

Consumer Neuroscience and its Application in Marketing

M.Raghuvaran, S. Gomathi

Abstract: *There is a very important difference between “Consumer neuroscience” and “Neuromarketing”. While the first field deals in research on subjects like neuroscience, psychology and marketing; the latter is linked to the functionality of neurophysiological tools, namely eye tracking, skin conductance, electroencephalography (EEG), and functional magnetic resonance imaging (fMRI). Neuromarketing is interested in carrying out market research which is specific to a particular company. This article covers topics like recent methods in neuroscience used by consumer researchers, basic ideas in consumer neuroscience derived on the basis of initial findings. The article also suggests ideas for future research in the field of consumer neuroscience.*

Keywords: *Consumer neuroscience, neuro marketing, functional magnetic resonance imaging and marketing.*

INTRODUCTION

In the recent past, the relevance of neuroscience in the field of marketing has grown. There are hopes that neuroscience can help throw light on the aspect of decision making of consumers. Not all researchers are this optimistic though, some of them look at this optimism unconvincingly. This paper looks into two key questions. How can neuroscience help form future theories and models in consumer decision making? How can neuroscience be included in research methodology of consumer decision making? We believe that neuroscience has many advantages. It helps in forming better theories, gives new empirical tests of standard theoretical claims, can give analysis for observed heterogeneity within and across populations. It can also deliver an instrument which takes into account the physiological context and assesses what role is played by constructs such as hunger, stress, and social influence on the preferences of consumers.

We want to delve into finding out how neuroscience paradigms can help us comprehend decision making processes. We wish to do so while keeping the interest of a vast audience. For audiences who wish to read more on the subject of decision neuroscience, we recommend looking up Glimcher et al. (2009), Vartanian and Mandel (2011), Glimcher, P., Camerer, C., Fehr, E., & Poldrack, R. (2009), *Neuroeconomics: decision making and the Brain*, Amsterdam: Elsevier, Vartanian, O., & Mandel, D. (2011) or *Neuroscience of decision making*, New York: Psychology Press.

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From the vast field of neuroeconomics, comes the subject of neuromarketing, which is also known as consumer neuroscience. Neuromarketing is very useful in helping solve marketing problems by using concepts from brain research. By using methods of neurology, the “black-box” of a living being can be better understood. Rather than being viewed as a hindrance or competition to traditional forms of consumer research, neuromarketing should instead be viewed as a supplementary method which can be used in order to analyse specific behaviour of consumers, when it comes to decision-making.

Consumers’ wishes and expectations when it comes to their options can be found out by using neuromarketing’s medical imagery. Another benefit of involving neuromarketing in consumer research is that it brings out the point that decision-making for a consumer is an emotional and instinctive process. Researches which have offered the above insights into neuromarketing were erstwhile kept confidential but have been made public since the 1990s. This paper wishes to throw light on a more specific definition of neuromarketing while also attempting to present some theoretical approaches in this field as well as delving into the history of this field.

Neuroscience measurements are more effective at removing possible biases which is difficult to achieve in methods like surveys and self-reports. Neuroscientific methods are also more reliable as they directly measure brain activity as opposed to going by what subjects tell us about their thoughts. This can definitely be useful in consumer research.

A. Methodological approaches in neuroscience

Different methods from neuroscience prove useful in examining the neural processes which cause human behaviour. Since every method is different, each one of them has their own benefits and disadvantages. Therefore, research is required in order to find out which are the most effective methods. Responses of both the central as well as the peripheral nervous system are measured using neurophysiological methods. In the field of consumer neuroscience, the focus has been on using methods which sense changes and manipulate activity in the brain, which is a part of the central nervous system.

Let it not be mistaken that physiological measures are new to the field of consumer research. They have been around for almost 30 years. Back then, skin conductance and eye movements were used as measures of motivation and immersion of consumers. Several peripheral physiological reactions can be assessed in order to examine neural functioning and the resulting behaviour of individuals. To quote examples, pupil dilation is correlated with mental effort; blood pressure, skin conductance, and heart rate are correlated with anxiety, sexual arousal, mental concentration, and other motivational states; by coding facial expressions and recording movements of facial muscles, one can measure emotional states.

