

*Review*

## Neuromarketing: Where marketing and neuroscience meet

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Neuromarketing is a new field where brain science and marketing meet. The emergence of brain imaging encourages marketers to use high-tech imaging techniques to resolve marketing issues. Marketers and advertisers have exploited the results of many brain imaging studies to know what could drives consumer's behavior. They have found out that some marketing actions can generate added satisfaction in a placebo-like manner. The findings of the human reward system studies also play an important role in neuromarketing research. The number of neuromarketing studies is growing and the findings are important for marketing research. However neuromarketing suffers from many limits that are a barrier to its development. Through this article, we attempt to give an overview on neuromarketing and its neural correlates while provide a perspective toward the use of field for less commercial purposes.

**Key words:** Neuromarketing, neuroscience, marketing, reward system, marketing placebo effect.

### INTRODUCTION

Recent years have seen an emergence in the abilities of neuroscientists to study cortical activity in terms of frequency and discoveries. Indeed, the recent techniques of functional imaging have permitted a deep knowledge in neuroscience and a precision of brain areas responsible for some pleasures and emotions. However, most social sciences have yet to adopt neuroimaging as a standard tool or procedure for research and marketing research has been far slower to wake up to the benefits of this technique (Lee et al., 2007). Economists were the first to propose the "neuroeconomics" (Zak, 2004; Kenning and Plassmann, 2005; Rustichini, 2005). The aim was to better understand the decision process of economical

agents decision to approaches of cognitive psychology and neuroscience (Droulers and Rouillet, 2006). Recent years have seen the development of a new discipline which can be labeled as "neuromarketing" or "consumer neuroscience". The goal of this emerging discipline is the transfer of insights from neurology to research in consumer behavior by applying neuroscientific methods to marketing relevant problems (Stoll et al., 2008). Thus, we can consider that the neuromarketing is where neuroscience and marketing meet.

Different techniques are used in neuromarketing. Among them, we have the positron emission tomography (PET), the functional magnetic resonance imaging (fMRI), the electroencephalography (EEG), the magnetoencephalography (MEG) and the galvanic skin response (GSR). Even if these techniques remain expensive and unavailable, the use of the EEG and the

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GSR are most current in marketing research. Since the birth of neuromarketing, researchers have more focused on some fields like the impact of advertisements and their memory. Also, in order to realize "neuromarketing" studies, some specialized agencies were born: Neuroco and Neurosense in UK, BrightHouse Neurostrategies and NeuroInsights in USA, PHD Media in Canada, SalesBrain in France, Neuro Insight in Australia and a lot more. Among these agencies, some really experience such studies, but others don't having no recourse to scientific techniques used in neuromarketing.

In this article we suggest studying neuromarketing through different angles. First, we will try to understand the link between neuromarketing and the humans reward system. Then, we'll point to the importance of the placebo effect in neuromarketing before tackling with the branding (application that has done most to know neuromarketing). Hence, throughout this paper, we will give an overview of the achieved works previously in this domain. Finally, we'll raise the controversy around neuromarketing, which is still at an embryonic stage till nowadays. The objective here is to make neuromarketing better known, and to explain the existence of some psychological phenomena through scientific and objective notions.

## **NEUROMARKETING AND REWARD SYSTEM**

Placed at the heart of the midbrain, the reward system is necessary to the survival of animals and humans. Its functioning is due the motivation which pushes to accomplish simple actions or behaviors as looking for food or reproduction, to more complex actions like the choice of an object, a brand or an investment. Neurobiologically, reward is mediated by dopaminergic systems involving the ventral striatum which includes the ventral tegmental area (VTA), nucleus accumbens and amygdala. This reward system that induces subjective feelings of pleasure and contributes to positive emotions is the same as the one activated when consuming some drugs - especially cocaine – bringing about addiction. So, some people become addicted to certain brands, tastes and products. Several studies were conducted on rats (Phillips et al., 1975) and on monkeys (Schultz et al., 1992; Morgan et al., 2002; Schultz, 2004). The activity of dopaminergic neurons in the nucleus accumbens has been shown to increase their activity by self-administration of cocaine or after the presentation of liquid or solid rewards. It's the same thing after the presentation of stimuli predicting the reward.

