

Neuromarketing: Exploring the Intersection of Neuroscience and Marketing for Consumer Insight: a literature review

Neuromarketing : Explorer l'intersection des neurosciences et du marketing pour mieux comprendre le consommateur : revue de littérature

KARIM Atika

P.H.D

Atika1karim@gmail.com

University Hassan I Settat

National School of Business and Management (ENCG), SETTAT
Morocco

KAMAL Samira

Research professor

kamalsamira@gmail.com

Laboratory for Multidisciplinary Research in Economics and Management (LARPEG)
University Sultan Moulay Slimane Beni Mellal (USMS)
Faculty of Economics and Management (FEG)
Morocco

Résumé : Ce papier donne une vue globale sur le neuromarketing, sur ses techniques, et sur l'état actuel de la recherche. Nous avons commencé par un aperçu général du neuromarketing en évoquant brièvement son histoire. Ensuite nous avons listé les techniques particulières qui peuvent mesurer différents types d'activité. Les techniques les plus courantes sont l'électroencéphalographie, la magnétoencéphalographie, l'imagerie par résonance magnétique fonctionnelle, la tomographie par émission de positons et le suivi oculaire.

L'objectif de l'article est d'attirer l'attention sur l'actualité et l'importance de la compréhension du neuromarketing. Cette recherche met la lumière sur les travaux antérieurs des auteurs réalisés principalement entre 2002 et 2022, pour analyser les techniques de Neuromarketing et leur portée sur le marché de la consommation.

Mots-clés : Neuromarketing, Neurosciences, Techniques du Neuromarketing, Consommateur, éthique

Abstract : This paper provides an overview of neuromarketing, its techniques and the current state of research. We begin with a general overview of neuromarketing, briefly mentioning its history. Then we listed the specific techniques that can measure different types of activity. The most common techniques are electroencephalography, magnetoencephalography, functional magnetic resonance imaging, positron emission tomography and eye tracking.

The aim of the article is to draw attention to the topicality and importance of understanding neuromarketing. This research sheds light on the authors' previous work, carried out mainly from 2002 to 2022, to analyze Neuromarketing techniques and their impact on the consumer marketplace.

Keywords : Neuromarketing, Neurosciences, Neuromarketing techniques, Consumer, ethics

INTRODUCTION

The advent of functional brain imaging techniques in the early 1990s made it possible for the first time to observe brain activation induced by certain tasks or stimuli in real time and non-invasively. To date, over 44,000 articles have been published on the functional imaging of human cognition or affect. As with any revolutionary technology, initial research has explored a variety of subjects, resulting in publications of varying quality. Among the themes studied were family love, shame, hatred, jealousy and so on.

Over time, this innovative technology has evolved from its initial clinical or diagnostic use to extend into the cognitive sciences, as well as the humanities and social sciences. Brain imaging research has been carried out in marketing, as in other fields such as sociology, education, political science and economics (B Roullet & Droulers, 2012). The contribution of neuroscience is beneficial to the marketing function, as it gives marketers a deeper analysis of consumers' thoughts and needs in order to improve marketing strategies.

Neuromarketing is a discipline that links neuroscience and marketing, offering a new perspective on marketing research. This approach uses a non-invasive brain-computer interface method to better understand consumer behaviors (Lim, 2018). It uses medical techniques in two ways. First, by examining a consumer's decision-making process and the factors that influence it, primarily in academic research. Secondly, by optimizing marketing communication to understand consumer needs and offer practical benefits such as improved advertising or products. Monitoring the unconscious factors that affect human behavior is the main promise of neuromarketing, as these factors cannot be monitored by conventional marketing techniques, which is particularly attractive at a time when cognitive science has changed its previous approach (Bočková et al., 2021).

A variety of methods are available to record and map neural activity inside and outside the brain to better understand, analyze and measure the specific response of the nervous system to marketing stimuli. Neuromarketing is thus able to draw practical lessons from neuroscience to improve organizations' sales communication and marketing strategies (Badoc and Georges, 2010). However, brain reading raises concerns about the possible use of neuromarketing to manipulate individuals' attitudes and beliefs, and thus specific ethical issues.

