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Neuromarketing – research and prediction of the future

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Abstract: The paper deals with neuromarketing, its techniques, the current status of research and the future prediction in this field of marketing. The first chapter brings the general overview about neuromarketing and briefly points out the history. It also represents six areas of practice which are branding, product design and innovation, advertising effectiveness, shopper decision making, online experiences and entertainment effectiveness. The paper further describes particular techniques which can measure different kinds of activity. The most common techniques are electroencephalography, magneto encephalography, functional magnetic resonance imaging, positron emission tomography and eye tracking. The last chapter deals with prediction and the future of neuromarketing. The aim of the article is to bring the attention and highlight its actuality and the importance of its understanding.

Keywords: Advertising, Brain, Customer, Marketing, Neuromarketing, Neuroscience, Product

1. Introduction to Neuromarketing

The term of neuromarketing has begun to shape in the late 90s of the last century. Its founder is considered to be a Harvard professor Jerry Zaltman. He pointed out the possibility of using modern technology to imaging brain in marketing and consumer behavior. It is a discipline that combines knowledge from different disciplines such as neurology, psychology, marketing, and sociology. “Neuromarketing is knowledge about the information processing and decisions made by humans and investigate in how businesses should communicate with the brain in detail” (Tourtoulou et al., 2013). A scientific journal called Journal for Psychophysiology has defined neuromarketing as “the contribution neuroscientific methods can make to the understanding of marketing-relevant human behavior is likely to be considerable” (Lee et al., 2007). The essence of neuromarketing is to understand better and know the way of consumer thinking, their emotions, suggestions or preferred value. Neuromarketing finds its application in various areas such as innovation, modification of the product, pricing strategy, creating of communication mix and others. The aim of neuromarketing is to understand better and read customer needs, motivations or values. It is a sort of prediction of consumer behavior and their responses to particular stimulus. Therefore, neuromarketing has emerged as new scientific areas of marketing that deals with the subliminal reaction of consumers in connection with marketing materials such as brands, products, and product lines. Neuroscience is a scientific discipline that aims to explore various parts of the nervous system and their interconnection. L. Zurawicki describes the neuroscience as “fusion of various disciplines embodying the molecular biology, electrophysiology, neurophysiology, anatomy, embryology and developmental biology, cellular biology, behavioral biology, neurology, cognitive neuropsychology and cognitive sciences” (Zurawicki, 2010). Neuromarketing is a new marketing subcategory. It is based on techniques of neurosciences for better identifying and understanding of human brain which is responsible for customer behavior and their acting in order to increase the effectively of commercial activities for particular enterprises. Neuromarketing is a modern discipline that presents an area between neuroscience and marketing. Professionals and marketers have to consider individual ideas provided by customers. They need to think further about the impact of this kind of knowledge to marketing research and activities

2. History of neuromarketing

The beginnings of the studies in neuromarketing can be observed already around 1960 when Herbert Krugman, as a pioneer, measured the spontaneous dilated pupils as an indicator of interest in people looking for products or printed advertisement. Later, there appeared the measurement of galvanic skin reactions that can express emotional reactions of human being to advertising and new technology. It is called eye tracking; it allows accurate tracking of the eye pupil, thus revealing certain places that catch the eye of the human brain. In 1970, Krugman and Fleming Hansen began to review the processes of the right and left hemispheres of the human brain through encephalography. These technologies have become a huge breakthrough in science. However, no one has been able to apply and take advantage of these advances in marketing (Hanlon, 2007). In 2002, American companies started with services of an advisory. They provided with few types of research in neuromarketing. In a history of neuromarketing, there was a research which was considered as an important milestone. A repeated research from 1975 overtook again in 2003 realized by Read Montague well known as “Pepsi Challenge”. Neurofocus is one of the largest and the most successful company. They are leader in the field of market research which brings knowledge and information to advertising and neuroscience. They employ wide number of professionals and have cooperation with major universities such as Harvard and Berkeley. They provided the service to different business areas such as car business, food, and beverage, finance, retail and services on the internet. The important clients of Neurofocus are the world leading companies: Google, Intel, PayPal, HP, Disney, Pepsi and Microsoft and many others. On the market, there are also the companies which deal with neuroscience and biometric tools as Forbes Consulting, Buyology, NeuroInsight, etc.

