy and temporal resolution (Zurawicki, 2010).

Further on we will describe indirect measuring methods for the neuronal activity. Positron Emission Tomography (PET), is a very costly method (in terms of finances), uncomfortable for the subject and less and less used in neuromarketing specific research. It consists of injecting the subject with a radioactive substance whose flow is measured in order to point out a flow's significant increase in the activated area. fMRI and MRI, these pieces of equipment are rather expensive. The price of each can easily go up to a few million dollars, and their weight can reach a few tons. They have a powerful electromagnetic field, 600,000 times larger than that of the Earth. This technology is capable of aligning the oxygen atoms, thus allowing the easy identification of the areas where there is increased cortical activity. There are two types of issues related to this equipment. The first refers to its non-medical use and the second refers to the difficulty of using the equipment on a large number of subjects in this research (Du Plessis, 2011).

PET is an instrument which is capable to point out various phenomena. Among these, brain blood flow, blood volume, glucose and last but not least oxygen consumption. One of the very often used substances in PET is fluorodeoxyglucose (FDG). This substance is absorbed by the cells which have higher activity due to the fact that they need more energy in order to compensate for their consumption. This is also the molecule emitting positrons. PET does nothing but tracking this molecule; it does not accurately identify an anatomical signal. One of the disadvantages of the EEG is that the electrical potentials can vary from one individual to another, as well as from one period of time to another. The cause of these variations is linked to the varying conductivity of the tissues in relation to electrical signals. In the case of the EEG, various amplitudes correspond to various mental states. Thus, alfa, beta, theta and delta waves can be identified (Zurawicki, 2010)

In what follows, we consider useful comparing two costly neuromarketing specific instruments (fMRI and MEG). We deem this comparison very useful. By identifying the strong and the weak points of each piece of equipment, we will be able to make the right decision regarding what is that we can research with the help of a fMRI and a MEG. Although the Magnetoencephalography is more sensitive to deep cortical structures such as the tonsil, unlike the fMRI, this instrument is not capable of accurately locating cortical activity. Unlike the fMRI, however, the MEG can track brain activity in time (Lee, Senior, Butler & Fuchs, 2009).

The Transcranial Magnetic Stimulation (TMS): its characteristic consists in modulating cortical activity by electromagnetic induction. In the case of transcranial magnetic stimulation, two types of electric impulses are used: low and high frequency impulses. The effect is being translated into the neuronal activation and de-activation of the subject. By means of these techniques we can temporarily activate a cortical area of interest. Although less expensive than the fMRI and PET, the problem with this instrument is that it cannot reach beyond the neocortex, and this is an aspect which prevents further study with this method (Zurawicki, 2010).

According to Du Plessis (2011), measuring the consumer's psychophysiological reaction to marketing stimuli is another indirect method of measuring cortical activity. This method reveals aspects related to the emotion of the consumer, in relation with structural elements which define the tonsil. However, these methods are not so reliable.

Another neuromarketing specific method would be measuring the ocular dynamics. At present, this can be done by means of eye-tracking. The movements of the eyes reveal the attentional bias and the focus degree (Du Plessis, 2011). As (Duchowski, 2007; Zurawiki, 2010) explains, the eye-tracking is an instrument by means of which we can analyze the way in which warnings are read, the distribution and gaze time (of the look) and last but not least, the pupil dilation. Eye-tracking helps us observe the way the print influence the subject's attention and cognitive processing. It should also be mentioned that eye movement can be divided in two categories: fixed and interrupted. The limitations of this methodology are common to that of other biometric ones'. The theory supporting eye-tracking tells us that pupil dilation and a longer blinking interval would correspond to the subject's better processing the information. We consider that the instruments which record brain's metabolic and electrical activity can, at any time, be corroborated with biometric data. The Implicit Associations' Test is not a neuroscience specific method, but it proves very useful to neuromarketing. By means of this method, we can measure the consumer's response time at the moment when they hear the name of a brand. This method has proven extremely useful in cognitive psychology, but also in researching more delicate social aspects. It should be reminded that our brain has the tendency to store the information in an interconnected structure. A positive emotion will be capable of raising a

positive association Du Plessis (2011). This approach is a complex one, and the chances to capture more accurately the consumer's cognitive and emotional responses to marketing stimuli increase significantly.

Although the neuromarketing is assigned the best instruments available in order to assess consumers' responses to marketing stimuli, this method does not guarantee success. Only by further knowing the decision-making mechanisms we can make various campaigns and products more efficient. It should be mentioned that our purchase decisions are most of the time influenced by the reptilian, primitive brain. While the neocortex processes rational, complex, information and the middle brain processes emotions and instincts, the reptilian brain is in charge of making decisions (Renvoisé, 2010).

3. Conclusion

By means of neuromarketing, we will have the chance to understand the basics of the decision-making mechanism. Thus, we will be able to access a superior level of knowledge on the consumer's behavior. They will be the basis of understanding the way in which consumers respond to various marketing stimuli. This approach is going to be a difficult one, given the context, as per the way it is presented in the specialized literature, according to which the decision-making process can activate various cortical areas (Hammou, Galib, Melloul, 2013; Lee, Broderick, Chamberlain, 2007)

According to Lindstrom (2010) by means of neuromarketing we can find out how the consumers behave and make decisions, while accessing the unconscious thoughts, emotions, feelings and desires which trigger in us the purchase decision. Neuromarketing can help us understand how unconscious mind processing influence the decision to purchase, providing a better understanding of the consumers' thoughts, emotions, feelings, needs and motivation in relation to the marketing products.

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