Erk et al. (2002) have studied the rewarding properties of cultural objects, mainly cars. The choice of such a category of products is not anodyne; cars can effectively reflect a degree of wealth and social domination. Compared to small cars and limousines, sports cars was considered more attractive, causing more activation in ventral striatum, orbitofrontal cortex, anterior cingulated

and occipital regions. Therefore, the subjects have felt a higher potential reward when viewing a sports car image; the sign of domination and of a high social rank.

Money is also a strong stimulus which can easily activate the human reward system. Nowadays, the notion of money is strongly assimilated to that of finance and investment. Recently, financial theories has been greatly enhanced by the study of investor psychology and behavior. The application of knowledge in cognitive neuroscience and neuroimaging has widely contributed that. Indeed, fMRI findings offer the opportunity to discern the fundamental neural processes that drive rational and irrational investor behavior. In an article published by Peterson (2007), the author discusses implications of one aspect of the relationship between the brain and the financial markets – the brain's "reward system approach". Thus, it was found that rewards activate the brain much differently than losses, both during anticipation and receipt (gain or loss). Indeed, the anticipation or expectation of receiving monetary rewards primarily active the nucleus accumbens (NACC), while receiving or enjoying a reward active the medial prefrontal cortex (MPFC). Moreover, anticipation of increasing reward magnitude increasingly activates the NACC, while increasing reward outcomes increasingly activate the MPFC.

Additionally, the level of NACC activation decreases after reward outcome to a level either slightly below baseline if the anticipated reward is received and to significantly below baseline if the anticipated reward is not received. In his study, Peterson had a wider sight by linking the reward system with the personality, the impulse, the affect and the good mood of the investor. Along with cultural objects and money, neuroimaging studies have shown that the ventral striatum may also be activated during the presentation of more natural rewards such as sexual stimuli (Karama et al., 2002) or food (Small et al., 2001).

## **THE MARKETING PLACEBO EFFECT**

Towards the end of the 18th century, the term "placebo" ("I shall please") takes its medical sense and will be the prescription given to please and satisfy the therapeutic desire of a patient (Guy-Coichard and Boureau, 2005). Shapiro (1964) defined the placebo as "any therapeutic procedure (or a component of any therapeutic procedure) which is given deliberately to have an effect or unknowingly and has an effect on a symptom, syndrom, disease, or patient but which is objectively without specific activity for the condition being treated". This same author has defined the placebo effect as "the therapeutic effect produced by a placebo".

Since a few years, the placebo effect is not only connected with the medical field. Shiv et al. (2005) document for the first time that non-conscious expectations about the relationship between price and quality

can influence consumers in a placebo-like manner. Some marketing actions, such as changes in the price, can affect neural representations on experienced pleasantness and on the efficacy of consumed products. Authors have shown, out of three experiences, that consumers who pay a less high price for a given product can take smallest advantage when consuming it, in comparison with consumers who paid a higher price. These results were reinforced later by Plassmann et al. (2008) who proved that increasing the price of a same wine increases subjective reports of flavor pleasantness (stated preference) as well as BOLD (Blood-oxygen-level dependent) activity in medial orbitofrontal cortex, an area that is widely thought to encode for experienced pleasantness during experiential tasks. The use of functional imaging techniques let go the placebo effect passes out of the subjective realm of being "all in the head" into something real and measurable.

Notably, a highly motivation and expectation play an important role in marketing placebo effect. The vast majority of imaging on the placebo effect has focused on the lessening of painful stimuli through suggestion. Even without placebos, mere expectation (or anticipation) alters the processing of tactile stimuli (Berns, 2005).

