

Neuroscience as a Resource of Powerful Tools for Marketing

KLJUČNE REČI: neuronauka, oslikavanje mozga, marketing, elektrofiziološke tehnike

POVZETEK - Neuronauka je multidisciplinarna nauka zasnovana na fiziologiji, molekularnoj biologiji, psihologiji i matematičkom modeliranju sa konačnim ciljem izučavanja nervnog sistema. Predmet istraživanja neuronauke se vremenom proširio i kao rezultat ovog procesa razvile su se različite poddiscipline koje imaju snažan uticaj na ljudsko društvo. Neuromarketing, takođe poznat i kao Neuronauka potrošača, izučava ljudski mozak kako bi predvidela i moguće čak i manipulisala ponašanjem potrošača i procesom njegovog donošenja odluka. Zasniva se na činjenici da je nervni sistem i njegov centralni deo mozak izvor svih osećanja, misli i akcija, kao i da deluje poput bioelektričnog uređaja čija aktivnost može biti merena. Stoga različite elektrofiziološke tehnike kao oslikavanje mozga, praćenje oka, kodiranje ekspresije lica, elektrencefalografija, elektroprovodljivost kože itd. mogu biti korišćene kako bi se zabeležio i predvideo proces donošenja odluke kod potrošača. Poznavanje ponašanja potrošača je odlična početna pozicija za razvoj strategije u marketingu. U ovom radu razmatrane su različite elektrofiziološke tehnike koje potiču iz oblasti neuronauke i odskora jesu važan alat za neuromarketing.

KEYWORDS: neuroscience, brain imaging, marketing, electrophysiological techniques

ABSTRACT - Neuroscience is a multidisciplinary science based on physiology, molecular biology, psychology, and mathematical modeling with the goal of studying the nervous system. The scope of neuroscience has expanded over time, and as a result of this process, several sub-disciplines have emerged with great impact on human society. Neuromarketing, also known as Consumer Neuroscience, studies the human brain to predict and possibly even manipulate consumer behavior and decision making. It is based on the fact that the nervous system and its central part, the brain, which is the source of all feelings, thoughts and actions, act as bioelectrical devices whose activity can be measured. Therefore, various electrophysiological techniques such as brain imaging, eye tracking, facial coding, electroencephalography, galvanic skin response, etc. can be used to detect and predict decision making. Knowing the details of consumer behavior is an excellent starting point for developing marketing strategies. This paper discusses various electrophysiological techniques that originated in neuroscience and have recently become important tools in neuromarketing.

1 Introduction

Neuroscience, also known as Neural Science, is a multidisciplinary science based on physiology, molecular biology, psychology and mathematical modelling with the final aim to study development, structure and function of the nervous system. Neuroscience, often denoted to in the plural as Neurosciences, focus on the brain and its influence on behaviour and cognitive functions (Marinković, 2018).

There are several achievements of Neuroscience that have an impact on our society. One of them is a basic understanding of how a group of neurons connected by synapses into a neural network processes information. The knowledge about the functioning of these biological neural networks was applied for the development of artificial intelligence, nowadays widely used for

machine learning. Neuroscience has also contributed to the design of a brain-computer interface that uses brain activity to move bionic limbs and wheelchairs that are necessary to the people that suffered injuries or neurodegenerative diseases. Mind computer interface is just one of the applications that emerged from this area.

The scope of neuroscience has broadened over time and as a result of this process different sub-disciplines with high impact on human society emerged. A whole group of interdisciplinary scientific fields that have the prefix neuro - emerged: Neuroeducation, Neuroeconomics, Neuromarketing, Neuropolitics, Neuroaesthetics, Neurotheology, Neurocriminology. Obviously, the study of neural correlates of mental processes has become an important element for understanding human society, social relations and human creativity in general (Marinković, 2018).

