Businesses Neuromarketing Strategies in the Knowledge Economy

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Abstract. *Within this paper, we develop an exploration of the strategies applied by companies that rely on neuromarketing in the business environment of the knowledge economy. Neuromarketing represents a new science that emerged in the conjunction of innovations in neurosciences and economics. Contrary to the traditional economic theories, based on the rational choices of consumers, the neuromarketing strategies are developed in order to influence the emotional side of individuals, which is considered predominant when making commercial decisions. The argument for a literature review paper on this topic is that we consider of great relevance to know and understand the most recent and impactful techniques for influencing the purchasing behavior of consumers today and for forecasting trends. Neuromarketing strategies are already widely used and provide unbelievable results but the challenge is to discover more and more of its potential which is yet unknown. Within the first section of the paper, we present the concept of neuromarketing in terms of the role it plays in the business environment and the benefits it provides for companies all around the world but considering also the limitations encountered by the companies during implementation. Throughout the second section we describe the techniques used in the application of neuromarketing strategies like: recording the brain metabolic activity, using fMRI, PET; recording of electrical activity in the brain, using EEG, MEG, TMS, SST; and others like eye tracking, measurement of physiological responses, IAT, skin reaction, face coding, facial electromyography, which don't imply recording the brain activity. In section three we briefly present the methodology of these neuromarketing techniques in order to understand their purpose and the way to apply them. In section number four we reviewed the actions and effects for a series of neuromarketing strategies applied at the international business level. In order to bring some practical evidence, we present two recent experiments which were conducted based on neuromarketing techniques. Our conclusions reach the idea that neuromarketing science is at an initial stage of application in practice but is rapidly shifting the marketing traditional ways of making profits in business.*

Keywords: *business ethics; knowledge economy; neuromarketing; strategy.*

The role and benefits of neuromarketing

Neuromarketing is a new field in permanent development that forms a connection between psychology and economic neuroscience (Pop et al., 2014). The purpose of this field is to study how the brain is physiologically affected by advertising and marketing strategies (Madan, 2010; Nyoni & Bonga, 2017). In order to evaluate the effectiveness of this strategy, brain activity that is subjected to ad viewing is carefully monitored and measured using neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG). In general, neuromarketing studies measure product preference in terms of brand familiarity and various product and brand categories. If neuroscience is described as incipient, neuromarketing is clearly in the embryonic phase. Marketers look at this aspect only from the perspective of the possibilities offered by the disclosure of brain circuits involved in the search,

choice and purchase of a product. Studies of neuromarketers show that there has been published countless evidence of highlighting some basic neurocognitive principles when consumers perceive advertising messages (Madan, 2010). At this point, it is extremely relevant for companies to acknowledge the most recent and impactful techniques for influencing the purchasing behavior of their consumers (Samuel & Prasanth, 2012). Within the fast evolution of the knowledge economy (Bratianu et al., 2011) and the wide recognition of emotions contribution to the organizational management (Hapenciuc et. al., 2016; Hapenciuc & Bejinaru, 2015) neuromarketing has the potential to provide a series of great benefits for the companies, like:

Information processing - when it comes to attention processes, they become responsible for selecting incentives that may or may not attract the consumer's attention. The main thing that is considered is how a person's stimuli work, for example, if they are different, a person's attention is concentrated from the bottom-up, but if the brain thinks that these stimuli are important, the consumer's attention is increased from the top-down direction.
Determining the meaning and emotional values - the human brain is able to recognize any information received from its senses and gives it meaning along with an emotional value. For this reason, when a consumer makes a decision without consent he or she already has a preferred option. In this sense, emotional values influence decision-making (Bejinaru & Iordache, 2010; Bratianu & Orzea, 2013).
Deliberation and analysis - this category includes conscious cognitive tasks, such as regaining memories, interpreting the past, anticipating the future, planning, solving a problem, generating intentions, simulating, calculating and reasoning. Therefore, a person can make a decision based on these aspects which are not necessarily the most attractive option (BitBrain, 2019).

Despite the numerous and valuable benefits that the neuromarketing application generates there is still a lot of reluctance with a view for ethical principles towards the final consumer (Neamtu & Bejinaru, 2018). There are voices that wonder if it is an ethical behavior that companies should act on influencing, like manipulating, the consumers' intentions and further actions because these might generate risks of harming or rights violation (Stanton et al, 2016). In this sense, we present in Table 1 two sets of advantages and limitations of the neuromarketing application.