The companies that implemented neuromarketing to their business:

- A well-known example can be IBM Watson. It is a computer system which can answer the questions asked in a natural language. Apart from this, it is a system which can predict the customer preferences. It is considered a great inputs and insights to what the customer need and valued.
- Microsoft used techniques of eye tracking. It helps to expose and learn about client's tendencies and preferences for deeper engagement. Microsoft also uses data mining of EEG. It provides a better understanding and bring further interactions with computers. It also includes the feelings, sense of satisfaction or frustration.
- Google has brought a new wave to biometrics. This study measured the efficiency of video-sharing website YouTube, Overlays vs. Pre-rolls. The result of this study discovers that overlays show as a more useful.

It says that car industry loves neuromarketing and neuroscience. Lexus as a luxury division of vehicle takes the totally different approach to accomplish the customer experience. It seems as a more creative type of marketing than just neuroscience. Nevertheless, it represents the connection between the rate of client's heart and experience from driving.

3. Techniques of neuromarketing

Electroencephalography

This technique was found in 1929. It is one of the best known and most widely used methods in neuromarketing research. Its principle is based on the electrodes that are placed on the human skin. It can measure the current pulses in the activation of neurons. In the brain, there are the electromagnetic waves and they are spread. It means that the measurement of electroencephalography is sensitive to time resolution. The advantage of encephalography is affordability compared to other methods and its ease of use.

Magneto encephalography

It captures the magnetic field caused by the activity of neurons. Its resolution is very accurate because it can identify sources with an accuracy of a few millimeters. Time resolution is almost the same as it is inencephalography - change is recorded in a matter of milliseconds. The reason for the less percentage of usage is the financial cost of its acquisition and operation.

Functional magnetic resonance imaging

The above-mentioned methods measure the activity of neurons directly. However, functional magnetic resonance technique examines brain activity indirectly. It is a modern method which is used for functional imaging of the brain, respectively mapping brain response to the external or internal stimulus. This technique allows precise measurements

in the specific part of the brain where some activities are happening. However, the functional magnetic resonance imaging has the certain delay. The disadvantage of this method is its cost.

Positron Emission Tomography

This is a method of nuclear medicine. It is one of the most expensive technique. In this method, the patient needs to use the radioactive substance. It measures the flow of the scheduled substance and the area where it is accumulating. This method is used less in the research, and the usage for marketing research activity is not likely.

Eye tracking

This method records the movement of the human eyes. The essence of this method is to monitor the frequency and intensity of the view. It monitors where and what people are looking for longer and more frequently. It also records the enlargement of the pupils.

Table 1: An overview of psycho physiological techniques

	Acronym	Physical measure	Applied measure	Temporal resolution	Spatial resolution
Neuroimaging Technologies					
Magnetic resonance imaging	MRI	Change in energy state of hydrogen	Grey and white matter	Days	< 1-3mm
Functional magnetic resonance imaging	fMRI	Blood oxygenation level	Metabolic activity	Seconds	1-5mm
Diffusion tensor imaging	DTI	Magnetic diffusion gradient of water	White matter tracts	Day	1mm
Positron emission tomography	PET	Radioactive	Metabolic activity	Seconds	3-5mm
Near infrared spectroscopy	NIRS	2-deoxyglucose	Metabolic activity	Seconds	2cm
Computed tomography	CT	Blood oxygenation level	Metabolic activity	NA	< 1mm
Magnetoencephalography	MEG	X-ray absorption	Grey and white matter	Milliseconds	Centimetres
Magnetoencephalography	EEG	Magnetic fields	Population neural activity	Milliseconds	Centimetres
Electroencephalography	TMS	Electrical fields	Population neural activity	Milliseconds	> 1cm
Transcranial magnetic stimulation		NA	Accuracy and reaction time		
Other psycho physiological techniques					
Voice pitch analysis	VPA	Vocal cord vibration	„ Arousal“	Fractional seconds	NA
Galvanic skin response	GSR	Electrical resistance	„ Arousal“	Fractional seconds	NA
Eye tracking		Corneal reflectivity	Spatial attention	Milliseconds	NA

Note: 1) Temporal resolution - the fastest rate of changes that can be measured by neuroimaging technique; Spatial resolution - the minimum possible distinction between location (Source: Perrachione, T, Perrachione, J. (2008) “Brains and brands: Developing mutually informative research in neuroscience and marketing”, Journal of Consumer Behavior, Vol. 8, No. 5, pp.303-318.)

The table 1 represents an overview of particular psychophysical techniques. The table is divided by acronyms, a physical measure, applied measure, temporal resolution and spatial resolution. The second part of the table has another psychophysiological technique.

