

Opening the “Black Box” in the Consumer's Mind: Understanding What is Neuromarketing

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Abstract

Neuromarketing (NM) and its predecessor, neuroeconomy, use clinical information about brain functions and mechanisms to help explain what happens in the “black box”, predominant in many explanations about consumer behavior. This paper has the objective of showing the most recent discussions about the concepts and applications of NM techniques, by means of a literature review. It was found that there is still much controversy about the scope of what should be considered NM or even if it is a sub-area of marketing or a sub-field of neuroscience or neuroeconomics. Furthermore, the potential ethical problems of this research have still been little discussed. Although some research has addressed this issue, very little was done to control this line of research to avoid abuse and invasion of privacy by companies or specialized consultancies.

Keywords: Neuromarketing, neuroeconomics, consumer behavior, marketing research

1. Introduction

With the advent of cognitive neuroscience in the 1980s, techniques and devices have been developed to measure thoughts and feelings, at least indirectly (Walter, Ablner, Ciaramidaro, & Erk, 2005). In traditional neuroscience studies, a relationship has been observed between pleasant and unpleasant emotional responses and the increase in neural activity of the medial, thalamus and hypothalamus pre-frontal cortex. Furthermore, unpleasant emotions are associated with neural activity in the occipital-temporal cortex, parahippocampal gyrus and amygdala (Lane et al., 1997). Facial expressions of dislike or anger have been associated with an increase in neural activity in the left inferior frontal gyrus and the anterior insular cortex (Phillips et al., 1997). A meta-analysis study on the activation of emotions using PET and fMRI concluded that no brain region is activated by all the emotions (Phan, Wager, Taylor, & Liberzon, 2002).

Lee and Chamberlain (2007) considered that the skills of researchers in directly observing brain activity has recently grown exponentially through the use of functional neuroimaging methods like magnetoencephalograms (MEG) and functional magnetic resonance imaging (fMRI). For example, they cite the fact that, on average, six to seven papers were published per day in 2007, using only the fMRI technique. Additionally, older techniques like the electroencephalogram (EEG), eye tracking and electrodermal response (EDR) remain popular, and they have received a renewed interest together with new methodologies.

Advances in neuroscientific methods have provided researchers with in-depth information on previously little understood psychological issues and they have also provided new interpretations for enrooted theories and concepts (Lee & Chamberlain, 2007). The neuroscience methodologies, especially non-invasive neuroimaging technology, now enable researchers to probe brain activity at the basic neural level of operation (Shiv et al. 2005).

It should be underscored that recently some studies in neuroscience and psychophysiology have dealt with relevant organizational problems, especially in decision making and information processing (Lee & Chamberlain, 2007). Such studies have received many names, such as Neuroeconomy (Braeutigam, 2005) or Neuromarketing (NM) (Lee, Broderick, & Chamberlain, 2007). To Hubert and Kenning (2008), in fact Neuroeconomics is an

area of research that evolved from the combination of both neurology and economics, and specifically examines the neural correlates of decision-making. Neuroeconomics and Neuromarketing are not the same, according to Hubert and Kenning (2008), to whom Neuromarketing is a sub-area of Neuroeconomics that addresses relevant marketing problems with methods and insights from brain research (Fugate, 2007). The term “consumer neuroscience” also differs from Neuromarketing (Hubert & Kenning, 2008): the former concerns the scientific proceeding of this research approach, and the latter designates the application of the findings from consumer neuroscience within the scope of managerial practice.

Walter et al. (2005) indicate that cognitive neuroscience deconstructs the picture of perfectly rational humans, which are deliberating their choices by weighting costs and benefits until a deliberative equilibrium is reached. Hubert and Kenning (2008) also mention that the consideration of all aspects that determine decision-making can help consumer researchers and social scientists to more fully understand human behavior, been this one of the advantages of using NM techniques. Consumer choice-making has proved to be a popular subject for neuroimaging research (Lee et al., 2007). However, Lee et al., (2007) explain that research in marketing is considerably broader than simply exploring end consumers and their decision making though, such as trust, pricing and negotiation.

According to Fugate (2007), NM use clinical information about brain functions and mechanisms to help explain what happens in the “black box”, predominant in many explanations about consumer behavior. Until now, most explanations about market behavior were based on inferences. If NM professionals can use the science to locate the consumers’ “buttons”, we will be closer to opening the consumer’s mind’s black box.