Table 1. *Benefits and limitations of neuromarketing application*

BENEFITS	LIMITATIONS
• Perceiving the way in which a consumer acts - in market research there are several techniques, such as field observation, ethnography, analysis of digital behavior and those obtained from the Internet.	• High-quality technology - without using high-quality technology the physiological data are not reliable, consequently, the results obtained are not valid.
• Understanding a person's method of analyzing and deliberating a product - the most practical techniques used are: surveys, interviews, and target groups.	• Proper forecasting of the experiment - in this context it is necessary to use a scientific methodology and to avoid experimental distortions.
• Analysis of unconscious reactions - due to the applied neuromarketing the acquisition of emotional or cognitive reactions is performed with the help of neurological tools such as EEG or bisenzymes.	• Experience in interpreting results - the consequences of applied neuromarketing provide numerical values for specific values such as attention, emotional impact, but there are no reasons why these values were obtained. Thus, the professional in charge of explaining them should comment on these results and offer recommendations.

Source: BitBrain, 2019

Techniques used in applied neuromarketing

The application of neuromarketing represents a strategy itself, but there are available a series of techniques in this field, which fall into 3 categories, presented in Figure 1:
a. Recording of brain metabolic activity: fMRI, PET
b. Recording of electrical activity in the brain: EEG, MEG, TMS, SST
c. Without recording brain activity: Measurement of physiological responses, IAT, Face coding, Skin reaction, Eye tracking, Facial electromyography (Bercea, 2012).

The most commonly used technologies in neuromarketing are EEG (tracking brain activity), GSR biosensors - galvanic skin response and BVB - heart rate, eye tracking devices and also implicit response tests. The practice of these technologies allows us to approach a wide range of studies and to obtain a large number of values in a reliable way, at a reasonable cost (Pradeep, 2008).

In turn, the other revolutionary brain imaging methods (fMRI, MEG, SST, PET), which are useful in other contexts, are generally eliminated in marketing because of their high price, invasiveness but limited applicability. Other bisectors, such as temperature, respiration or electromyography, are usually not included in the same context, which is usually not taken into account for similar reasons (Kenning et al., 2009).