Real-time brain activity at the time of consumer decision-making can now be captured thanks to technological developments. Research in the field of brain imaging is carried out by doing comparisons between various subjects while they perform different tasks. One is the “experimental” task (A) and the other is the “control” task (B). The changes in brain activity is different for task A and B. This can help researchers in finding out which part of the brain is used for which task. The EEG, an old and trusted imaging method, measures electrical activity in the brain through electrodes that are placed on the skull. The timing of an activity is noted very accurately by an EEG, with a resolution of around 1 millisecond. However spatial resolution of the EEG is not good. Therefore, capturing brain activity in areas of the brain that are very small (for example the amygdala) is difficult.

Another technique in this field is the ‘Positron emission topography (PET)’. The PET does not record brain activity; instead it measures the metabolic changes which are connected with differentials in brain activity. After giving weekly radioactive injections, positron emissions are documented. The spatial resolution of PET is better than the EEG. However the temporal resolution of PET is poor and the technique can be used only for short tasks owing to the speedy radioactive decay. PET usually requires averaging over fewer trials than fMRI, the method most widely used in consumer neuroscience, which is an advantage. fMRI records and measures changes in the ratio of oxygenated to deoxygenated haemoglobin. Neural activity is traced since the brain exceeds in delivering oxygenated blood to the active areas of the brain. The magnetic properties of oxygenated blood are not the same as those of deoxygenated blood. From this, signal is picked up by the fMRI (blood-oxygen-dependent-level, or BOLD, signal). However, the ratio between signal to noise, given by the fMRI is faint and therefore judgements cannot be made in the first go. Frequent sampling and trials are required.

Another approach is the single neuron recording, a method which is effective in tracing smaller scale neural activity, which the fMRI cannot do. In this particular method, extremely small electrodes are inserted into the brain. Each electrode aims to measure the firing of one precise neuron. Since these electrodes are capable of causing damage to the neurons, they are used only for animals and special human populations like epileptic patients undergoing neurosurgery. Since the testing of this technique has been limited to animals, it hasn’t been able to give much information on higher processes of the brain function, which are found only in humans, like cognitive control for example. Despite the limitations, the single neuron recording technique’s great body of work in the research in neurobiology, based on the experiments carried out on animals, is still useful for the purpose of theorizing in consumer neuroscience. Since there are several functional and structural similarities in human and animal brains, using animals for testing has been beneficial. The major difference between human and animal brain is the presence of a cortex enfolding the mammalian brain and is responsible for cognitive processes of the higher level. Partial functional overlaps in the sub-cortical areas enable examining of lower level processes during simple decision-making. The same is useful when it comes to analysing decision-making processes in humans. Working with animals has its’ benefits as manipulations can be done

on animals in order to make cause-effect observations. This cannot be done using PET or fMRI.

Observing patients with brain lesions, is one of the earliest and most effective methods in analysing decision-making in humans. Studying individuals who have brain damage, localized to a specific area of the brain (which could have been caused by accidents or strokes) or by observing patients who have undergone radical neurosurgical procedures, relevant insights can be made. For example, if an individual who has damage in a particular area of the brain has difficulty performing some task which can be easily performed than ‘normal’ patients, this is indicative of the fact that the particular area of the brain is imperative to performing that particular task. Transcranial Magnetic Stimulation (TMS) can be used to create “virtual lesions”, which are nothing but temporary local disruption to areas of the brain. This is achieved using magnetic field stimulations.

BROAD CATEGORIES as listed by AdMap *	METHODS as listed by AdMap*	TECHNIQUES as listed by ESOMAR**	10 MAJOR TECHNOLOGIES OF CONSUMER NEUROSCIENCE as described by InnerScope
Psychometrics	Implicit Testing	IAT: Implicit Association Tests	Implicit Testing
	Facial Decoding	FACS: Facial Coding	Facial Coding
	Eye Tracking	Eye Tracking	Eye Tracking
	Heartbeat	HR: Heart Rate	Heart Rate
	Biometrics	Skin Perspiration (GSR)	EDA-SCR or GSR
		Motion	Motion
	Respiration Patterns	RR: Respiratory Rate	Respiration
		VPA: Voice Pitch Analysis	Voice Analysis
NeuroMetrics: Brain or Neural Response	EEG	EEG/SSS Electroencephalography/ Steady State Topography	EEG
	fMRI	fMRI: Functional Magnetic Resonance Imaging	fMRI

*Source: Thom Noble, "Neuroscience in Practice," AdMap magazine, March 2013
 **Source: "96 Questions to Help Commission Neuroscience Research," The world association for market, social and opinion research (ESOMAR), 2012.

