

Neuromarketing: How Neuroscience Can Inform Marketing



ISBN: 978-81-924713-8-9

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In the overlapping areas of neuroscience, psychology and marketing, neuromarketing exists. From the literature surveys on these domains, a conceptual model is developed to elucidate the neuroscientific and psychological intersection of consumer behavior. Classic experiments where brain mapping technologies are used to interpret the brain science behind consumers' response to various marketing stimuli are reviewed. This young science enables precise understanding of consumer mindset thereby maximizing returns on marketing investments. Evidences from this paper can facilitate comprehensive understanding and empirical studies on neural and psychological correlates of marketing activities.

Key words: neuromarketing, consumer psychology, neuroscience

1. Introduction

Most of the marketing expense is spent on determining what consumers want and how to satisfy their want. While seeking answers for why consumers often buy what they buy and whether the purchase fulfills their expectation marketers are keen to get deeper insights into consumers' thinking process. With unprecedented access into the nooks and crevices of the subconscious mind, the drive behind neuromarketing is to unveil the inner secrets of brain and discover how consumers will respond to marketing stimuli. This interdisciplinary domain has originated from the overlapping areas of neuroscience, psychology and marketing. It is a science that is more marketing oriented than medically oriented since it picks up electrical signals from the brain, analyses and translates them for predicting the buyer-behavior. When Harvard University Professors Zaltman and Kosslyn who had filed a patent for neuroimaging used it as marketing tool, the term neuromarketing was coined (Zaltman, 2003) though its earliest reported usage was in 2002 by an Atlanta based advertising firm, *Brighthouse* using functional magnetic resonance imaging for marketing research (Fisher *et al.*, 2009).

As a futuristic research method using high-tech brain scanning tools, neuromarketing unravels the holy grail of sensorimotor/subliminal, cognitive and affective responses of consumers towards any marketing stimuli (Suomala *et al.*, 2012). It is the application of neuroscientific methods to analyze and understand consumer reactions to product design, packaging, advertisement, pricing and other marketing elements (Lee *et al.*, 2007). While social psychologists who study the social influence consider it as a form of social psychology, neuroscientists study the nervous system and the neural activities in different brain areas. While neuroscience is the clinical research on nervous disorders called as neurology, consumer neuroscience is the non-clinical studies encompassing the complex consumer behavior that remove the discrepancy between what consumers say they think and what they actually think. Cognitive neuroscientists measure the paradoxical relationship between brain and mind whereas neuromarketing scientists study the brain regions that are engaged in making brand choices, building emotional connections with brands or in impulsive purchase.

Though consumers can express what they want, it is difficult for them to precisely articulate how and why their purchase is influenced by brand associations and store displays. While the academic interest is to draw concepts and techniques to enhance marketing research processes and to understand the customer behavior, practitioners are fascinated by its application as a means to an end for selling more (Karmarkar, 2011). However the raw brain data can help to unlock the mysteries of consumers' brand choice. Neuromarketing paradigm being "atheoretical" consists of disjointed, one-shot empirical studies that highlight distinct neural activation patterns (Garcia & Saad, 2008). Its commercial use has been prevalent than academic studies as neuromarketers explore the neural circuits towards the subliminal stimuli in brand the logos, jingles, color contrast and sound of packaging, advertisements to precisely predict the buyers' response and frame cost effective marketing decisions (Garcia & Saad, 2008).

Unlike traditional market research methods that translate incoherent and subjective opinions of consumers, neuromarketing measures neural correlates of the attention level, emotional engagement and memory storage in human brain. Considering the interdisciplinary approach needed to interpret human behavior, some neurobiological tests like electroencephalography (EEG), positron emission tomography (PET) and frequency magnetic resonance (fMRI) can help researchers in understanding the various determinants that affect consumer decision making by interpreting brain activities. Functional magnetic resonance imaging shows what parts of the brain are active by detecting changes in the blood flow and the amount of oxygenated blood consumed in different brain areas. The greater the activity in a specific area, the oxygenated blood flow to that area will be higher. Though it is expensive the accuracy of test results for location-specific brain activity is very high compared to other tools. EEGs are less costly and less intrusive tool with a headset filled with electrodes placed on respondents' scalp to

measure the electrical activity of neurons in the brain while they are exposed to marketing stimuli. To elicit which image or which portion of an image grabs maximum attention Eye Tracking Test is conducted by measuring the location, span and pattern of the consumers' gaze. Galvanic skin response (GSR) measures the subtle changes in skin such as temperature and sweat that occur in concurrence with certain emotions. The knowledge provided by such tools enable marketers to determine accurate market potential, create marketing campaigns, design new products and services or revitalize brands more effectively (Kenning *et al.*, 2002).