Fugate (2008) indicates that this area of marketing research can have important implications for the future of the area, especially service marketing. This is not a new area of research, since equipment capable of performing neurological studies has been around for several decades. However, the application for marketing is relatively recent and the extrapolation of neural sciences for marketing has received the name “neuromarketing”.

The idea subjacent to NM is that understanding the human brain will help marketing professionals develop better methods for selling products (Lindstrom, 2009). For example, it is possible to check whether people simply like the products or if they also want to have them. Furthermore, if people in general buy products they want to have, then it could also be possible to obtain information about the probability of people buying the products. Recent studies have shown that the information about the brand has considerable influence on brain activation. In this context, this paper has the objective of showing the most recent discussions about the concepts and applications of NM techniques, by means of a literature review, which is presented next.

2. Concepts Related to Neuromarketing

The objective of this section is to permit a brief understanding of neuroscience discussions and points related to NM, that is, brief knowledge of how the brain operates and how it is possible to observe and study it. As cited previously, the use of brain tracking techniques, fundamental to the areas of medicine and biology, have contributed significantly to non-medical areas, like marketing, for example. The use of some of these methods has been aimed at analyzing and understanding consumer behavior at the brain level.

The interaction between marketing and neuroscience, or better, NM, has permitted the formulation of some questions, such as, how does a brand, product, an ad or decision making affect our brain and, consequently, behavior. Neuromarketing has permitted, within the methodological limits inherent to those brain mapping techniques used, unveiling which brain areas are activated in response to certain stimuli tied to consumer experiences. However, Hubert and Kenning (2008) indicate that consumer neuroscience is still in its infancy and it constitutes a complementing advancement for further investigation of specific decision-making behavior.

According to Lindstrom (2009), NM can contribute to expanding the knowledge of how our unconscious drives our behavior. For him, a greater understanding of apparently irrational behavior, involved at the moment of a choice, such as the purchase of a high-cost product, for example, would permit greater control over this behavior and greater perception of possible strategies used by advertisers, thus making it possible to defend against eventual tactics and tricks they use. Meanwhile, NM could be a fundamentally important tool for companies because as the subconscious needs and desires of the target public become known, production and introduction of increasingly more useful and significant products for the population could be expanded in the market. Although very interesting, this knowledge is still limited by our restricted understanding of the functional organization of the human brain.

At the end of the 19th Century, Spanish histologist Ramón y Cajal postulated that the central nervous system is comprised of billions of neurons, polarized nerve cells that communicate through chemical synapses. He

described the morphology of a typical neuron, which is comprised of dendritic ramifications, cell body and axon. Later, with the advent of electronic microscopy, the existence of electrical synapses was observed. These occur through cell membranes maintained in touch by gap junctions that enable the exchange of substances between cells, including ions (Guimarães, 1999).

The human being has approximately 10^{11} to 10^{12} neurons, and due to their morphological and biochemical characteristics and their interconnections, they play the role of control and integration of body activity, and they participate in the elaboration and modulation of mental activity (Guimarães, 1999). The central nervous system is also comprised of glia cells, which are bigger in number than the nerve cells, and with primordial functions for operation of the neural network, such as support for neurons and the transporting of nutrients and other substances between blood vessels and brain tissue (Vallejo, Tilley, Vogel, & Benjamin, 2010).

The transmission of information between nerve cells occurs through the propagation of electric stimuli, nervous impulses, which generate sources of electric currents, which in turn promote hemodynamic changes and alterations in the magnetic field. These cerebral structure properties permit using neuroimaging techniques, such as fMRI, MEG and EEG (Araújo, 2002).

The neuron membrane in a relaxed state is polarized due to an unequal distribution of ions between the intra and extracellular mediums and membrane permeability to these ions. In this condition, neuronal membrane hampers the entry of sodium (Na^+) and chlorine (Cl^-) ions, while the opening of potassium channels facilitates the passage of potassium ions. Besides the selective opening of ionic channels, protein molecules called Sodium-Potassium Pumps act against the grain of existing concentration, pumping three Na^+ ions out for every two K^+ ions that enter, generating a difference in electrical potential between the intra (electrically negative) and extracellular (electrically positive) mediums (Guimarães, 1999).