4. Research in neuromarketing

One of the first neuromarketing researches was released in 2004 by Read Montague as a director of the human neuroimaging at Baylor College of Medicine in Houston. It was published in a scientific journal called *Neuron*. The study was called “Pepsi paradox”. It was inspired by one of the commercial which is called “Pepsi Challenge“. In this research, the brain was scanned at 67 people. They were blind tasted Coca-Cola and Pepsi. Half of the involved people chose Pepsi. It can be considered that Pepsi can produce a stronger response than Coca-Cola. It is processing in the brain's ventromedial prefrontal cortex. It is a place which is responsible for the processing of feelings. Once the people were known that they were drinking Coca-Cola, $\frac{3}{4}$ expressed that Coca-Cola tasted much better. It needs to be also said that their brain activity had been changed. The results show that Pepsi should have half the market share; however the reality is that consumers prefer to buy Coca-Cola for the reasons which are related to their preferences of taste. They also have better personal experience with the brand of Coca-Cola. It shows the reason Pepsi did not win the wars with Coca-Cola. The fact is that consumers had thought that it tasted better. Therefore, the emotional engagement was higher to Coca-Cola than Pepsi (Lindstrom, 2009).

Martin Lindstrom is a Danish author and author of the book called “Biology - Truth and Lies about Why We Buy”. The book consists of all studies which analyzed the main reason what makes people to buy the particular product. It was claimed that it is currently the human psyche which has the main role in decision making what the customers will buy. The study deeply analyzed the behavior of 2000 human beings during the three years, and 7 million dollars were used to this study. They watched several commercial activities, advertising and marketing materials such as logos, product placements, health warnings and subliminal images. According to this study, it can be considered that branding plays a crucial role to emphasize and optimize all signals of the brand. “When we brand things, our brains perceive them as more special and valuable than they actually are” (Lindstrom, 2010). As an outrageous result discovered that the hearing and smelling is much more dominant than what the people really see. “When Nokia phones first hit the market, the company’s default tune became instantly popular, largely because it was the first melody people recognized when they were starting to buy mobile phones (in case you are wondering, the simple ditty is based on *Gran Vals* composed by Francisco Tarrega in the nineteenth century). Since then, the tone has taken on an almost viral quality. In fact, if you go onto YouTube, you can observe complete strangers playing the Nokia melody on the piano, the guitar, or on a clavier. If you're into hip-hop, there's even a gangster' Nokia remix. One Web site claims that the impact of the Nokia melody is so great that there've been reports of songbirds chirping it over the skies of London (Lindstrom, 2009).

5. The future of neuromarketing

It has been identified five predictions for neuromarketing in the future time frame. It can be summarized as the following (iMotions, 2015):

- More collaboration: different kinds of research platforms will be used to provide sufficient comparison and effective collaboration. Therefore, the researchers feel confident to share their outcome.
- More studies will be done: numbers of case studies and research will grow in next period. It will help to understand better, analyze or compare the obtained information and relevant data. It will offer the place for deeper studies of human minds.
- Greater frequency of testing: the profit from the effectiveness of time-saving and usage will bring the higher volume of trial. These tests will be set up on the monthly or bi-weekly basis.
- Better company benchmarking: According to the previous prediction, the better benchmarking will be implemented. It brings the possibility to predict buying behavior.
- More case studies and real-life examples: as it was said previously, more case studies and real-life examples will be provided in the future. It brings better understanding and overview in neuromarketing.

Critical to the success of neuromarketing is the necessary generation of empiricist-driven links between bio-measures and behaviors. As these links become clearer, our understanding of unconscious emotional arousal and valence will be able to predict behavioral outcomes more precisely and reliably than ever before. The advancements in information processing, data capture and scientific theory have created the perfect storm to advance the fields of neuromarketing and consumer neuroscience beyond what was once thought impossible (Clark, 2015).

6. Conclusion

In the last decades, marketing and research have passed through the tremendous changes. Those changes could attribute to the way of consumerism, lifestyle and mostly to the progress and achievement of science itself. Marketing research has never been so concrete and precise since the consumer cannot always honestly and accurately respond to the questions asked. Therefore, neuroscience opens the door to the unknown world. It is about our unconsciousness. It is a modern not-well expanded field. Concerning this type of research, there are plenty of discussions about the ethic principles and accuracy of neuromarketing usage. Many professionals talk about the increasing dangers and abuse from its usage. Neuromarketing research provides us with a unique and accurate feedback from the customer about the effectiveness and efficiency of the marketing communication. Although, it is a field which is evolving and growing we can expect a prosperous future once the ethics will be taken into the consideration.

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