Irmak et al. (2005) conducted a study on the placebo effect for an energy drink. They found that the placebo effect manifests only for consumers who desire (high motivation) the arousing effects of an energy drink. The placebo energy drink was capable of raising blood pressure, increasing physical reflexes, enhancing mental alertness, and raising the self-reported arousal level for the participants. In particular, these effects were only observed for highly motivated subjects who read informations about the energy drink purportedly excerpted from a prestigious newspaper.

Till the studies of Shiv et al. (2005), the placebo effect was presumed as a conscious mechanism. These authors suggest that kinds of placebo effects can done without catching conscience. The extrinsic components of products, especially the price, are part of it.

All the results of the studies mentioned in this part of our article may be considered as a proof that marketing actions lead to placebo effects.

## **NEUROMARKETING AT THE HEART OF THE BRAND**

The exploration of neural circuits aimed at identifying a preference towards a brand has been the center of research that made neuromarketing better known. McClure et al. (2004) have published the results of a study of two sodas of different brands (Coke and Pepsi). The research protocol consisted in registering, using fMRI, the brain activity of subjects during two types of tasting tests: a blind test and a labeled test.

The results of the study have surprised researchers and a large public and have created a big sensation. Indeed, this study has shown that there could be parallel

mechanisms in the brain able to bias the preference. Two separate systems are involved in generating preference for a brand: the ventromedial prefrontal cortex (VMPFC) when judgments are based solely on sensory information (taste in the case of soda); the hippocampus, dorsolateral prefrontal cortex and the midbrain when judgments are based respectively on sensory and cultural informations (significantly more activation for Coke).

The ventromedial prefrontal cortex is an area of the brain which is strongly implicated in signaling basic appetitive aspects of reward (McClure et al., 2004). During the blind tests, this region reflects the "cerebral preference" (Droulers and Rouillet, 2006) towards one of the two brands. However, knowing the mark tasted shuffles that preference. Different areas take part in the process when tasting Coke, specially the hippocampus, the dorsolateral prefrontal cortex and midbrain. These areas don't have a significant activation when tasting Pepsi. The dorsolateral prefrontal cortex is typically implicated in aspects of cognitive control, including working memory (Robertson et al., 2001). It even might have monitored the outcome of goal-directed behaviour (Watanabe, 1996). Located in the heart of the limbic lobe, and according to its interconnections with the cingulate cortex and the mammillary bodies, it is acknowledged that the hippocampus interferes in the emotional treatments and in the memory (Gazzaniga et al., 2001). It would be implied in the recollection of episodic autobiographical memories (Viard et al., 2007) and contribute to the retrieval of events.

Hence, giving subjects informations related to the mark has constituted a bias for preference. The activation of the dorsolateral prefrontal cortex and the hippocampus prove that the preference for a brand can change. So, preference becomes a matter of behavior; and behavior is not always in line with the "cerebral preference". Specifically, the preference for a brand is not only based on intrinsic components of product. The "branding" plays a key role in the mechanism of preference. This directly influences the buying behavior and loyalty.

## **NEUROMARKETING, A DISCIPLINE LITTLE KNOWN AND USED**

Already in 2004, while the neuromarketing was just born, Gary Ruskin, executive director of Commercial Alert, U.S. consumer association, has lauched the alarm about the use of brain imaging techniques for a mercantile purpose. Ruskin sent letters to members of the U.S. Senate Committee on Commerce, Science and Transportation, requesting an investigation of neuromarketing and its implications for politics and public health ([www.commercialalert.org](http://www.commercialalert.org)). According to him, neuro-marketing would constitute a big danger for the consumer. This one could be manipulated by marketing agencies without even being aware of it. More than that, the neuromarketing could – according to Ruskin – attack

the political world and influence the vote in favor of one candidate or another. So the future of nations would be compromised. We could share this opinion by supposing that the use of neuromarketing by some companies would be a big danger for public health. We could indeed assist to a growth of some diseases such as obesity, diabetes, alcoholism or lung cancer if junk food, alcohol or tobacco companies would use neuromarketing in their commercial strategies.