LITERATURE REVIEW

The beginning of research on the subject of the role played by neuroscience and biology in decision-making can be traced back to 2004 when one of the first papers on this topic was published. This particular paper by (Shiv et al. 2005) came out of a workshop on this subject at the Invitational Choice Symposium in 2004. The paper made the following key claims; “knowledge in neuroscience can potentially enrich research on decision-making” (p. 375) and “integrating neuroscience with decision-making offers tremendous potential” (p. 385).

Since 2004, tremendous progress has taken place in the field of decision neuroscience over these ten years. The field of decision neuroscience includes sub-fields like neuroeconomics, consumer neuroscience and social neuroscience. According to (Levy and Glimcher 2012), we now have a more refined understanding of the process by which the brain calculates the value of options while making a choice. We can also understand how the brain compares the values and make a choice and also the role played by context in assigning values and decision-making. Apart from the broad field of decision neuroscience, its’ sub-field of consumer neuroscience has also grown by leaps and bounds.

Consumer neuroscience is an area that delves into the ways by which neuroscience methods can be applied to problems regarding consumer behaviour and marketing. Proof of the growth in this field, is that more and more relevant marketing papers that use neuroscientific methods are being published, there are special issues of journals focusing on the topic (e.g., Shiv and Yoon 2012), conferences are taking place on the subject, and summer schools and symposia are being organized. The fact that business schools are investing in this field by employing faculty to work in this area and are conducting training for doctoral students as well, shows that the growth is remarkable. As of 2013, around 30 business schools are engaged in studying this field. In this paper, we attempt to focus on the history of consumer neuroscience and also throw light on the theories and developments in research methodology.

Existing literature in multiple areas of neuroscience provides material for the field of consumer neuroscience as well. Studies on the valuation and decision network (Hsu et al. 2005), inter-temporal choice (Kable and Glimcher 2007), self-control (Hare et al. 2009), framing (De Martino et al. 2006), and heuristic choice (Venkatraman et al. 2009) are examples of literature in neuroeconomics. In the area of social neuroscience, neuroscientific techniques are used in order to explain factors which underline ways of understanding consumer behaviour. These factors include, the neural basis of social interaction, perceptions about trust, fairness, and reciprocity (Hsu et al. 2008) mentalizing, empathy, emotion regulation, social exclusion, and pain networks (for reviews, see Lieberman 2007; Rilling and Sanfey 2011). All these theories together help us comprehend consumer decision-making processes and also the manner in which social context influences decision-making.

The subject of consumer neuroscience is vast and includes many topics. In the first ten years of the development of this field, the four crucial factors of marketing (product, price, promotion and place) have all been given interest. Pricing and products (e.g., Knutson et al. 2007; Plassmann et al. 2008), have been given a lot of attention and so has branding (for review, see Plassmann et al. 2012). Advantages of using neural methods were highlighted by (Knutson et al. 2007) in their study wherein they had participants take part in a shopping task while being under the fMRI scanner. Their research work deduced that if we add neural methods to self-report measures, then the efficacy of predicting purchasing decisions can be improved substantially. The technique fMRI was used by (Plassmann et al. 2008) for the purpose of examining the relation between information generating expectations about quality of a product and the perception of that product. They wished to study whether any given information can affect the perception of the quality of the product. For example, does the price of a product influence how the product's quality is viewed by the consumer. Results of their study showed that by changing the price of identical wines, a change in viewing the taste of the wines was observed.

Klucharev et al. (2008) and Stallen et al. (2010), have conducted research on studying the phenomenon of the effect of celebrity endorsements on the brain mechanism of consumers while they make decisions. Reimann et al. (2010) explored the domains of packaging and product design. (Hedgcock and Rao 2009) did their research on consumer research topics like influence of attraction while choosing a

product. It is interesting to note that majority of the literature in the field of consumer neuroscience has been published in neuroscience journals and not marketing journals. This shows that these marketing topics are popular in the arena of scientific research as well. The Coke/Pepsi study by McClure et al. (2004) was the first published consumer neuroscience article. It took the help of neuroimaging in order to analyse the effects of a brand on consumption.