When excitatory stimuli promote the depolarization of neuron membrane beyond a certain threshold, the cell triggers a nerve impulse of potential for action that consists of a rapid change in membrane voltage polarity, from negative to positive and back to negative, causing a repolarization. The inversion of electrical charges occurs because membrane depolarization promotes the opening of Na^+ channels with the consequent increase in the inflow of this ion, with the simultaneous outflow of K^+ . Thus, the potential for action propagates throughout the entire extension of the axon. The arrival of the potential for action at the pre-synaptic terminal, located at the extremity of the axon, promotes the opening of calcium (Ca^{++}) channels in the terminal. The increase in Ca^{++} levels causes the fusion of synaptic vesicles located in the terminal (organelles that contain chemical mediators or neurotransmitters) with presynaptic membrane and the consequent release of the neurotransmitter in the synaptic cleft. Once released in the cleft, the neurotransmitter can act on specific chemical receivers located in the postsynaptic neuron, generating inhibitory or excitatory alterations in postsynaptic membrane. Inhibitory stimuli cause a hyperpolarization of the membrane impeding the formation of a new potential for action in the postsynaptic neuron. Thus, a nerve cell is able to receive information from thousands of neurons and transmit it to thousands of other nerve cells (Guimarães, 1999).

Interest concerning the location of brain functions, and the interconnections between areas, emerged mainly from studies conducted by French surgeon Paul Pierre Broca in 1861. He discovered the center for speech, located in the third circumvolution of the left frontal lobe, demonstrating that patients who are unable to speak had lesions in that region of the brain, known today as the Broca area. At the same time, German neurologist Carl Wernicke detected that lesions in a similar area of the temporal lobe, caused sensorial language deficit and that this area maintained intense communication with the Broca area, forming a complex system responsible for the understanding and expression of spoken language (Sabbatini, 2003; Thomson et al., 2008).

In 1937, neuroanatomist James Papez observed that superior cognitive processes, such as emotional experiences, would be processed and controlled not in a single brain structure, but rather a neural circuit that was given his name, and comprised of the hypothalamus the anterior thalamus nucleus, the cingulate gyrus and the hypofield (Papez, 1937).

MacLean (1949) proposed that besides the brain areas belonging to the Papez circuit, two other important structures would have implications in processing emotions: the amygdala and the prefrontal cortex. Besides these areas, the somatosensory cortexes, insula, septum, brain stem, corpus striatum and nucleus accumbens would also be part of the neural circuitry involved in regulating and expressing emotional behavior (Dalglish, 2004).

Knowledge of the neural substrate of different emotions, such as fear, anger, anxiety, reward and motivational systems, has been based on clinical and experimental evidence obtained from human beings and lab animals. Among the research tools responsible for providing valuable information about the functionality of the human brain, there are brain tracking or neuroimaging techniques, which we shall see in the next topic.

3. Neuroscience Research Techniques

The objective of this section is not to exhaust the discussion of neuroscience research techniques, but rather permit a general perspective for professionals not from the medical area, especially marketing scholars. Many of these techniques will not be cited in this topic, but an attempt was made to identify the main ones that have direct or indirect importance for studies related to NM. The excess abbreviations and sub-techniques derived from equipment would distort the objectives of this paper.

SPECT (Single Photon Emission Computer Tomography) and PET (Positron Emission Tomography) scanner equipment permit a visualization of brain operations through the association of equipment with the injection of radioactive agents in a person. The main idea for mapping is for the injected substance to travel the entire body, including the brain and when a person uses another part of the brain, it will necessarily use more energy, in the form of glucose, and this injected substance interacts with glucose. In this case, it is as if the substance were a glucose marker, indicating the part of the activated brain (Araújo, 2002; Cabeza & Nyberg, 1997). These techniques represent methods we can consider invasive for studies about consumer behavior, as well as having very high costs (especially PET), which alone would make many studies in the area unfeasible.

Another technique currently used is fMRI (Functional Magnetic Resonance Imaging). Popularly known as magnetic resonance, it is an improvement over conventional magnetic resonance (MRI), where the latter permits only images of the brain anatomy. Like SPECT and PET, fMRI is a hemodynamic technique, that is, it seeks to identify the activated areas of the brain using blood flow, although the measurement is different, through oxygenation (Cabeza & Nyberg, 1997).