2. Objectives of the Study

The major objective of this study is to offer a comprehensive understanding on the neurophysiological and neuropsychological interpretations of neural circuits towards different marketing stimuli. Literature survey of previous researches in neuromarketing, consumer neuroscience and consumer psychology are conducted in the light of explaining the neural of responses to brand logos, packaging, advertisement, brand preference in choice ambiguity, decision making at risk and so on. In the next section the test results and interpretations of some classic experimental studies on neuromarketing are summarized to complement its commercial application in predicting the buyer behavior. The two conceptual frameworks in this study reflect the interplay of neural and psychological response while illustrating how a strong marketing stimulus is utilized to build customer-brand relationship and to provide customer experience. The neural activation of attention, emotions and memory is proposed to have direct impact on brand-customer relationship. Since customer experience is the outcome of customer-brand relationship, neuroscientific techniques are likely to provide meaningful insights into building and delivering trust worthy brand promises.

3. Need for the Study

Though we believe that our purchase decisions are the result of our conscious mind, our decision making is beyond the reasoning of rational mind. In his book *Blink*, Gladwell strongly argues that "people are ignorant of things that affect their actions, yet they rarely feel ignorant" (2005). Still the psychological aspects of buyer behavior were assessed without realizing the neurobiology of consumer psychology. Evidences from research suggest that the cognitive process of purchase decision cannot be confined to the activation of a single area in brain called "buy-button" (Berns & Moore, 2012; Nobel, 2012). Moreover, a given region of brain is involved in multiple cognitive processes. In order to explore how a brand can fulfill customer expectations and provide customer experience, it is indispensable to focus on the neural activation of the brain areas that are involved in purchase decision (Ariely & Berns, 2010). According to Pine and Gilmore (1999), more than 50% of purchase decisions are made by those who are ready to pay more for better customer experience is of higher priority even during negative economy. Keller (2008) supports this argument when he states that customer experience is a journey to drive customer lifetime value (CLV). Aaker's brand equity model states that perceived quality is the overall feeling to the brand driven from brand association, brand awareness and brand loyalty that determines willingness to pay. Despite the studies in consumer research examine the conscious emotional information processing, little is known about how marketing stimuli such as brands are processed by the human brain (Kenning & Plassmann, 2005). This young science relies on multidirectional experimental research that overlaps neuroscience and psychology for understanding both voluntary and involuntary brain functions and its intricate emotional behaviors in the light of neural activities in the brain.

4. Methodology

This study explores the literature reviews in consumer neuroscience, neuromarketing and consumer psychology in order to frame a conceptual model that explains the interplay of cognitive and emotional aspects of consumer decision making. Hence this paper is exploratory in nature and inductive in style. The critical review of the articles gives an understanding on the rational and emotional brain responses to various marketing stimuli. A separate section for reviews on neuromarketing based on brand elements gives clear evidences. The fundamental questions that are critiqued in this research are why do consumers buy what they buy and how do they respond to various marketing stimuli such as brand logo, advertisement package and product design. Neuroscientific underpinnings of Aaker's brand equity theory (1996) are depicted in the conceptual model in this study. Using the established neuroscientific experiments, the theoretical underpinnings of brain activities and its intersection with consumer psychology are checked for its contributions to neuromarketing and to analyze purchase decisions made under risk while there is choice ambiguity and determinants of brand preference.

5. Literature Review on Neuro Science, Consumer Psychology and Neuromarketing

Though brain was treated as the seat of the locus of control, it was heart which was preferred as "the seat of the soul" till Hippocrates introduced the concept of mind as a distinct function from that of brain. Descartes referred to a dualistic approach where mind had control over the body, and body could have influence over the mind. Thomas Willis used the terms neurology and psychology in his physiological approach to brain behavior study and found the higher structures accountable for complex functions and lower structures responsible for automatic reactions or animal instincts. In Plato's chariot and two horses' theory that links human person to human mind, one horse symbolizes irrational mind (emotion) and the other represents rational mind (reasoning). Though brain is only 2% of our body mass, it burns 20% of our energy to meet our daily functions and most of these are managed by our brain below the level of consciousness. Still, only 20% of our brain is used (Morin, 2011). Brain contains millions of neurons that interconnect every single part of the brain so that no single part

operates in isolation. Neurons are the nerve cells that electrically transmit any form of stimuli through the neural synapses which is the gap between two neurons. Research has identified our brain's origin from reptiles. Reptilian streak of brain still prefers images over words and experiences over explanations (Morin, 2011). An infant's brain will have less area of rational brain and more of mid brain which is naïve in nature. Fig (1) shows an adult brain where the primate rational brain mass is more than mid brain. The emotional interplay of decision is self explanatory as we see the mid brain regulating emotions which is between reptilian brain and primate brain.