The main aim of this article is to provide a comprehensive review of the literature on neuromarketing, based on theoretical and empirical studies carried out by various researchers. To this end, we cover basic knowledge of how the brain works, the history and definitions of neuromarketing, the techniques used, and the benefits and ethical implications of this practice.

1. NEUROSCIENCE AND MARKETING

Traditional marketing is based on traditional market research, using surveys, group discussions, personal interviews, field tests and observations to gather consumer reactions. It thus renders an a posteriori analysis of consumer response. These techniques are limited by the time required, high costs and unreliability of the information provided. In contrast, neuromarketing techniques can capture consumers' tacit cognitive and emotional response to various marketing stimuli, and predict their decisions in real time (Rawnaque et al., 2020).

1.1 Basic knowledge of brain function

Neuroscience studies the central nervous system in relation to memory, perception, evaluation, intentionality, planning and action. Their revolution results from understanding brain function in a resolutely multidisciplinary approach with a combination of traditional approaches and modern technologies, to gain an up-to-date view of brain organization and function and open up new perspectives (Bear et al., 2016).

Neuroscience methods encompass the use of tools and techniques to measure, map and record brain and neural activity during behavior, as well as to generate neurological representations of this activity, in order to better understand the specific responses of the brain and nervous system following exposure to a stimulus (Lim, 2018). Recent functional imaging techniques are furthering our knowledge of neuroscience and clarifying the brain areas responsible for certain pleasures and emotions (Ouazzani Touhami et al., 2011).

The application of neuroscientific approaches improves understanding of the subconscious factors that influence human behavior. Interest in these approaches initially focused on how these human factors (HFs) can be analyzed (Iloka & Onyeke, 2020).

The influence of neuroscience today is more extensive in all fields, contributing to the emergence of new disciplines such as neuromanagement, neuroeconomics, neuropedagogy, neurocoaching, and Neuromarketing, which is the subject of our research work. Neuromarketing is about creating value for the customer and the company.

Neuroscience plays a very important role in marketing, providing scientifically verifiable explanations of how the human brain works. This enables marketing professionals to gain a better understanding of consumers' thoughts and needs, which is essential for creating value for customers while improving company profitability. By using knowledge gained from neuroscience, it is possible to better understand how the brain works, to make the link between

decision-making processes and actions, and to explain the motivations underlying people's behavior. In short, the use of neuroscience in marketing helps to create an environment conducive to customer satisfaction and business success.

1.2 History and definitions of neuromarketing

Recently emerged, "neuromarketing" (NM) is a field of marketing that draws on neuroscience theories and methods to better understand and influence consumption and purchasing behavior (Roulet & Droulers, 2010 in (Courbet & Benoit, 2013). It is a combination of several disciplines such as neurology, psychology, sociology and marketing.

As an investigative method, neuromarketing is important because it uses neuroscientific theories and methods to access otherwise hidden information. This information materializes through the observation of neural processes without directly asking people about their thoughts, feelings, memories, evaluations or decision-making strategies. The outcome of neuromarketing, as a field of research, is promising because its results can secure new ground for generating new marketing theories or complementing existing theories in marketing and related disciplines (Lim, 2018).

Neuromarketing is "an understanding of how humans process information and make decisions, and investigates how companies should communicate with the brain in detail" (Bayle-Tourtoulou, et al., 2013). The aim is therefore to gain a better understanding of how consumers think, to understand their emotions, needs, motivations and preferences. Neuromarketing has applications in various fields, such as innovation, product modification, pricing strategies and the creation of communication portfolios. It is a combination of neuroscience and marketing (Garcia & Saad, 2008).

The concept of neuromarketing is the application of a non-invasive brain-computer interface technique (Lim, 2018). It has become an interdisciplinary bridge between neuroscience and marketing, changing the way marketing research is perceived (Rawnaque et al., 2020). It was coined by Ale Smidts in 2002, who refers to it as "the study of brain mechanism to understand consumer behavior in order to improve marketing strategies" (Luna-Nevarez, 2021).