Transcranial magnetic stimulation (TMS) uses intense magnetic fields to excite specific regions of the brain (Araújo, 2002). TMS is being used to identify consumer patterns and the specific role of some areas of the brain in these patterns. This is done through a “virtual lesion”. This device permits “turning off” a specific brain region through magnetic fields, which enables identifying the real effect of the studied region on consumer behavior during the test (Lee & Chamberlain, 2007).

Some techniques have an indirect relationship with brain study, but they belong to the category as likely to be included in NM because they study physiological or cognitive effects and responses tied to the brain. Such is the case of Electrodermal Response (EDR), also known as electrodermal activity (EDA) or Galvanic Response of Skin (GRS), which is a classical technique (Montagu & Coles, 1966) and has shown potential for NM studies. The technique consists of identifying emotions based on measuring electrical conductivity in the palms of the hands and the feet when they imperceptibly perspire. This technique permits analyzing existing emotions in decision making, relating them to aversion or pleasure (Gakhil & Senior, 2008). The Electrodermal Response permits capturing some types of emotions that questionnaires often do not capture.

Along this same line of physiological and/or cognitive response techniques, there is eye tracking. As explained by Perrachione and Perrachione (2008), this technique uses the measurement of cornea reflectiveness aimed at understanding the spatial attention given an object of an individual under study. This technique permits identifying the areas of the object or image that were given more attention and, consequently, that represented greater interest on the part of the individual.

Another technique is called electroencephalogram (EEG) involves the direct measurement of electrical fields generated in brain activities. For such, the equipment has a hair net with electrodes attached to the scalp (Araújo, 2002). Of all the equipment listed, the EEG is one of the most used due to the comparative lower cost and its characteristic of exceptional temporal resolution, which permits identifying practically instantaneous changes in brain activities, with minimal delay (Costa & Cabral, 2000). This characteristic makes it very interesting for use in image analysis, such as commercials.

4. Applications in Marketing

For Fugate (2008), the skill in using equipment for capturing images when the brain is performing functions related to consumption has garnered enthusiastic proponents as well as pessimistic detractors. The proponents indicate that such images can help marketing researchers understand the consumer’s “black box”, which tends to be used to explain the mystery of the purchase decision. However, Fugate (2007) explains that if knowledge about brain functions during decision making by the consumer simply reaffirm what is already known about the process through thousands of inferential studies, then NM will certainly be less controversial. Its power and contribution will be more confirmatory than explanatory.

Lee et al. (2007) also indicate that NM studies add a “layer of theory” on top of the actual cortical activity measure, and that it should not be forgotten that this layer of theory is essentially subjective and cannot

directly prove a posited relationship between marketing constructs. There is a number of different layers of theory that one could overlay on the basic neural activity of the brain: the cognitive layer (internal mental processes that rely on these neural substrates, such as memory and information processing), and the social layer (how social interaction can provide an interactive influence in conjunction with cognitive or neurophysiological mechanisms or both) (Lee & Chamberlain, 2007).

That been said, table 1 summarizes some of the important studies in NM.