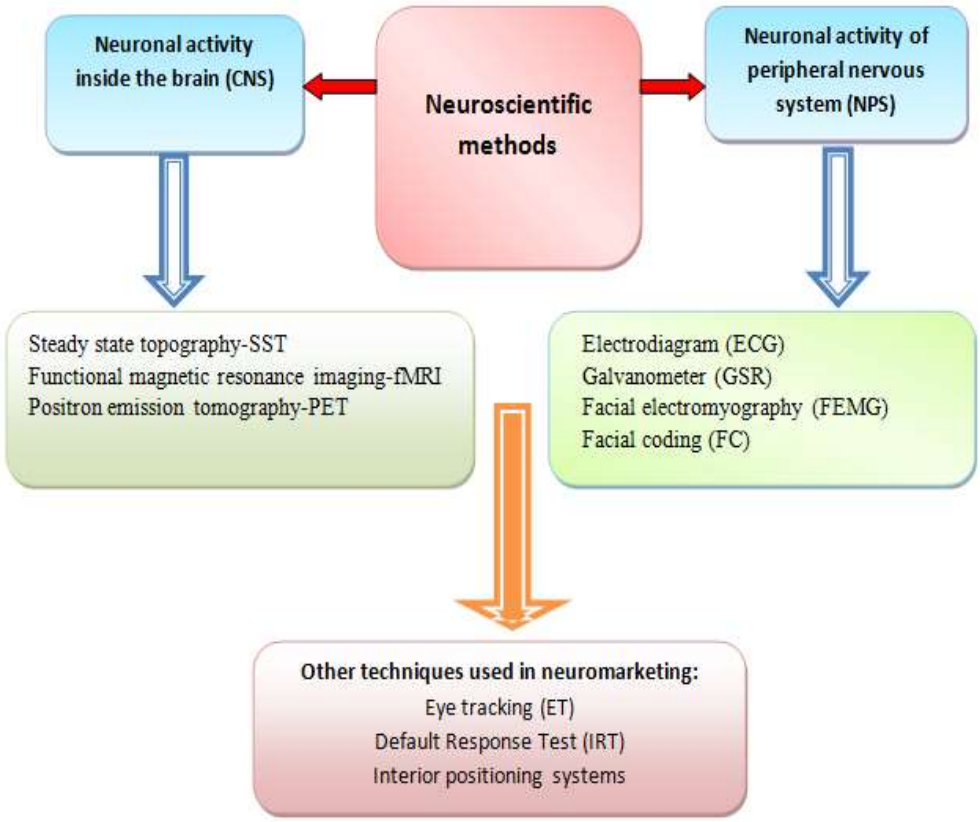


Figure 1. *Techniques used in applied neuromarketing*
(adaptation after BitBrain, 2019)

Neuromarketing methodology

In order to be able to identify variations in brain activity at the sight of packaging, advertising, and other communications, neuromarketing uses the latest technology to register which parts of the brain "light up" when tested individuals process a stimulus. Thus, there are three methods that neuromarketing uses the most: -Electroencephalography (EEG), -direct measurement of brain activity using functional magnetic resonance imaging (fMRI), -an indirect measurement of brain activity through eye-tracking and visual focus analysis. In addition to the three methods mentioned above, there are three other data collection processes, which are: steady-state topography (SST), ectodermal activity (EDA) galvanic skin response (GSR) and facial recognition (Hildebrand, 2016). All the devices for the above-mentioned techniques are represented in Figure2.

Electroencephalography (EEG) (Figure 3)- represents the measuring of variations in the electrical activity of the brain that occurs directly below the scalp and occurs as a result of neuronal activity. In its raw form, the EEG data shows little more than a curved line of lines that might be indecipherable to non-specialists. Each wavy line is a specific frequency of brain waves: alpha waves, beta waves, delta waves and theta waves (Hildebrand, 2016).

Figure 2. *Technologies used in applied neuromarketing (adaptation after BitBrain, 2019)*

This method helps researchers measure short- and long-term emotions, levels of involvement and frustration (Davis, 2012). The EEG works by attaching electrodes (special sensors) to the surface of a human's head and which are connected to a computer that reads brain activity. The sensors are positioned in three different areas of the scalp: the amygdale (the place where the emotionally charged memories that trigger different physical reactions are stored), the hippocampus (the memories) and the lateral prefrontal cortex (the highest level of cognitive power and attention). Based on recorded brain waves, researchers can track the intensity of visceral responses, such as anger, lust, disgust, and enthusiasm (Penenberg, 2011).