The industry takes a keen interest in the developments in the field of consumer neuroscience, as it can be directly applied to practice. In fact, neuroscientific techniques show promise of resolving a major problem for many marketing researchers, which is, accurately measuring internal reactions to marketing stimuli. Thus there is widespread acceptance of neuroscience by the marketing research industry. According to (Levallois et al. 2013), in 2008 there were 13 neuromarketing companies, whereas in 2012 the total had increased to 60 companies. Biometric methods like eye tracking, galvanic skin response and facial coding are being employed by several of these companies. The electroencephalogram (EEG) is the most used from the direct neural measures. However, very few companies are using fMRI. The fact that Nielsen acquired Neurofocus, which is a top Neuromarketing organization, in 2011, is a sign that marketing research companies have a huge interest in neuromarketing and see it as a valuable tool.

In the practical application of neuroscience techniques, ad testing is the most popular (as discussed in Ariely and Berns 2010). The Advertising Research Foundation (ARF) realizes the value addition that neuroscience methods bring to advertising. This is evident by the ARF's NeuroStandards 2.0 initiative, which proves that using fMRI substantially improved predictions when it comes to commercial effectiveness, as compared to using traditional measures only. According to (Berns and Moore 2012; Falk et al. 2012), "neural focus groups" can help predict behaviour of population not included in the sample and can also foresee market success.

Overall, it is visible that researchers have tackled a wide range of topics in consumer neuroscience. Business world is also enthusiastic about this subject. Consumer neuroscience is therefore in a good place right now. They can contribute greatly to the marketing science domain in the near future. In this paper, we will be addressing the challenges faced by this field and we will also throw light on the important developments which are needed in order to propel consumer neuroscience further.

RESEARCH METHODOLOGY

The two main type of researches are; qualitative research and quantitative research. While quantitative research is defined by Aliaga and Gunderson (2000) as research that is conducted by gathering numerical data and then analysing it by using mathematical methods. Qualitative research on the other hand gathers data which is not numerical in nature. Therefore this data cannot be analysed by mathematical means.

Therefore it is clear that there are two types of research approaches.

- Quantitative research
- Qualitative research

Attitudes, activities and views are assessed in Qualitative research. Thus, the results of such a research are non-quantitative in nature. Therefore qualitative research analysis cannot be carried out using quantitative means. Qualitative research uses methods like group interviews and in-depth analysis. Qualitative research requires qualitative methods of analysis. The research design for this study is a descriptive and explanatory case study. The research is conducted with the help of academic books, journal articles and market reports.

Lincoln and Guba's (1985), exalt the case study approach as it helps in comprehending a complex problem and can add strength and experience to existing research. By way of using case studies, events can be understood better. The case study method has been popular amongst researchers, for a wide range of streams, especially with social science. Robert K. Yin, a researcher, defines the case study research method as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used". Secondary data collection method is used in order to gather data. Business books, journals, magazines, previous case studies, companies' websites and articles with relevant information on the research topic are referred to in order to acquire data. Stake (1980) asserts that case study methods prove useful since they describe many realities at a time which are challenged at given sites since they form the foundation for both individual real-life generalizations and ability to be moved to other sites.

According to Yin (2003), a case study aids in making an in-depth analysis of a situation, within its' real-life scenario. Cohen, Manion and Morrison (2000, p. 184) listed out different benefits of using the case study method, which are adapted from Adelman, Kemmis and Jenkins (1980). They are:

- Deep-rootedness of social truths is recognized by case studies.
- Data of case study are grounded strongly in reality despite the difficulty in organizing it.
- Case studies provide materials that may be used for future re-interpretation
- Case studies allow generalizations
- Case studies' research data is in a form which is more publicly accessible than other kinds.

A converter helps describe the actual nature of case study as being explanatory. According to Yin (2003), this research is referred to as an explanatory case study since it examines cause and effects. He goes on to say that this type of case study describes the occurrence of an event and the possibility of the existence of causal conduits.

DATA ANALYSIS

For this case study we chose the company, Procter & Gamble whose brand image is established worldwide. Information regarding the company was obtained from the website of the company and a large scale secondary data research.

A. About the company

Procter & Gamble is a multinational manufacturing company whose products range from personal care items, household cleaning items, laundry detergents, prescription drugs and disposable nappies. Their slogan is "Touching lives, improving life". Consumers of P&G products count to about 4.4 billion people. P&G has more than 300 brands of products. It has factories or branches in more than 80 countries and regions around the world. The employee count of the company worldwide is 127,000 employees. In its' 2007 financial year, the company's annual sales reached up to nearly \$78.9 billion. P&G is assured in its' plans for dedicated growth and productivity.