Subsequently, multiple definitions of neuromarketing have developed. Specifically, according to Lee & al. (2007), neuromarketing sees itself as "the application of neuroscientific methods to analyze and understand human behavior in relation to markets and trade", while others characterize it as "the application of neuroscience findings in marketing" (Hubert & Kenning, 2008) or as "a field that focuses on the implications of marketing from the analysis of human behavior, based on neuroscientific methods" (Javor & al., 2013)

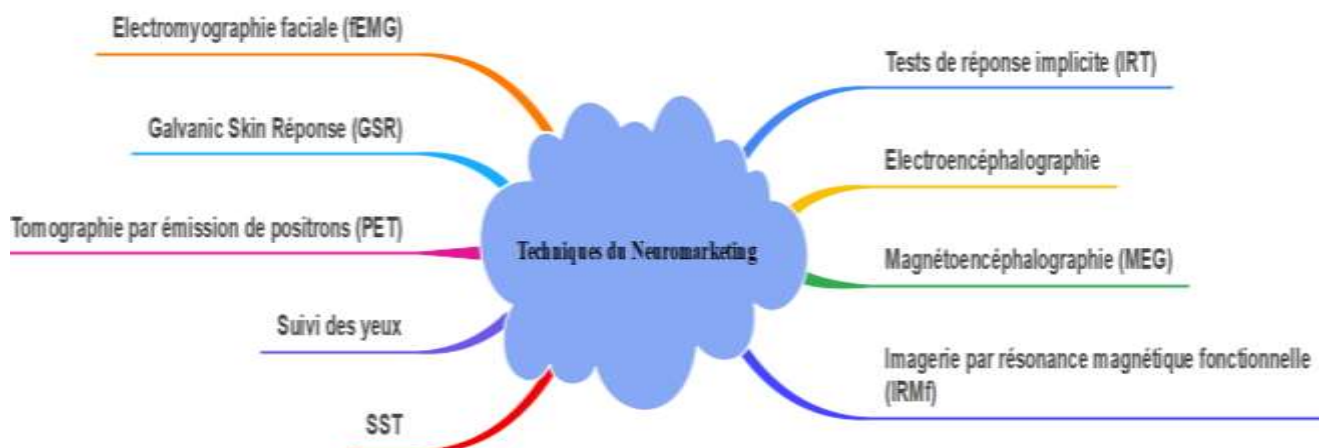
According to Droulers & Rouillet (2007), the role of consumer behavior researchers cannot be limited to sporadically borrowing imaging techniques, but they must become "consumer neuropsychologists". In doing so, they move from a behaviorist to a cognitivist vision, and knowledge and mastery of new neuroscientific study techniques are required.

1.3 Neuromarketing techniques

In all neuromarketing studies, subjects are exposed to some kind of stimulus in the form of images, advertisements, texts, ...etc. and their response is observed, analyzed or measured by one or more of the neuromarketing techniques, which are based on the recording of brain signals and come to replace traditional marketing methods. There are several techniques whose aim is to record and map neuronal activity inside (electromagnetic and metabolic) and outside the brain (Lim, 2018) to be able to understand, analyze and measure the specific response of the nervous system to a marketing stimulus.

Several neuroscientific methods are applied today to neuromarketing (Bercea (2012), Kable (2011), Morin (2011), Plassmann, Ambler, Braeutigam and Kenning (2007), Ramsøy (2015) and Zurawicki (2010)). They are used to conduct commercial market research (Plassmann et al., 2015). Among the most important are Functional Magnetic Resonance Imaging (fMRI), Electroencephalography, Magnetoencephalography (MEG), Positron Emission Tomography (PET), Eye Tracking, SST, Galvanic Skin Response (GSR), Facial Electromyography (fEMG), Implicit Response Tests (IRT). We schematize these techniques in the following mind map:

Figure No.1: Mind map of neuromarketing techniques



Source : A.KARIM, S.KAMAL

1.3.1 Electroencephalography

This technique first appeared in 1929, and is one of the most widely used methods in neuromarketing. Its principle is based on electrodes placed on human skin. It measures current pulses when neurons are activated. In the brain, electromagnetic waves are present and propagate. This means that electroencephalography measurements are sensitive to temporal resolution. The advantage of encephalography is ease of use and affordability compared with other methods (Bočková, et al., 2021).

1.3.2 Magnetoencephalography (MEG)

This is a neuroimaging technique that measures the magnetic field induced by the electrical activity of neurons in the brain. Its resolution is very precise, allowing sources to be identified with an accuracy of a few millimeters to identify slight changes in mind movements (Bočková et al., 2021). It has almost the same resolution as encephalography. It is used in several fields, notably cardiology and cognitive neuroscience research. But the installation costs of this technique are much higher than those of EEG. MEG is not practical.