In a broader sense, Neuroeconomics is a scientific field that tries to explain the neurobiological mechanisms of the decision-making process in humans, their ability to consider several possible alternatives and follow a certain direction of action. The final aim is to provide an explanation for human behaviour related to the decision-making process that would have application in both the natural and social sciences. In a somewhat narrower sense, Neuroeconomics and Neuromarketing are new interdisciplinary scientific fields that combine neuroscience, economics, psychology, and computer science, with the goal of studying the factors that model human consumer behaviour. Neuromarketing studies the sensorimotor, affective and cognitive reactions of consumers to a marketing stimulus, in example, the offer of a certain product or service. Consumer reactions are measured by brain imaging methods and standard physiological methods. Starting assumption for this approach is that the true reaction of the consumer cannot be assessed from his response obtained through interview and questionnaire, but only from the reaction of his nervous system, which can be accurately measured (Levallois et al., 2012; Marinković, 2018).

The aim of this paper is to present and discuss different techniques that derives from the field of Neuroscience and could be successfully applied in Neuromarketing and Neuroeconomics. Appropriate choice of such techniques might be of great help in establishment of marketing strategies.

2 Methodology

A literature review was used as to present techniques of Neuroscience that could be successfully applied in Neuromarketing and Neuroeconomics, and potential limitation and obstacles in their application. All described techniques were divided into three sections. Presented data were collected from previously published work of the author together with some of the latest data derived from significant authors from the interdisciplinary area of Neuroeconomics and Neuromarketing. In the last part of the paper different potential applications of these techniques were further discussed.

3 Results

Neuroscience offers several techniques that could be used to detect and predict consumer's decision process. These are functional brain imaging techniques, direct electrophysiological techniques and indirect electrophysiological techniques. Results obtained by these techniques are used in the development of convincing marketing strategies.

3.1 *Brain imaging techniques*

Noninvasive brain imaging methods are also known as neuroimaging methods. They aim to “peek” into the intact brain and “image” its structure, while some of them detect changes that take place on a physiological level in the specific brain structures during occurrence of specific thoughts and feelings.

Positron Emission Tomography (PET). This technique is based on monitoring a radiolabeled probe, which is introduced into the body just before specific task that requires specific mental activity is given. The probe might be a neurotransmitter, its agonist or antagonist, or an energy metabolite such as glucose or oxygen. By measuring the flow of a radiolabeled metabolite, the activity of a specific brain structure in a certain cognitive process is determined. PET is expensive and invasive method, uncomfortable for the subjects, a method that employs radioactive agents and exposes subjects to radiation, and therefore less and less used in Neuromarketing.

Functional magnetic resonance imaging (fMRI). Functional magnetic resonance imaging is based on measuring the change in the magnetic field due to oxygen consumption during increased blood flow in active parts of the brain. It uses the same equipment as standard magnetic resonance imaging, and unlike positron emission tomography, there is no use of a radioactive probe. However, despite its high spatial resolution, it presents very low temporal resolution, it is a very expensive, restrictive and not portable. fMRI instrument is proficient in accurate identification of increased activity in a certain brain area while a stimulus situation is presented. On the other hand, during the experiment, the subject must stay immobile throughout the testing, in order not to compromise the collected data (Sebastian, 2014).

Magnetoencephalography (MEG). The movement of electric current through conductors, or in the case of the brain through neuronal fibres, causes the appearance of a magnetic field. While EEG monitors the electrical component of an electromagnetic wave, MEG records its magnetic component. Thus, magnetoencephalography is a technique based on measuring changes in the magnetic field on the surface of the subject's head, as a consequence of changes in neuronal activity (Marinković, 2018). The MEG has the same temporal resolution as the EEG, but it has better spatial resolution. Magnetoencephalography is not portable, therefore studies can only be carried out in laboratory settings.