Table 1. Examples of important studies related to Neuromarketing in recent years

Title	Authors/Journal	Year	Summary
Branding the brain: A critical review and outlook	Plassmann, H., Ramsoy, T. Z., & Milosavljevic, M./ Journal of Consumer Psychology	2012	The application of neuroscience in marketing, and in particular in brand consumer psychology, has gained popularity over the past decade in academia and the corporate world. This article offers a general overview of the topic and shows why researchers and professionals are excited about the application of neuroscience to brand consumer psychology. The article was concluded with the authors' view on the potential of research at the intersection of consumer neuroscience and psychology.
New scanner data for brand marketers: How neuroscience can help better differences in brand preferences	Venkatraman, V., Clithero, J. A., Fitzsimons, G. J., & Huettel, S. A./ Journal of Consumer Psychology	2012	Using brand management as an example, it is proposed that neuroscience offers a new way to establish the mapping out between cognitive processes and traditional marketing data. A better understanding of the neural mechanisms for decision making will increase the ability of merchants to effectively sell their products. Therefore, as neuroscience can model potential influences in the decision-making process, including pricing, choice strategy, context, experience and memory, it can also provide new insights into individual differences in consumer behavior and brand preferences.
A neural predictor of cultural popularity	Berns, G. S., & Moore, S. E./ Journal of Consumer Psychology	2012	The possibility of using functional magnetic resonance imaging (fMRI) was tested to predict the relative popularity of a common consumer item: music. It used fMRI to measure brain responses of a relatively small group of teenagers while listening to songs by mainly unknown artists. As a measure of popularity, sales of these songs were combined for the next three years, scan and brain responses were then correlated with these "future" sales. Although subjective enjoyment of the songs was not predictive of sales, the activity in the ventral striatum was significantly correlated with the number of units sold. These results suggest that the neural responses to the merchandise are not only predictive of purchasing decisions for individuals who were actually scanned, but such responses can be generalized for the general population and can be used to predict cultural popularity.
Gifts of the NEURO-MAGI	Green, S., & Holbert, N./ Marketing Research	2012	NM offers researchers new marketing techniques for understanding and potentially changing the minds of consumers, but brings with it the dangers of exaggeration, misrepresentation and public skepticism. Market researchers and traders who want to employ NM techniques are likely to benefit by understanding the technical aspects of neuroimaging taking into consideration cautionary feedback from the field, and enjoy the social and practical implications of this technology.
Technologies of ironic revelation: Enacting consumers in neuromarkets	Schneider, T., & Woolgar, S./ Consumption Markets and Culture	2012	Neuroscience is increasingly seen as a possible basis for new business and management practices. A prominent example of this trend is NM - a relatively new form of consumer and market research that applies neuroscience to marketing, using brain imaging and measurement technology to anticipate consumer response to, for example, products, packaging or advertising. The revelation is ironic in the sense that it involves the construction of a contrast between what appears to be and what it really is. This contrasting structure characterizes much of the popular and academic literature in NM, and helps explain the distribution of the relations of accountability associated with the evaluation of their effectiveness.
Novel versus familiar brands:	Reimann, M., Castaño, R., Zaichkowsky, J.,	2012	Two experiments were conducted to analyze the neurophysiological activation, response latency, and actual brand choice on both new and familiar brands. The