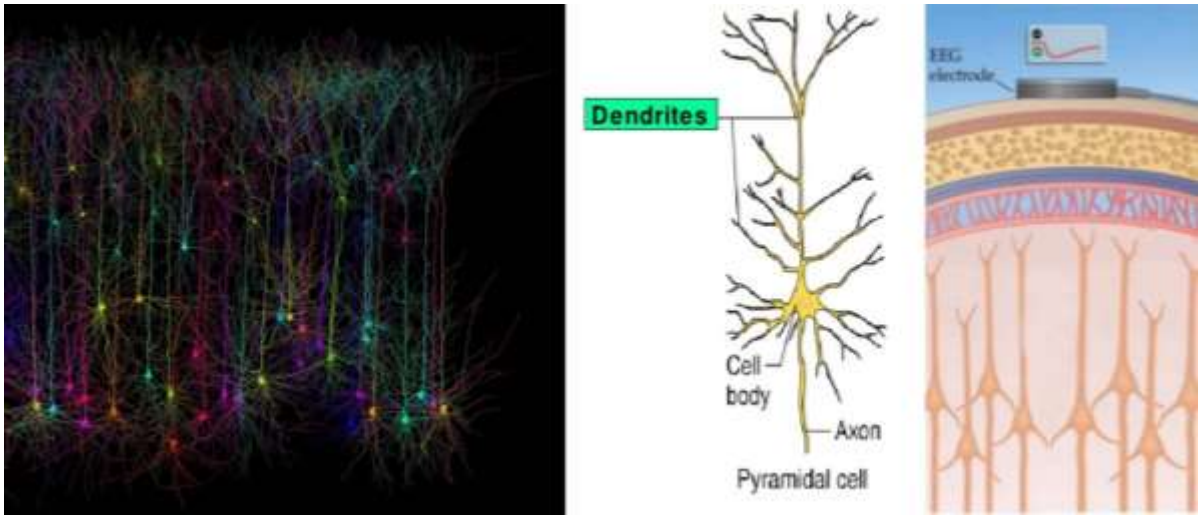


Figure 3. *In the center: the structure of a pyramidal neuron, on the right: the arrangement of pyramidal neurons perpendicular to the cortex, on the left: the parallel arrangement of the aforementioned neurons. (Tecnicas de Neuromarketing (III): EEG, https://bit.ly/2F5VBqH, accessed on 24/05/2019)*

The topography of a stable brain state (SST) - it is a particular use of EEG technology that uses a sinusoidal flickering stimulus, driven to the visual periphery. "Once the stimulus-response is recorded, these data are calculated to measure short latencies. SST was first described by Richard Silberstein in 1990 and has been used as a research method for cognitive neuroscience in areas such as brand communication, media and entertainment analysis" (Hildebrand, 2016, p. 30). The SST studies the viewer's response by recording brain activity, while the participants follow visual materials or perform psychological tasks. An important feature of the SST is the ability to measure delay variations between the provided stimulus and the SSVEP stimulus - this is the oscillating electrical response. of the brain, also known as the visual potential evoked by the stable state of the brain (Hildebrand, 2016). The main purpose of this method was to examine the

normal function of the brain in combination with visual alertness, working memory, long-term memory and emotional processes (Tagliazucchi, 2019).

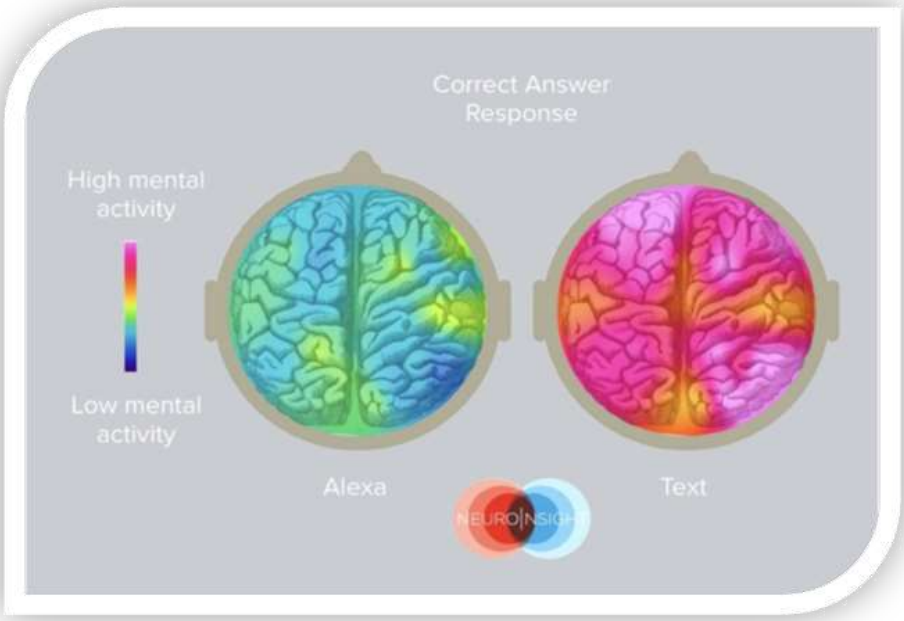


Figure 4. *Brain activity map when receiving a response (https://twitter.com/brianroemmele/status/853610414587887616)*

Mindshare Futures and the Innovation Group of J. Walter Thompson have produced a report on the Voice First revolution. The SpeakEasy report is a fascinating insight into how quickly your voice will take the place of handwritten text. Their research has identified efficiency as a primary motivation for voice use. Figure 3 above shows the brain activity measured with the help of SST headphones, its unit of measure is radian and is equivalent to the power of the brain response. Correspondents of this study were asked to perform a number of tasks, either talking to Alexa or typing on an iPad. Using Neuro-Insight, the management of a neuroscience research agency investigated the brain's response to vocal interactions. The report shows that voice interactions have consistently shown a lower level of brain activity than their tactile counterpart. It highlights a problem that has been present for more than 20 years and that the human tendency is to apply human characteristics to things that are characteristic of man, for example, Voice First. 72% of regular users of Voice First say that all brands should use unique voices and personalities for their own applications (Mindshare Futures & Thompson, 2017).