1.3.3 Functional magnetic resonance imaging (fMRI)

Functional Magnetic Resonance (FMR) is a modern method of studying brain function that maps the brain's response to an external or internal stimulus, and directly measures the activity of brain neurons. This shows how the brain responds to changes in brain behavior in response to stimuli (Gill & Singh, 2020). It therefore serves as an indirect visualization of brain activity. fMRI is sometimes used in sales and marketing to record and analyze customer reaction to a product. The disadvantage of this method is its high cost. In 2002, Emory University in Atlanta announced the creation of a business unit using fMRI for marketing research. This has been criticized by various organizations, particularly when it comes to the ethical aspects of their application (Pereira et al., 2021; Bočková et al., 2021).

1.3.4 Positron emission tomography (PET)

Positron emission tomography, known as PET, is a medical imaging test performed by nuclear medicine specialists, used to quantify the body's metabolic movement (Gill & Singh, 2020). In this technique, the patient must use the radioactive substance (intravenous injection of a tracer). It measures the flow of the intended substance and the area where it accumulates. PET is one of the least used methods in research, as it is one of the most expensive. Its use in marketing research is unlikely.

1.3.5 Eye tracking

This technique records the movement of human eyes. It monitors where and what people look at longer and more frequently. It also records pupil enlargement. The essence of this method is therefore to monitor the frequency and intensity of gaze. This produces heat maps of where people's gaze is fixed. (Gill & Singh, 2020)

1.3.6 Steady State Topography (SST)

Steady State Topography is a technique for obtaining and visualizing the buyer's reaction to an advertising enhancement (image, advertisement, question, etc.). This mapping enables the experimenter to gather information dependent on the consumer's subliminal mind. (Gill & Singh, 2020)

1.3.7 Galvanic skin response (GSR)

GSR is a method used to measure consumer arousal after exposure to external stimuli (film announcement, new product announcement, advertising, photos...), which provides indicators of the appropriateness of marketing behavior and therefore makes essential modifications if the desired degree of arousal is not achieved (Gill & Singh, 2020).

1.3.8 Facial electromyography (fEMG)

FEMG is a strategy that measures the electrical response delivered by facial muscles in order to understand the feelings associated with certain outward appearances.

1.3.9 Implicit Response Test (IRT)

This method aims to provide information and detect customer behavior when confronted, for example, with two different products or two brands.

2 NEUROMARKETING: WHAT BENEFITS FOR THE COMPANY?

The study by Krajnovic & al (2012) concluded that neuromarketing is based on the fact that around 70% of consumers' decisions are made at a subconscious level, and that the majority of them are unable to logically explain why. Neuromarketing then offers the possibility of explaining them (Iloka & Onyeke, 2020).

A number of studies have demonstrated that neuromarketing can harness knowledge gained from neuroscience to improve companies' sales and marketing communication strategies (Georges & Badoc, 2010). In particular, it is based on the principle that "the better we know the human brain, the better we can influence people's purchasing behavior" (Courbet & Benoit,

2013). This research provides a new insight into consumer thinking. The results will obviously be an increase in sales, and a preference for certain brands.

The emotions generated by products and brands strongly influence the way consumers make purchasing decisions, the way memory traces are created, the way they perceive a brand or company, etc. (Morin, 2011).

Many of the subconscious elements that influence this cognitive buying process cannot be studied by traditional market research methodologies. This justifies the application of neuroscientific methods to analyze and understand human behavior related to markets and marketing (Lee et al., 2007). Automatic and rapid cognitive processes, without direct volitional control, make most economic decisions (González-Morales, 2020).

Many leading companies prefer to make pre-marketing decisions via neuromarketing in order to better understand consumer behavior.

Neuromarketing has practical applications in product development, design and packaging, advertising design, promotional campaigns and product distribution in the marketplace (Figure 2).