An analysis of neurophysiology, response latency, and choice	& Bechara, A./Marketing Letters		results show that: (1) the choice of new brands (compared with the choice of known brands) is preceded by an increased activity of both the cingulate and ventromedial prefrontal cortex, as measured by functional MRI (fMRI); (2) new brands are associated with a longer latency choice response from that of well-known brands, and (3) positive humor increases the response latency of new brands that are chosen in comparison to known brands.
Perceptions of marketing academics, neurologists, and marketing professionals about neuromarketing	Eser, Z., Isin, F. B., & Tolon, M./ Journal of Marketing Management	2011	The purpose of this exploratory study was to reveal the perceptions of marketing academics, marketing professionals and neurologists regarding NM studies, as they have an important role in the future of NM studies. Three factors - interest and participation, knowledge and awareness and ethics, were perceived as the important aspects of NM according to the three groups of participants. Analysis of the perception of NM revealed that neurologists and marketing professionals perceive NM more favorably than marketing academics.
NeuroIS: The Potential of Cognitive Neuroscience for Information Systems Research	Dimoka, A., Pavlou, P. A., & Davis, F. D./ Information Systems Research	2011	The paper proposes a framework to explore the potential of cognitive neuroscience for IS research and offers examples of potentially fertile intersections of cognitive neuroscience and it is a research into the dominions of the science of design and human-computer interaction. This is followed by a study on a "NeuroIS" example, in the context of the adoption of electronic commerce using fMRI, which generates new and interesting perspectives. The challenges of using functional neuroimaging tools are also discussed. The paper concludes that there is considerable potential for using cognitive neuroscience theories and functional brain imaging tools in research to enhance theories.
Medial Frontal Activity in Brand-Loyal Consumers: A Behavior and Near-Infrared Ray Study	Lin, C., Tuan, H., & Chiu, Y./ Journal of Neuroscience, Psychology, and Economics	2010	Researchers have recently begun to explore the physiological factors that influence consumer preferences for product brands. Results for assessing the preference and reaction time indicates that loyal customers are more sensitive to switches in differentiating between luxury and generic products and between attractive and unattractive products. The interaction between brand and attractiveness dominates the preferences of the majority of subjects. Consequently, this preliminary investigation presents a new approach for brand research based on measurement of brain responses.
Aesthetic package design: A behavioral, neural, and psychological investigation	Reimann, M., Zaichkowsky, J., Neuhaus, C., Bender, T., & Weber, B./ Journal of Consumer Psychology	2010	In four experiments, the research sheds light on aesthetic experiences for investigating the properties of behavioral, neural and psychological packaging design. It was found that aesthetic packages significantly increase the response reaction times of consumer choice, which are chosen for products with well-known brands in standardized packages, despite higher prices, which result in greater activation within the <i>nucleus accumbens</i> and ventromedial prefrontal cortex, according to magnetic resonance imaging (fMRI). The results suggest that the amount of reward obtained plays an important role in the product aesthetic experiences.
Using the P3a to gauge automatic attention to interactive television advertising	Treleven-Hassard, S., Gold, J., Bellman, S., Schweda, A., Ciorciari, J., Critchley, C., & Varan, D./ Journal of Economic Psychology	2010	This document is the first step to understanding how involvement with interactive television advertisements can increase the relevance of a brand and therefore facilitate the automatic processing of brand logos (measured by P3a) after seeing the advert, when compared with non-interactive advertisements on television. The results of this analysis suggest that the brands associated with interactive advertisements have more attention automatically assigned to them.
Application of frontal EEG asymmetry to advertising research	Ohme, R., Reykowska, D., Wiener, D., & Choromanska, A./ Journal of Economic Psychology	2010	The aim of the study was to identify activation of the frontal cortex in response to TV advertisements. We compared three consecutive creative processes of world famous advertisements from Sony Bravia ("Balls", "Paint" and "Play-Doh"). It was concluded that the frontal asymmetry measured may be a diagnostic tool for examining the potential of advertisements for creating trends related approaches. It is believed that methodologies based on measuring brainwave activity very quickly significantly enrich the portfolio of marketing research and will help traders to go beyond simple verbal declarations of their consumers.
Celebrities and shoes on the	Stallen, M., Smidts, A., Rijpkema, M., Smit,	2010	The article proposes a study on the acceptance of products which have celebrity endorsement. An increase in activity in the medial orbitofrontal cortex (MT) was