Functional magnetic resonance imaging (fMRI) - is a functional neuroimaging process that uses MRI technology to measure brain activity associated with changes in blood flow. When the 32 parts of the brain are used, the blood flow in the area increases. The reason this technique works so well is that brain blood flow and neuronal activation are coupled. The brain's response to the need for more oxygen in specific areas of the brain can be measured by the blood flow to these areas. fMRI uses magnetic resonance scanners to produce sets of cross-sections in the brain called tomograms, which allow fMRI scanners to accurately identify which specific areas of the brain are activated at a given time (Davis, 2012; Hildebrand, 2016). Following a simple fMRI experiment it was found that voxels whose signals closely match have a high activation score, whereas those that do not have a correlation have a low level, representation in figure 5 (Devlin, 2018).

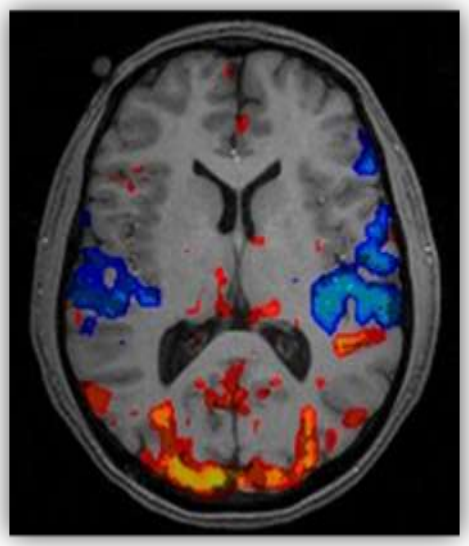


Figure 5. *The result of a simple fMRI experiment (Devlin, 2018)*

Eye-tracking technology - offers the opportunity to register and analyze the movement of an individual's eye while seeing stimuli. Typically, this method is used when the subjects of an experiment are watching TV ads, reading or watching ads, watching the product packaging, or interacting with a web page. Eye-tracking techniques are not disturbing and allow the person concerned to act normally. In general, the subject sitting on a chair is presented with a stimulus and as he/she sees it, the eye tracking device transmits an undetected beam of filtered light that is reflected back into the tracking device. This indicates where the individual is looking (Davis, 2012; Hildebrand, 2016).

Neuromarketing strategies in international business

The benefits of neuromarketing can be easily detected in each company, which has made the decision to use advanced technologies to promote their product in a way that is different from the competition and to bring out the best "weapons" that they have. (Dragolea & Cotirlea, 2011; Zbuchea & Vidu, 2018). These companies that benefit from neuromarketing, have the advantage of creating a better understanding of consumers' brains and deciphering the decision-making process. Therefore, by using neuromarketing methods, consumer groups and their perspective on a particular brand or product can be identified. Crowds of consumers can be delimited by different categories: based on age, sex, ethnicity, area of origin, socio-economic constraints and many other elements. Using all of these methods, neuromarketing researchers and marketers have the chance to better understand consumer behavior and to accurately target marketing strategies. In table 2 below, we find different examples of neuromarketing, their mode of action, but also the effects they have on consumers (Solomon, 2018).

Table 2. *Different examples of neuromarketing strategies, their mode of action and their possible effect on consumers*

STRATEGY	ACTION	EFFECT
-Using sound and colors to sell a product;	-It has an immediate impact on the human brain.	-Strong sound makes people subconsciously participate in dark objects -Music more inclined to high frequencies shifts the receiver's attention to luminous objects - White is more attractive than black.
- Decreasing frames in commercials;	-It influences the consumer through advertisements.	-Winning boxes are phrases like: "Get the new edition now!", While the losing ones sound like this: Make sure you don't miss the new edition! " People with a high need for uniqueness prefer to hear what they will lose when they do not buy the product, while individuals with a low need for