Figure 2 : Neuromarketing fields of application

Product development	Packaging and design	Advertising design	Promotion design
<ul style="list-style-type: none"> • Health / fashion • Smell • Color • Identification of a new target group • Taste 	<ul style="list-style-type: none"> • Logo • Odor • Package size • Color scheme • Packaging material 	<ul style="list-style-type: none"> • Advertising content • Location • Advertising duration • Management and color scheme • Choice of celebrity 	<ul style="list-style-type: none"> • Music • Product grouping • Special offers • Shelving • Atmosphere and availability

Source : (Rupali Gill & Singh, 2020)

Neuromarketing does not seek to turn people into "automated consumers"; on the contrary, it seeks to ascertain consumers' preference for their brands. Its techniques can be used to test what an advertiser is thinking of testing before the ad goes to market, and to help consumers understand the transition between truths and lies about why they buy. (Rupali Gill & Singh, 2020)

3 HOW ETHICAL IS NEUROMARKETING?

According to De Vries (2007), the neurosciences give rise to particular ethical questions, and this has given rise to a new sub-disciplinary field, proposed a few years ago (Farah, 2002) and rapidly established, which is nothing other than neuroethics, meaning the ethics of the neurosciences, i.e. the moral questioning of the use and instrumentalization of neuroscientific techniques. Research shows that: "The central problem of neuroethics is to establish appropriate limits to human intervention in cognitive (knowledge processing) and affective (emotional) functioning". Farah (2002), considers "brain reading" to be one of the major themes addressed by neuroethics. Brain reading raises concerns among the general public, who fear that neuromarketing could be used for brain manipulation. In other words, to modify an individual's attitudes and beliefs.

Like all fields of research, the use of neuromarketing has raised ethical concerns about the use and abuse of neuroscientific techniques (Luna-Nevarez, 2021). Indeed, researchers wishing to conduct neuromarketing research are expected to consider the ethical component, something that is now considered to be the concern of many research studies (Murphy et al., 2008) and one of the sensitive topics in the use of neuroscientific methods in marketing (Pop, Dabija, & Iorga, 2014).

The protection of study subjects is one of the ethical concerns of neuromarketing research, and this issue of protection is often raised when neuroscientists fail to take the necessary steps to obtain prior consent for research (Beauchamp, 1997; Murphy et al., 2008; Ulman et al., 2015;) and of course to ensure confidentiality (Slowther & Kleinman, 2009) and the protection of parties likely to be harmed or exploited by the research (Luna-Nevarez, 2021) . These measures include information on the results, risks and benefits of participation in the study, and study procedures. Although every researcher has an obligation to ensure informed consent and privacy when it comes to studies involving human beings, the worrying thing is that the human subject can be adversely affected by the use of neuroscientific technology (Farah, 2005; Luna & Macklin, 2012) and the absence of such safeguards can lead to the possibility of exploitation. Neuromarketing has also been the subject of criticism regarding the validity and reliability of the results obtained. Scientific validity is also an ethical concern linked to the use of neuroscientific methods in marketing; the researcher must equip himself with the necessary scientific competence and knowledge to be able to interpret the results and mark the limits of the use of a neuroscientific method (Illes, 2002; Ulman et al., 2015). Indeed, lack of scientific competence can lead to a biased analysis of neuroscientific results, to underestimating the

advances of marketing discoveries, and to implementing erroneous marketing strategies (see Plassmann et al., 2012; Poldrack, 2006). (Lim, 2018).

Another ethical question is raised by Courbet (2010) regarding the manipulation that neuromarketing can exert, as a tool enabling certain actors with some knowledge of neuroscience and cognitive psychology, to sell NM-based techniques to other actors in the communication and marketing sectors by "making them believe" that it can really improve their company's communication and marketing strategy.

Stanton et al (2017) in their study of the uses and abuses of neuromarketing, addressed consumers' fears that neuromarketing could be used to influence their purchasing choices as and not just to predict.