female brain: The neural correlates of product evaluation in the context of fame	G., Klucharev, V., & Fernandez, G./ Journal of Economic Psychology		encountered underlying the processing of celebrity-product pairings. This revelation suggests that the effectiveness of celebrities stems from a transfer of the positive affect from the celebrity to the product. In explaining the neural mechanism of fame, our results show how neuroscience can contribute to a better understanding of consumer behavior.
Does neuroeconomics give new impetus to economic and consumer research?	Hubert, M./ Journal of Economic Psychology	2010	The integration of neuroscientific methods and findings in economic theory has led to the emergence of a transdisciplinary approach to neuroeconomics. This article discusses the status quo, the future development and the key challenges of these branches of research. The central challenge for neuroeconomics and NM is to extend and validate the results obtained, as well as the implementation of a deductive focus increasingly allowing rejection, modification or extension of current economic theories.
Analysis of Neurophysiological Reactions to Advertising Stimuli by Means of EEG and Galvanic Skin Response Measures	Ohme, R., Reykowska, D., Wiener, D., & Choromanska, A./ Journal of Neuroscience, Psychology, and Economics	2009	This article demonstrates how marketing can benefit from neurophysiology. The authors discuss a particular research case on the analysis of a skin care product advertisement. Pre-testing of two versions of this television advertisement revealed that, although the versions were nearly identical, each of them generated significantly different impacts. The only difference between these two versions of the advertisement was in a single scene that contained a particular gesture from a model. It is worth noting that the gesture seemed to increase the effectiveness of the advert. The authors tested whether neurophysiological measures can capture differences in reactions to slightly different consumer marketing stimuli. In fact, using electroencephalography and electromyography and by monitoring skin conductance, the authors were able to register significant differences in neurophysiological responses to a changed scene, although the difference was not consciously noticeable.
A neuroanatomical approach to exploring organizational performance	Gillingwater, D., & Gillingwater, T. H./ International Journal of Business Science and Applied Management	2009	Insights derived from the study of the human brain began to open up promising new areas of research in the social and behavioral sciences. Based on neuroscience principles, these were incorporated in areas such as business management, economics and marketing, leading to the development of artificial neural networks, neuroeconomics, NM and, more recently, organizational cognitive neuroscience. Similarly, the brain has been used as a powerful metaphor to consider and analyze the nature of organizations. In this study, which is primarily conceptual, we propose several ways in which neuroanatomical approaches could be used to improve the organization: theory, practice and research.
Advertising and Consumer Privacy: Old Practices and New Challenges	Rapp, J., Hill, R. P., Gaines, J., & Wilson, R. M./ Journal of Advertising	2009	Our objective is to examine the evolution of public policy and the marketing domain of consumer privacy with regard to the strategies of current advertisers and future activities. After a brief introduction, there will be a discussion on privacy issues identified in literature, focusing on the tensions between the interests of the advertiser and consumer needs.
Neuromarketing and consumer free will	Wilson, R. M., Gaines, J., & Hill, R. P./ Journal of Consumer Affairs	2008	This article analyzes the impact of the discoveries and methods of neuroscience on marketing practices as they relate to the exercise of individual free will. Therefore, the central focus is on ethical issues involving consumers' knowledge, and on consent and understanding on what can be seen as an invasion of their privacy rights.
Neuroethics of neuromarketing	Murphy, E. R., Illes, J., & Reiner, P. B./ Journal of Consumer Behaviour	2008	Companies are starting to offer their customers basic information about cerebral consumer preferences, pretending to ignore focus groups and other market research techniques on the premise that looking directly into the brain of a consumer when viewing products or brands is a much better indicator of consumer behavior. These technologies raise a number of ethical issues. Academics and companies using NM techniques should adopt a code of ethics, which we propose here, to ensure the beneficial use of non-harmful technology in consideration of both categories of ethical concerns.
Neuromarketing and the perception of knowledge	Butler, M. J. R./ Journal of Consumer Behaviour	2008	The emerging field of NM reveals that knowledge has plasticity; in other words, the different participants, researchers and marketing professionals, perceived the development and application of knowledge of NM in different ways. The gap in

What is "neuromarketing"? A discussion and agenda for future research	Lee, N., Broderick, A. J., & Chamberlain, L./ International Journal of Psychology	2007	NM research practice is briefly discussed and then resolved through the contribution of this review, the proposal of a new research model on NM. The application of neuroimaging on market research - which came to be called "neuromarketing" - has caused considerable controversy in neuroscience circles in recent times. This work is an attempt to broaden the scope of NM beyond commercial brands and applications of consumer behavior, in order to include a broad conceptualization of marketing science. The design of general neuroscience and neuroeconomics, NM as a field of study is well defined, and some future research fields are suggested.
Neuromarketing: A layman's look at neuroscience and its potential application to marketing practice	Fugate, D. L./ Journal of Consumer Marketing	2007	The objective of this study is to briefly discuss the origins of NM, explain the process in layman's terms, enumerating some of the results in anecdotal form and suggest future avenues for consumer behavior research based on these findings. The discussion in this document is based on reports of a theoretical and applied nature. Its contents were synthesized and placed into context, showing how they relate to traditional approaches to marketing research and assumptions. Although there are no concrete results, preliminary assessments suggest that the traditional inferential assumptions about consumer behavior may be less potent and explanatory than previously believed. Combining images of neural activity with conventional tools can produce more effective marketing practices.
Are we listening and learning? Understanding the nature of hemispherical lateralisation and its application to marketing	Grimes, A./ International Journal of Market Research	2006	With the advent of increasingly advanced technology available and brain-scanning and the emergence of 'neuromarketing', this paper seeks to critically examine the basis on which marketing research has sought to apply a specific area of neuropsychological understanding: the hemispheric lateralization of brain function. To this end, the author provides an analysis of the scientific research in this area and critically evaluates the application of this study into marketing. The document highlights future research in this particular field, and also serves as a reference point for important and timely implementation of other neuroscientific concepts in the marketing arena.