Probably, neuromarketing suffers from ethical limits that are a barrier to its development. Beyond the ethical side, the low use of neuromarketing is also due to other types of limits. First, we found methodological limits. Research protocols in neuromarketing are long and difficult to elaborate. The number of subjects is generally weak and the answers they give must be important and clear enough to allow a significant statistical treatment. Some techniques used in neuromarketing (such as fMRI) can be unpleasant or uncomfortable for the subjects (noise, claustrophobia, ...). Second, neuromarketing suffer from financial limits. Indeed, the cost of using brain imaging techniques remains high. A neuromarketing study based on ten people can cost 50 thousand dollars or more. The high price of techniques is a major handicap to the progress of neuromarketing. Finally, we have legal limits. Neuromarketing studies require a certain number of procedures since the subjects are submitted to brain imaging techniques. The agreement of an ethics committee, the wise consent of subjects as well as the assignment of a doctor as a supervisor is necessary to the conformity of the study.

The emergence of new denominations including the prefix "neuro" (neuroeconomics, neuromarketing, neuro-criminalité, neurorecrutement, etc.) may suggest that the combination of neuroscience with other disciplines is a fashion phenomenon, of which would benefit mainly neuroscientists who are adepts of the movement and also advertisers. There can really be some abuses in the use of the term "neuro". There are probably some offices and agencies which use the term as their livelihood; and their targets are generally business leaders who are eager for gain and in search of perpetual success. But this is not a generality. Neuroeconomics and neuro-marketing are also fields of interest to a lot of researchers and academicians who are not concerned by economical and financial issues. They only hope to exploit the technological progress in order to better their science. This is not the first time we witness an alliance between researchers in life sciences and social sciences.

Neuromarketing has often been despised by literature and the leaders of opinion. However, wouldn't it be appropriate to consider it as an emerging discipline that uses advanced technology in order to better satisfy the consumer. A consumer who doesn't eat only fast food, sodas or cars. He also needs to live in a clean environment, to lower the rate of illiteracy, corruption, cancers and obesity. In that way, searchers can study neuro-marketing while respecting the ethical constraints which

they face. In these cases, it would be a matter of exploring the brain of the consumer or the citizen so as to push him to perform benefic acts for the well-being of society. The most promising application of neuroimaging methods to marketing may come before a product is even released, when it is just an idea being developed (Ariely and Berns, 2010).

## CONCLUSION

Throughout our article, we have tried to give a brief outline of neuromarketing; this new discipline that combines neuroscience and marketing. After giving a definition of neuromarketing and mentioning the different medical techniques which are connected with it, we have tried to understand the link between the consumer's neuroscience and the reward system. Following this, we have devoted a part of the article to explain the importance of the marketing placebo effect on the consumer's behavior. Neuromarketing has various fields of application. In the third part of this paper, we have chosen to talk about its application in understanding the mechanism of preference in presence of a strong brand image. Finally, in the last part, we have tempted to explain the different reasons that let neuromarketing positioned at an embryonic stage.

We do not pretend, through this article, to have surrounded neuromarketing in all its dimensions. We only hope it will be a means of research towards the use of discipline for less commercial purposes. Neuromarketing can be an effective way to convey sensitizing messages for social comfort and sustainable development.

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## REFERENCES

- Ariely D, Berns GS 2010. Neuromarketing: the hope and hype of neuroimaging in business. *Nature Rev. Neurosci.*, 11: 284-292.
- Berns GS (2005). Price, placebo, and the brain. *J. Mark. Res.*, 42: 399-400.
- Droulers O, Rouillet B (2006). Neuromarketing: Cadre théorique et perspectives. Paper present end at the XXII<sup>e</sup> Congres of the French Marketing Association, 11-12 may Nantes, France.
- Erk S, Spitzer M, Wunderlich AP, Galley L, Walter H (2002). Cultural objects modulate reward circuitry. *Neuro Rep.*, 13: 2499-2503.
- Gazzaniga MS, Ivry RB, Mangun GR (2001). *Neurosciences Cognitives. La biologie de l'esprit.* Paris : De Boeck Université.
- Guy-Coichard C, Boureau F (2005). Comprendre l'effet placebo pour mieux traiter la douleur. *La revue de médecine interne.*, 26: 226-232.
- Irmak C, Block LG, Fitzsimons GJ (2005). The placebo effect in marketing: sometimes you just have to want it to work. *J. Mark. Res.*, 42: 406-409.
- Karama S, Lecours AR, Leroux JM, Bourgouin P, Beaudoin G, Joubert S, Beaugregard M (2002). Areas of brain activation in males and females during viewing of erotic film excerpts. *Hum. Brain Map.*, 16(1): 1-13.