Table 1: Critics of neuromarketing

The main themes	Anti-neuromarketing arguments
The nature of the tool	Neuromarketing is a powerful tool for "manipulation". It reactivates the "myth of non-conscious influence through subliminal images".
NM and public health	Marketing excesses can cause: obesity, diabetes, addiction or gambling, addiction to tobacco or alcohol, eating disorders...etc. - For example, a 5% increase in the effectiveness of tobacco marketing would correspond to 22,000 more deaths in the United States.
The research tools used in neuromarketing	Doctors who are supposed to help individuals and society may, in the course of an MRI marketing study on an experimental subject, provoke a medical problem due to an error in the use of the MRI, or a psychological problem (e.g. severe anxiety linked to "confinement" in the MRI "tunnel").
Neuromarketing and children	Neuromarketing contributes to the advertising manipulation of defenseless children
Neuromarketing and unnecessary purchases	Neuromarketing encourages consumers to buy brands and products they don't need or want.
Transparency of neuromarketing advertising practices	Consumers have a right to know whether they are being manipulated or not. We need a public report and government investigations to show which companies are using it discreetly.
neuromarketing and regulation	Neuromarketing practices can lead to serious excesses. The legislator needs to regulate it.
Neuromarketing and individual freedom	neuromarketing does not respect the democratic principle of individual free will and choice, and is contrary to freedom.

Source : (Courbet, 2010)

Despite neuromarketing's critics, there is a group of researchers defending this field, and these defenders are mainly represented by advertising companies, who aim to meet consumers' needs by taking into account how their brains work. In addition, numerous consulting and expertise companies have emerged to offer services and invest in neuromarketing experiments, contributing to the consolidation of this field (Luna-Nevarez, 2021).

4 LIMITS AND PROSPECTS OF NEUROMARKETING RESEARCH

The literature shows that neuromarketing is a new disciplinary field based on neuroscience, addresses the tools of neuromarketing, the ethical and deontological dimension as well as the limits and future work that will broaden the scope of neuromarketing.

According to Harris (2006), neuromarketing has several limitations, such as:

1. The impossibility of manipulating all the factors influencing consumer behavior in a single experiment.
2. It is unlikely that large samples can be used for neuromarketing studies, due to the high cost of the experiments - the fMRI scanner costs millions to research. This justifies the possibility of producing biased responses and consequently generalizing study results.
3. It is not possible to measure consumers' brain activity if they are not willing to undergo the tests; consequently, not all samples are representative;
4. Ethical issues concerning the use of subjects for neuroscientific studies (such as the manipulation of participants) are also evident in neuromarketing. Furthermore, there are no well-defined ethical standards for the practice of neuromarketing (Luna-Nevarez, 2021).

According to neuroscientists (Droulers and Roulet, 2012; Racine, Bar-Ilan and Illes, 2005), neuromarketing techniques, in particular fMRI, are not designed to stimulate or read an individual's thoughts. Second, we cannot force a person to buy a product (Lee et al., 2009) because the purchase decision is based on a process of affective and cognitive activations (Roulet and Droulers, 2010). Finally, the imaging technique requires the presence of specialists (doctors, biotechnicians, personal protection committees, etc.) to guarantee the protection of the product (Roulet & Droulers, 2012).

To date, neuromarketing has been implemented by major brands such as McDonalds PepsiCo, Hyundai, Coca Cola, Intel, Microsoft, Sky television network, HBO, IBM, P&G, Johnson and Johnson, Unilever, ESPN, E-bay. Because neuroscience-based techniques can only benefit society, and it's all thanks to these marketing strategies that products have been able to gain good market share, something that can only be achieved when companies adopt neuroscience-based advertising and promotion methods (Gill & Singh, 2020).

Indeed, the world has seen the creation of consulting and expertise companies whose aim is to provide expert advice in neuroscience and neuromarketing, such as Lab in Spain, Neurensics in the Netherlands, SensoMotoric Instruments in Germany, CBC in Switzerland, Neurosense in the UK, Synetiq in Hungary and The Eye Tribe in Denmark.

The Neuromarketing Science and Business Association was established in February 2012, to provide collaborations and support for neuromarketing researchers and practitioners (Luna-Nevarez, 2021). This organization addressed ethical issues by promoting the social interests of research projects (Olteanu, 2015). The association also developed a code of ethics for the use of neuromarketing research, which was published in January 2013 (NMSBA, 2013). In 2016, Hensel et al (2017a, b) created a guideline that extends the NMSBA code of ethics, entitled; "EGNM".

According to Hensel et al. (2017a,b), any code of ethics developed for neuromarketing should include five essential components:

1. Protection of research subjects,
2. Protection of vulnerable populations from marketing exploitation,
3. Full disclosure of objectives, risks and benefits,
4. Accurate representation in the media and marketing must focus on disclosure of methodology, measures and benefits in order to build trust between participants and the general public.
5. Internal and external validity is essential for neuromarketing research, including the marketing of marketing products and services influenced by neuromarketing studies (Hensel et al., 2017a, b)."