		uniqueness must hear what they will gain from their purchase.
- Use of subtle rewards in order to attract consumers online;	- This method has the effect of convincing customers to return again.	-Stores focus on delayed rewards, such as a certain number of points for each purchase made, which can be converted into store credits at any given time. -Short-term rewards help people stay on track, while they need to achieve long-term goals.
- Creating an efficient product design process;	- Offers the most qualitative and unique packaging options.	-Comparison of different packaging options for products. -Volvo and Hyundai have used similar methods to find out which elements of the new car models have aroused consumer interest.
- Production of a multi-sensory mismatch;	- Inventing products and packaging that make materials look different.	- Successful brands involve consumers in multi-sensory stimulation. - This means that they offer something more than just the visual appearance of a product, such as smell or taste. If two sensory indices do not adjust, then this is considered a mismatch.
- Predicting future successes with the help of neuroscience.	- It influences the market success of a product.	- It influences market investments, time management and money power.

Source: Solomon, 2018

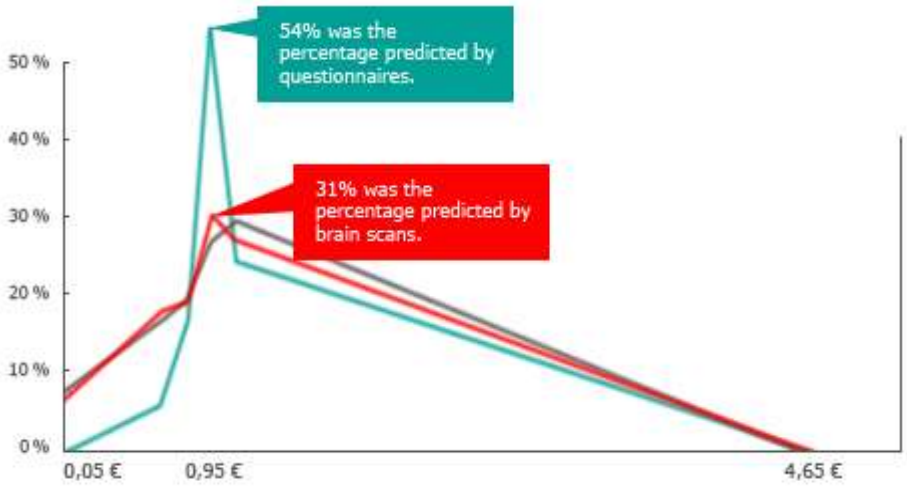
Currently, there are over 150 neuromarketing companies across the Globe dealing with a wide variety of studies in the field of neuromarketing. Thus, their classification by continent and their number can be found in the following way (Solomon, 2018): South Africa = 3 neuromarketing companies; Asia = 9; Australia = 4; Europe = 96; North America = 44 and South America = 17.

In Romania, at present, there is no company to do research with the new revolutionary technologies of neuromarketing. Ana Iorga, the founder of the company Buyer Brain in London, confessed in an interview that although neuromarketing in Romania has begun to take color, its degree of development is at a low level. The main causes are related to the reluctance of managers, managers of a business to use a research technique. If in other European countries, managers view the chance of being the first in scientific research as an opportunity, in Romania, managers are reluctant and consider the use of such a technique a high risk for their business. Thus, the difference between the European and the Romanian culture is made by the unstoppable desire of the people to take a risk, to be regarded as an advantage over their competitors in order to promote the brand and to understand the human brain in the purchase of products (Badoiu, 2016).

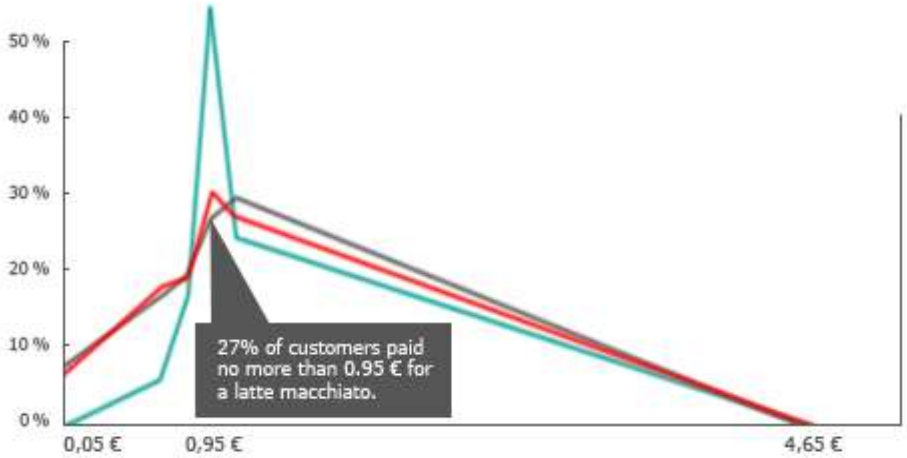
Experiments carried using neuromarketing techniques