3.2 *Direct electrophysiological techniques*

Electroencephalography (EEG). EEG is basically a non-invasive technique for measuring the bioelectrical activity of the brain. The brain has a constant bioelectrical activity, which changes depending on the general mental state and therefore can serve the purpose of monitoring psychological processes. The measurement of the electric potential is performed using two or more electrodes, and the obtained record of the electrical activity of the brain is further analysed. The characteristics of brain activity recorded in the form of waves, the frequency and amplitude, change with brain activity. Depending on the type of brain activity, it is possible to observe different types of brain waves: alpha, beta, delta, gamma and theta waves. Each of these wave types has a specific wavelength, frequency, amplitude and shape and indicates a specific brain state (Gazzaniga et al., 2013; Marinković, 2018). For example, frontal asymmetries reflect instant, preconscious motivational responses to marketing stimuli like media ads, brands, and physical products (Ramsøy et al., 2018). In last few years, EEG gear has become more inexpensive, movable, and wireless, opening up new options for mobile, in-store, and virtual reality studies.

3.3 *Indirect electrophysiological techniques*

Behavioural changes that reflect the decision-making process and the choice between multiple alternatives can be monitored indirectly based on measurements of electrophysiological activity of muscles, eyes, skin and blood vessels. These types of the measurements are used in several techniques that have application in Neuromarketing.

Eye tracking (ET). Eye tracking is technique that follows the eye movements and registers gaze patterns of the participants by utilizing infrared light. This information is used to explain the visual path as a response to a specific stimulus. There are several types of eye-trackers: stationary eye-tracker, eye-tracker glasses, eye-trackers in virtual reality glasses, and eye-tracking through webcams. ET delivers information on temporal processes, with high resolution, at a reasonable cost, and it is portable. As a result, eye-trackers are one of the most used techniques in Neuromarketing (Bitbrain, 2019).

Electromyography (EMG). Electromyography is a procedure for measuring muscle tension in which an electromyogram is obtained as a result of recording by placing two electrodes on the surface of the skin above the examined muscle. In the state of muscle rest some of the muscle fibers are maintaining muscle tone (tension), while upon stimulus the tone of skeletal muscles enhance. Therefore the difference in muscle tension is a measure of a subject's psychological and mental state (Marinković, 2017).

Electrocardiography (ECG). This technique measures the electrical activity of the heart by placing sensors on the skin surface. It enables to collect information from participants that were exposed to stimuli in real time. In addition, this technique is low-cost and participants are comfortable.

Galvanic skin response (GSR). Increased values of electrical conductivity of the skin are associated with increased sweating, which indicates the emotional arousal of the subjects upon exposure to a marketing stimulus. Bitbrain's Ring is one of the most employed technologies used in Neuromarketing studies as it includes both GSR and ECG, and participants demonstrate high acceptance (Bitbrain, 2019).

Facial coding (FC). FC technique uses a camera to register the voluntary and involuntary movements of facial muscles associated with specific emotional and cognitive states while participants are exposed to investigation stimuli. Facial coding is an inexpensive and portable technology and it can be implemented with a webcam (Bitbrain, 2019).

4 **Discussion**

The scientific results achieved through Neuroeconomics and Neuromarketing have opened space for new scientific branches, such as Neurofinance, Neuroinvestment and Neurotrade. Altogether, this knowledge can have practical application in improving financial investment decisions, various market and stock market decisions, etc. Knowing the details of consumer behaviour is an excellent starting point in the development of marketing strategy.

What would be the advantage of neuroscience approach in market research over the classical economy? Neuroscience approach enables a better understanding of the behaviour of participants in financial trading, based on which it improves the financial results of the trading. Based on the identification of brain regions that encode forecasting (expectations), profits and risks in making economic decisions, it enables understanding of the process of making economic decisions. Besides, it offer new methods and strategies to improve the process of economic decision-making and trade. Neuroscience approach also possesses better predicative

powers than standard economic theories and is more precise in observing and interpreting economic models of decision making (Kolev et al., 2016; Marinković, 2018).

5 Conclusion

Neuroscience gave birth to several different techniques developed primarily for investigation of the brain functions. All these techniques found application in Neuromarketng research due to the fact that all decisions of the consumers are basically reflections of their brain functions. The main obstacles in usage of some techniques are high expenses, robust immobile gear and complicated analysis of obtaining data. Due to further development in the field of engineering and information technologies in last few years Neuromarketing is getting small, inexpensive, and easy to use appliances. Obviously, synergy between neuroscience, engineering and IT opens new possibilities for the Neuromarketng.

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