CONCLUSION

Neuromarketing is an emerging field whose aim is to understand consumer emotions, perceptions, motivations, needs and preferences. It is a combination of marketing and cognitive science. It is based in particular on the principle that "the better we know the human brain, the better we can influence people's purchasing behavior". Advances in this field require appropriate documentation to grasp its state of advancement. This scientific research was carried out to shed light on the concept of neuromarketing, its definitions, its techniques, its contribution to business, and its ethical aspects. Over the last few years, a number of studies have been carried out to gain a new insight into consumer thinking, which obviously has an impact on consumer purchases and consequently on sales, which is why some companies are aware of the importance of this new marketing avenue.

Much of the discussion has been based on a review of the literature, but empirical work remains limited.

As with all areas of human-centered research, the use of neuromarketing raises concerns, criticisms, and ethical concerns about the misuse of neuroscientific techniques, which is now considered one of the most sensitive issues in the field of neuromarketing.

Our research will be complemented by a qualitative empirical study of neuromarketers to explore the intersection of neuroscience and marketing.

BIBLIOGRAPHY :

- Bear, M. F., Connors, B. W., & Traduction, M. A. P. (2016). *à la découverte du cerveau* (4e édition).
- Bercea, M. D. (2012, August). Anatomy of methodologies for measuring consumer behavior in neuromarketing research. In Proceedings of the Lupcon Center for Business Research (LCBR) European Marketing Conference. Ebermannstadt, Germany.
- Bočková, K., Škrabánková, J., & Hanák, M. (2021). Theory and practice of neuromarketing: Analyzing human behavior in relation to markets. *Emerging Science Journal*, 5(1), 44–56. <https://doi.org/10.28991/esj-2021-01256>
- Courbet, D. (2010). NEUROMARKETING ET NEUROSCIENCES AU SERVICE DES PUBLICITAIRES. *Colloque International Francophone "Ethique et Métaéthique Dans Les Professions de l'information et de La Communication"*.
- Courbet, D., & Benoit, D. (2013). Neurosciences au service de la communication commerciale : manipulation et éthique. Une critique du neuromarketing. *Études De Communication*, (40), 27–42. <https://doi.org/10.4000/edc.5091>
- De Vries, R. (2007). Who will guard the guardians of neuroscience? Firing the neuroethical imagination. *EMBO reports*, 8(S1), S65-S69.
- Droulers, O., & Rouillet, B. (2007). Émergence Du Neuromarketing : Apports Et Perspectives Pour Les Praticiens Et Les Chercheurs. *Décisions Marketing*, 46(January 2014), 09–22. <https://doi.org/10.7193/dm.046.09.2>
- Droulers, O., & Rouillet, B. (2012). Neurosciences du consommateur.
- Garcia, J. R., & Saad, G. (2008). Evolutionary neuromarketing: Darwinizing the neuroimaging paradigm for consumer behavior. *Journal of Consumer Behaviour*, 7, 397–414. <https://doi.org/10.1002/cb>
- Georges, P. M., & Badoc, M. (2010). *Le neuromarketing en action: parler et vendre au cerveau*. Editions Eyrolles.
- Georges, P. M., Bayle-Tourtoulou, A.-S., & Badoc, M. (2013). *Neuromarketing in action: How to talk and sell to the brain*. Kogan Page Publishers.
- González-Morales, A. (2020). Right evaluation of marketing stimuli with neuroscience. An