The Latte Macchiato experiment. The Neuromarketing Labs company, established in Germany in 2011, conducted an experiment, at the request of a client, in order to find out what price students are willing to pay for a cup of latte macchiato from the coffee machines located inside a university campus. In order to help the customer in the pricing strategies, the company applied the NeuroPricing technique in parallel with traditional market observation (Boksem & Smidts, 2015). In April 2013, they conducted a field study placing a new machine on the campus of the University of Applied Sciences in Munich. The price of coffee ranged from 0.05 euros to 4.65 euros. In the first stage, 35 students participated in this experiment, where they were tested with the help of the EEG device and asked based on a questionnaire which is the amount for which they would be willing to pay for a cup of latte macchiato on an automatic, meanwhile registering their brain activity to measure their willingness to pay. This part of the study led to two different forecasts: one based on questionnaires and the other based on brain data using the EEG technique. What the researchers noted was that the demand curve prediction for the two measures was different. In the second stage, the researchers controlled the coffee machine, so that the prices for a cup of latte macchiato to vary constantly between 0.05 euros and 4.65 euros. This allowed them to discover the behavior in the real world of 150 students using coffee vendors. Thus, the three demand curves were analyzed: the demand curve

based on NeuroPricing provided by the EEG data, the demand curve based on the questionnaire data and the curve of real-world demand with the help of 150 students. In conclusion, the results showed that the demand curve based on the NeuroPricing EEG was much more accurate in predicting population behavior than the demand curve derived from the questionnaire data, as showed in Graphics 1 and 2 (The Neuromarketing Labs).



***Graphic 1**. Representation of the demand curve based on the questionnaire data (green color) and the demand curve based on the NeuroPricing EEG (red color)*
(The Neuromarketing Labs)



***Graphic 2.** Representation of the curve of real-world demand with the help of 150 students (gray color)*
(The Neuromarketing Labs)

The Dupio chocolate experiment. Researchers Simone Kuhn, Enrique Strelow, and Jurgen Gallinat conducted a study to find out who is the best predictor of buying behavior: qualitative research or fMRI scans? They began their study with the help of a sample of 18 women, between the ages of 23 and 56, all describing themselves as chocolate drinkers. The women were shown a picture with the product and 6 related communications, including a control image representing 'a toothbrush'. The product picture appeared on the screen for 2 seconds, followed by 3-second advertising, then the product again for 2 seconds. During the testing, the researchers used fMRI imaging connected to several areas of the brain. Then, participants were asked to make a hierarchy of communications according to their preferences. Thus, the experiment generated 3 sales forecasts: one based on stated preferences, one based on brain activity during message viewing and one based on fMRI changes when viewing the product before and after message

communication. The German supermarkets exposed each test treatment for one week, thus recording real sales. The strongest correlation between forecasts and actual sales came from the fMRI signals during communications, the fMRI data before and after the message was displayed the second, and the preference stated by the subjects of the experiment ranked in the last place (Gleason, 2018).

Smart neuromarketing strategies that companies use to influence customers

Nowadays it is obvious that ambitious companies struggle for discovering the best strategies in order to influence (or even manipulate) consumers and increase their revenues. Following we describe the most efficient smart neuromarketing strategies: *Ingenious packaging*. Companies have discovered the efficiency of data provided by electroencephalograms (EEGs) in order to understand which items consumers prefer on their packaging and on the outside and also which they do not like to see in the packaging. For example, when Chips Ahoy decided to use neuromarketing in the creation of their packaging, the company discovered that customers had a negative emotionality for the words "resealable" on the product packaging. This was due to the fact that people found it difficult to read. Surprisingly, the photo of the chocolate chip cookie on their pack failed to elicit large reactions from the test subjects. As a result, the Chips Ahoy brand redesigned its packaging with a "resealable" tab that was clearer and more visually appealing, with chunks of chocolate flying (Heerkens, 2017).