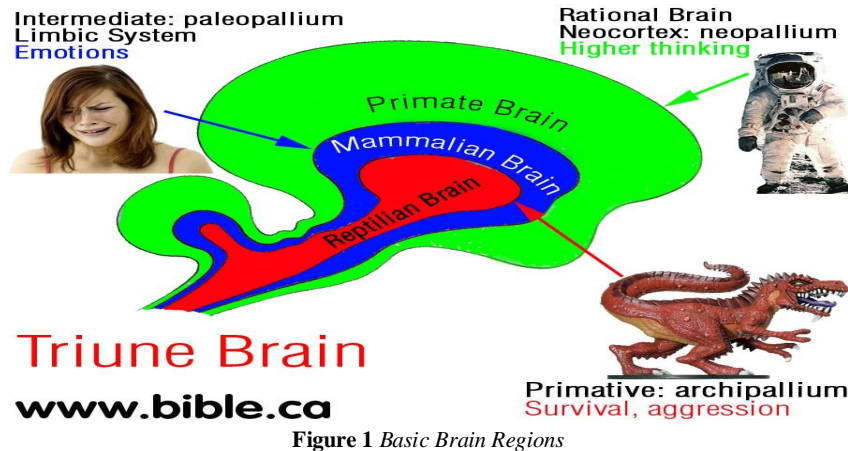


Figure 1 Basic Brain Regions

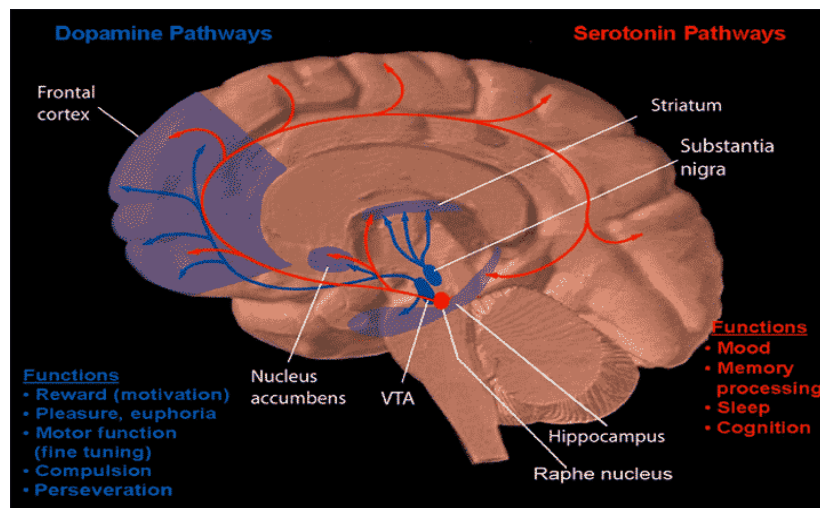


Figure 2 Emotional and Rational Pathways in Brain Areas

(Source- <http://www.wikipedia.com>)

The major components of prefrontal cortex that appear to fulfill different functions related to emotional interaction in decision making are:

- Nucleus accumbens is a part of ventral striatum, amygdala and dopamine system that is often associated with pursuit of pleasure and hence get activated by reward system. It is often connected with anticipation and prediction of rewards (Plassman *et al.*, 2007; McClure *et al.*, 2004).
- Dorsolateral prefrontal cortex (DLPFC) is active in the cognitive actions and rational decision makings (Deppe *et al.*, 2005; Stoll *et al.*, 2008).
- Amygdala activation indicates the perceived strength of arousal of an incoming stimulus. It is identified to have a significant role in the brain regions involved in the actual comparison and decision process (Mc Clure *et al.*, 2004).
- Orbitofrontal cortex (OBFC) is connected to reward and punishment system; also evaluation of incoming stimuli. Due to its ability to memorize the reward value of the sensory stimuli and its proximity to numerous brain structures, OBFC is found to play a vital role in reward processing and in the subsequent purchase behavior.
- Ventromedial part of prefrontal cortex (VMPFC) is vital for its integration of emotions in the decision making process due to its close proximity to amygdala and hippocampus. Several studies reinforce the role of PFC in building brand preference and brand loyalty (Plassman *et al.*, 2007; Deppe *et al.*, 2005; Kenning *et al.*, 2007).