- electroencephalography experiment. *Computers in Human Behavior Reports*, 2(October).
<https://doi.org/10.1016/j.chbr.2020.100030>
- Harris, J. M., Ciorciari, J., & Gountas, J. (2018). Consumer neuroscience for marketing researchers. *Journal of consumer behaviour*, 17(3), 239-252.
- Hensel, D., Wolter, L. C., & Znanewitz, J. (2017). A guideline for ethical aspects in conducting neuromarketing studies. *Ethics and neuromarketing: Implications for market research and business practice*, 65-87.
- Hubert, M., & Kenning, P. (2008). A current overview of consumer neuroscience. *Journal of Consumer Behaviour: An International Research Review*, 7(4-5), (July–October), 272–292.
<https://doi.org/DOI: 10.1002/cb>
- Illes, J., Desmond, J. E., Huang, L. F., Raffin, T. A., & Atlas, S. W. (2002). Ethical and practical considerations in managing incidental findings in functional magnetic resonance imaging. *Brain and cognition*, 50(3), 358-365.
- Iloka, C. B., & Onyike, K. J. (2020). Neuromarketing : a historical review.
- Javor, A., Koller, M., Lee, N., Chamberlain, L., & Ransmayr, G. (2013). Neuromarketing and consumer neuroscience: contributions to neurology. *BMC Neurology*, 13, 1471–2377.
- Kable, J. W. (2011). The cognitive neuroscience toolkit for the neuroeconomist: A functional overview. *Journal of Neuroscience, Psychology, and Economics*, 4(2), 63.
- Kenning, P., Plassmann, H., & Ahlert, D. (2007). Applications of functional magnetic resonance imaging for market research. *Qualitative Market Research: An International Journal*, 10(2), 135-152.
- Krajnovic, A., Sikiric, D., & Jasic, D. (2012). Neuromarketing and Customers ' Free Will. *Managing Transformation with Creativity*, (Proceedings of the 13th Management International Conference), 1143–1163.
- Lee, N., Broderick, A. J., & Chamberlain, L. (2007). What is “neuromarketing”? A discussion and agenda for future research. *International Journal of Psychophysiology*, 63(2), 199–204. <https://doi.org/10.1016/j.ijpsycho.2006.03.007>
- Lim, W. M. (2018). Demystifying neuromarketing. *Journal of Business Research*, 91(November 2017), 205–220. <https://doi.org/10.1016/j.jbusres.2018.05.036>
- Luna-Nevarez, C. (2021). Neuromarketing, Ethics, and Regulation: An Exploratory Analysis of Consumer Opinions and Sentiment on Blogs and Social Media. *Journal of Consumer Policy*, 44(4), 559–583. <https://doi.org/10.1007/s10603-021-09496-y>
- Morin, C. (2011). Neuromarketing: The New Science of Consumer Behavior. *Society*, 48(2), 131–135. <https://doi.org/10.1007/s12115-010-9408-1>

- Murphy, N. A., & Isaacowitz, D. M. (2008). Preferences for emotional information in older and younger adults: a meta-analysis of memory and attention tasks. *Psychology and aging*, 23(2), 263.
- Nasirahmadi, A., Sturm, B., Olsson, A. C., Jeppsson, K. H., Müller, S., Edwards, S., & Hensel, O. (2017). Automatic scoring of lateral and sternal lying posture in grouped pigs using image processing and Support Vector Machine. *Computers and electronics in agriculture*, 156, 475-481.
- Olteanu, A., Vieweg, S., & Castillo, C. (2015, February). What to expect when the unexpected happens: Social media communications across crises. In *Proceedings of the 18th ACM conference on computer supported cooperative work & social computing* (pp. 994-1009).
- Ouazzani Touhami, Z., Benlafkih, L., Jiddane, M., Cherrah, Y., El Malki, H. O., & Benomar, A. (2011). Neuromarketing: When marketing meet neurosciences. *Revue Neurologique*, 167(2), 135–140. <https://doi.org/10.1016/j.neurol.2010.07.025>
- Rawnaque, F. S., Rahman, K. M., Anwar, S. F., Vaidyanathan, R., Chau, T., Sarker, F., & Mamun, K. A. Al. (2020). Technological advancements and opportunities in Neuromarketing: a systematic review. *Brain Informatics*, 7(1). <https://doi.org/10.1186/s40708-020-00109-x>
- Roullet, B., & Droulers, O. (2012). Ethique et Déontologie du Neuromarketing. *Actes Du 28ème Congrès de l'Association Française de Marketing*.
- Roullet, Bernard, & Droulers, O. (2010). *Neuromarketing le marketing revisité par les neurosciences du consommateur. Tendances marketing*.
- Rupali Gill, & Singh, J. (2020). A study of neuromarketing techniques for proposing cost effective information driven framework for decision making. *Materials Today: Proceedings*, 49, 2969–2981. <https://doi.org/10.1016/j.matpr.2020.08.730>