- Kenning P, Plassmann H (2005) Neuroeconomics: an overview from an economic perspective. *Brain Res. Bull.*, 67: 343-354.
- Lee N, Broderick AJ, Chamberlain L (2007). What is neuromarketing? A discussion and agenda for future research. *Int. J. Psychophysiol.*, 63: 199-204.
- McClure SM, Li J, Tomlin D, Cypert KS, Montague LM, Montague PR (2004) Neural correlates of behavioral preference for culturally familiar drinks. *Neuron*, 44: 379-387.
- Morgan D, Grant KA, Gage HD, Mach RH, Kaplan JR, Prioleau O, Nader SH, Buchheimer N, Ehrenkauf RL, Nader MA (2002). Social dominance in monkeys : dopamine D2 receptors and cocaine self-administration. *Nature Neurosci.*, 5: 169-174.
- Peterson RL (2005). The neuroscience of investing: fMRI of the reward system. *Brain Res. Bull.*, 67: 391-397.
- Phillips AG, Brooke SM, Fibiger HC (1975). Effects of amphetamine isomers and neuroleptics on self-stimulation from the nucleus accumbens and dorsal noradrenergic bundle. *Brain Res.*, 85: 13-22.
- Plassmann H, O'Deherly J, Shiv B, Rangel A (2008). Marketing actions can modulate neural representations of experienced pleasantness. *Proceed. National Acad. Sci.*, 105: 1050-1054.
- Robertson EM, Tormos JM, Maeda F, Pascual-Leone A (2001). The role of the dorsolateral prefrontal cortex during sequence learning is specific for spatial information. *Cerebral Cortex*, 11: 628-635.
- Rustichini A (2005) Neuroeconomics: present and future. *Games Econ. Behav.*, 52: 201-212.
- Schultz W, Apicella P, Scarnati E, Ljungberg T (1992). Neural activity in monkey ventral striatum related to expectation of reward. *J. Neurosci.*, 12: 4595-4610.
- Schultz W (2004) Neural Coding of basic reward terms of animal learning theory, game theory, microeconomics and behavioral ecology. *Curr. Opin. Neurobiol.*, 14: 139-147.
- Shapiro AK (1964) Factors contributing to the placebo effect. Their implications for psychotherapy. *Am. J. Psychotherapy.*, 18: 73-88.
- Shiv B, Carmon Z, Ariely D (2005) Placebo effects of marketing actions: consumers may get what they pay for. *J. Mark. Res.*, 42: 383-393.
- Small DM, Zatorre RJ, Dagher A, Evans AC, Jones-Gotman M (2001) Changes in brain activity related to eating chocolate: from pleasure to aversion. *Brain*, 124: 1720-1733.
- Stoll M, Baecke S, Kenning P (2008). What they see is what they get? An fMRI-study on neural correlates of attractive packaging. *J. Consum. Behav.*, 7: 342-359.
- Viard A, Piolino P, Desgranges B, Chételat G, Lebreton K, Landeau B, Young A, De La Sayette V, Eustach F (2007). Hippocampal activation for autobiographical memories over the entire lifetime in healthy aged subjects: an fMRI study. *Cerebral Cortex*, 17: 2453-2467.
- Watanabe M (1996). Reward expectancy in primate prefrontal neurons. *Nature*, 382: 629-632.
- Zak PJ (2004). Neuroeconomics. *Philosophical Transactions of the Royal Society B*, 359: 1737-1748.