At a time when the balance of power is quickly changing in favor of the consumer, gaining access to neural diagnostic tools has important implications. The use of these tools avoids the problem of strongly trusting verbal responses from researched subjects, because it is improbable for people to precisely articulate their subconscious motivations for the purchase (Fugate, 2007).

According to Wilson, Gaines and Hill (2008), new neuroimaging technologies could permit marketing researchers to better understand the role of emotions in decision making, to develop more effective methods for releasing these emotions, to build more trust and loyalty in relation to the brand, to better measure the intensity of consumer preferences and, in general, to be more persuasive.

An example of applying neuroscience techniques to marketing, according to Fugate (2008), is the study of service ads. Obvious applications refer to observation of the level of emotional involvement or power of attraction exercised in subjects exposed to the elements of the service ad. However, there are more specific applications, such as the understanding of images/characters that can be used in ads to generate associations with service tangibility (a means to provide specificity and meaning to intangible services).

Another application of NM is in product appeal tests in which researchers in general use consumer preferences, consciously generated, to determine which product designs have greater appeal in their target markets (Fugate, 2007). This application is important because, according to Friedman (2006), the most authentic responses (no bias) could be obtained.

However, for Lee and Chamberlain (2007), despite their potential, neuroimaging applications in marketing have focused only on brands and consumer behavior. In particular, the EEG technique has been used to explore reactions to television ads in a number of ways. The authors believe research in marketing is much broader than merely exploring end users and their thoughts during decision making.

A theme with potential for applying neuroimaging techniques, according to Lee and Chamberlain (2007), is trust, not only in brands and products, but also in organizational agreements (joint ventures, strategic alliances, commercial agreements), which depend on mutual trust between the parties. The social utility of trust is clear

when considering companies that sell products with “fair trade” or “organic” appeals, which depend on consumer trust in these appeals for success.

Furthermore, another area for application is in pricing, crucial for the organizations’ product positioning (Lee & Chamberlain, 2007) want to make excellent decisions and truly have utility, in a broader sense. For Fugate (2008), NM can be used to help marketing researchers develop more effective price strategies. Neural research shows the reward for immediate economic gratification (generated by the limbic region, which governs emotion) prevails over the rationality of future rewards generated by the prefrontal cortex (region associated with reason and calculations) (Fugate, 2008).

Finally, since exchanges are a central concept in marketing, negotiations are also of critical importance and can be analyzed using neuroimaging techniques (Lee & Chamberlain, 2007). For example, consumers are frequently in situations that require price negotiations or other benefits, especially for high-price items like cars and houses.

A brand can be considered a set of associations with a name in a person’s brain (Franzen & Bouwman, 2001). According to this perspective, a brand is a set of information, meanings, experiences, emotions, images, intentions, etc., interconnected by neural bonds of various strengths (Walvis, 2008).

It is important to consider that, for Walvis (2008), in order to increase the probability of a brand being chosen, it is necessary to increase the probability of an associative network that represents the brand being activated and of a brand name entering our consciousness during the choice process. Therefore, marketing researchers should understand the neurological rules that determine what Walvis called the “probability of a brand’s cortical representation”. In order to increase this probability, the author suggests brands should have three characteristics: distinctive relevance, coherence and participation (involvement of the brand's environment).

5. Final Thoughts

The measurement of neurophysiological responses is the future of marketing research and should be a mandatory complement to traditional marketing research in the coming decades. The potential applications of current techniques already allow the scientific community studying marketing to make emphatic statements in this sense. One should take into account that each new technological development in the field of diagnostic medicine, each new discovery about the human brain and its effects on the body and each new understanding of the various interactions between different brain structures will irreversibly have a direct impact on new marketing studies through this new area of research called Neuromarketing. There is still much controversy about the scope of what should be considered NM or even if NM is a sub-area of marketing or a sub-field of neuroscience or neuroeconomics. It does not seem that it should be any of these options, but rather a new multidisciplinary area with peculiarities and specificities that can be very useful either by marketing researchers or neuroscientists who could better understand cognitive processes of everyday consumption experience of people, their vices, desires, interests and conflicts. Moreover, the potential ethical problems of this research have still been little discussed. Although some research has addressed this issue, very little was done to control this line of research to avoid abuse and invasion of privacy by companies or specialized consultancies.

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