Limited editions. When it comes to the successful Nike brand, along with the brand name is instantly attached a story of the limited edition sneakers that cause total chaos among collectors on the day of the store opening. There is a good reason for this that has to do with neuromarketing. The effect of consumer love for limited editions and limited offers is called deficit marketing. Marketers add a deadline on a product, such as limited offers and reduced bookings, in order to pressure consumers to purchase the product as fast as possible. Creating a sense of urgency for the customer has been a technique used many times and has proven to be extremely effective (Heerkens, 2017).

Multisensory stimulations. Nowadays businesses are pushing their marketing efforts to an impressive level. Thus, they offer their customers an experience that goes beyond the common senses of sight and sound. This domain is long-life-learning and with each new mystery unraveling, the marketers understand better their target's behavior and bring in new sensorial elements in order to stimulate smell and touch. An excellent example is the video game, South Park: The Fractured but Whole. To develop a convincing promotion of the game, have been invited journalists and bloggers to test the latest gadget, the Nosulus Rift. This gadget should be a peripheral companion for their game, which emits an unpleasant odor in several scenes of the game (Ariely & Berns, 2010; Heerkens, 2017).

The striking headlines. The title is the main component of advertising and its impact has never diminished until now. In most cases, headlines are the ones that get people's attention in an add. Therefore, they need to be more attractive, interesting and surprising to the human brain. A new technique used is called "Hippocampus Headlines", translated as news or hippocampus headlines and refers to the use of familiar everyday expressions that can be easily changed and applied in the description of a product. This method activates the brain making the title more attractive and memorable. A successful combination was realized for the Silver Patron tequila product which created the slogan 'Practice Makes Patron' by transforming a similar and common expression as 'practice makes perfect' (Dooley, 2019; 2015; 2011; Heerkens, 2017).

Efficient web design. Web-based neuromarketing struggles to enhance visitors' engagement and conversion rates. This is possible due to the cognitive preference used in the content and design of the web page. Small details, like the font, colorful graphics and appearance, have an effect on visitors. Numerous studies have shown that people are more inclined to explore sites that are vertically designed than new horizontal sites. The explanation of neuromarketers is that the vertical design sends a signal to the reader's brain according to which there is more information underneath, as opposed to the horizontal landscape (Dooley, 2019; Heerkens, 2017; Lindstrom, 2008). According to the literature, studies conducted by numerous researchers and through experiments performed on different groups of people from different parts of the world, it has been concluded that neuromarketing is one of the most important exact sciences in terms of understanding consumer behavior.

Conclusions

The essence of this paper was to analyze the reactions of consumers, to deduce and confirm the role that marketing has at the moment, consumers having a vivid and unstinting desire to discover other new products that will satisfy all their aspirations, needs and induce a fundamental conception about their own personality. This research paper has achieved the proposed objectives in terms of identifying the arguments for which consumers, regardless of age or gender, are targeting a particular product on clear grounds. What marketers are trying to understand with the help of new neuromarketing technologies is to clarify what drives consumers to choose a particular product and how they can improve all of their methods to arouse curiosity and charm neurons in the human brain.

We conclude that the results identified according to the researches we studied show that more and more consumers aspire to the choice which is most suitable for them, without arousing a feeling of regret when they physically give up a sum of money for a certain product in favor of another. Although the fear of risk is greater than the desire to discover a new thing, the marketing strategies guide the consumers in the proposed direction, attaching to the products a psychological conception related to "trust". Thus, marketing agents have succeeded through a successful “packing” of games of words, colors, sounds and shapes, to embrace the needs of consumers, having the persuasive gift of stimulating an individual to select precisely the whole package created by them.

As a bottom-line, it can be said that neuromarketing is the ideal puzzle piece to complement the idea of how consumers feel, think and act in comparison to the other methods of understanding their behavior. The explanation is by the simple fact that, when using questionnaires to certain target groups, their responses, from a psychological point of view, may be totally different with reality, or in some cases coincide with it, for various reasons, such as the answers negligent, the desire to provide that desired response by the person questioning or even their dishonest statements for fear of telling the truth. In conclusion, we argue that neuromarketing can really improve the way a company creates a product and the method by which it promotes it so that the product is considered more interesting, more attractive and more valuable to the consumer.

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