B. Challenge

P&G was in the process of coming out with their new single-dose pods of their Gain laundry detergent. The clients were well aware of the fact that consumers of Gain love its' scent, which is why they are often called 'Gainiacs'. Clients had deduced the fact that consumers of Gain feel some sort of an emotional connection with the scent of the product. They realized that this could possibly be since they compare it to other experiences in their lives which were important to them on an emotional level. The client was keen to test the link between the scent and music; specifically, how the emotional responses to smelling Gain matches up to the emotional response while listening to one's favourite music among Gainiacs.

C. Solution

Innerscope measured the emotion evoked by Gain scents as well as the emotion generated by several other good, neutral and bad scents, in its' biological context. Responses to these scents were then viewed in comparison to reactions for favourite music. After evaluating the results it was found that the emotion evoked by the scent of Gain products was superior and more positive as compared to the emotion from listening to one's favourite music. Also, it was observed that if the Gain scent was experienced prior to listening one's favourite music, a priming effect took place. The emotional response to the favourite music then turned out to be greater than that which took place without the presence of the gain scent. Therefore it can be concluded that the emotional responses of participants to the Gain scent was more than the emotional response to listening to one's favourite music.

D. Results

The result of this path-breaking research was that Procter & Gamble came out with a confident and proud claim, "Gain, It's Music To Your Nose." This new tagline was used in a new national level ad campaign for the product launch of the new single dose Gain laundry detergent pods. Silvia Tavaral-Leal, Research & Development, Procter & Gamble; made the following quote on their new campaign, "Innerscope helped us prove that smelling Gain makes people feel more positively than listening to their favourite music, revealing that Gain really is 'Music To Your Nose!' This enabled us to provide our consumers with the ultimate Gain scent experience and it became the base for our new national campaign."

CONCLUSION

Future research in this area should be focussed on creating publication standards, forming training centres for the purpose of training graduate students and for offering supplementary training for faculty.

New areas of research can also be explored, as new tools are now available for carrying the research out. Research opportunities for studying decision-making in humans by using biological approaches are aplenty.

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AUTHORS PROFILE



Dr. Raghuvaran completed BDS and MBA degree. He hold twelve years of experience in healthcare marketing. He is pursuing a Ph.D Degree in VITBS, VIT, Vellore and have research publication.



Dr. S. Gomathi has obtained a doctoral degree in the field of Human Resource management in 1994 at a very young age from Alagappa University, Karaikudi, Tamilnadu as a first full-time research scholar. She was born on April 9th, 1966 in Tiruchirappalli. She was the first one to receive the stipend for her Ph.D. Programme based on merit. At present, she has 27 years of teaching experience, inclusive of 25 years of teaching P.G. students. She made an active contribution in creating nine doctorate candidates successfully enhancing her research contribution. At present, she is guiding six Ph.D. scholars at VITBS. She is a popular and friendly speaker, trainer in most of the premier educational Institutions and corporates and in other Public forums. She is specialized in stress management techniques, emotional intelligence, HR analytics, Knowledge management, Balanced scorecard, entrepreneurship, and other Organisational behavior & HRM Subjects. As an academic achievement, she has authored five books one on essentials of Entrepreneurship in 2003, and a study on Grievance management in a Pvt. enterprise in 2014 , impact of social network on employee Productivity in 2015 and Managing Human Resource in an Organisation and a study on workers relationship with management in a Weaving Industry She is also a recipient of a lot of honors as best teacher, best paper presenter in conferences and also research awards continuously for more than 7 years.

She is a recipient of senior woman Educator and Scholar Award from National foundation of entrepreneurship development, Coimbatore on 8th March 2014. She is also a recipient of an Award on the International women's day for the contribution made to Science and Engineering in VIT, University, Vellore on 9th March 2015. Guided more than 500 projects in MBA and other mini projects of Interest. Completed a consultancy project for ITCOT in 1999 and As a single individual organized an AICTE Staff development program for other engineering colleges in Tamilnadu which was sponsored by AICTE in 2004. Yet another achievement, at a very young age she also served as the head of the department for in the Department of Management studies in Vellore Institute of Technology in the academic year 2004-2005. She had delivered more than 72 Guest lectures and also presided as a resource person for UGC Sponsored conference and other national conferences. She has visited countries Malaysia and Singapore in 1993.