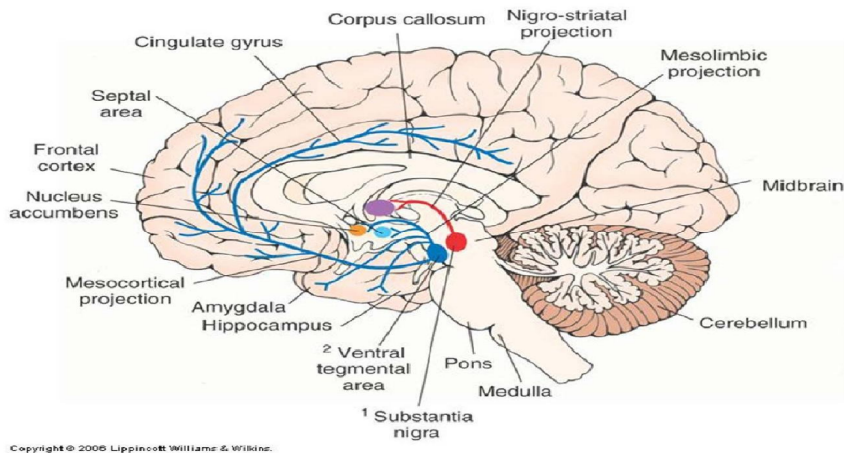


Figure 3 Neural Networks and Associated Parts of Brain
(source- <http://www.wikipedia.com>)

As shown in Fig.2 and 3, VTA, NACC and amygdala are the dopaminergic system that mediates pleasure and reward (Touhami et al., 2011). The brain regions involved in decision-making process are anterior cingulate cortex, nucleus accumbens, orbitofrontal cortex and ventromedial prefrontal cortex. On investigating how emotions, feelings, moods, memories and herd instincts influence our buying decisions using neuroimaging technology, the neuropsychological and neurophysiological aspects of purchase intentions could be unraveled (Annette, 2005). Every decision making is aided by emotions and it is taken in the face of risk and uncertainty. Higher brain areas like PFC and DLPFC are involved in the higher cognitive functions called executive functions. A virtual customer journey model that reflects customer engagement process in a simulated store using neuroimaging, studies the cortical activity in terms of frequency, time and space has helped in understanding our brain and cognition (Soumala et al., 2000). Customer preferences are subconscious in nature and hence difficult to express using words (Berns & Moore, 2012). Studies on the neural correlates of consciousness examine the relationship between the experiences reported by the subjects and the simultaneous activity that takes place in their brains. The interplay between the neural systems that extract emotional and bodily states that relate to purchase or consumption decision needs in-depth investigation (Morin, 2011). Neuromarketing is a sub area of neuro economics that addresses marketing related issues using insights from brain research methods (Lee et al., 2007; Fugate, 2007). Interdisciplinary collaboration between business and neuroscience calls for the application of neuroimaging to marketing research. Without the help of neuroimaging, access to neural data is difficult because the brain's valuation system acts at a conscious level. Also, neuromarketing cannot push a "buy button" in the customers' brain because there is no "buy button" to push (Berns & Moore, 2012).

6. Literature Review on Neuromarketing and Branding

The objective of consumer neuroscience is to study the neural activation patterns evoked by marketing mix stimuli. A comprehensive model of Esch et al., (2012) explains how the combination of brand knowledge and brand relationship affects current and future purchases. Current purchases are found to be directly affected by brand image and often indirectly affected by brand awareness. The future purchases are affected by brand knowledge in combination with brand relationship that is moderated by brand satisfaction. Brand managers can adopt this model to measure consumer- brand relationship on the basis of trust and feeling, apart from brand awareness and brand image measures. The anticipation phase of choice of brands with which one has established a long-lasting and close relationship is associated with insula activation in both hemispheres of the brain. Based on the fMRI data on short term memory processing of advertisement, led to the activation of brain areas where the integration of emotions (MPFC) and the perception of rewards (nucleus accumbens) in the decision making process were identified (Kenning et al., 2007; Plassman et al., 2007). Regarding the long term memory of brand information, advertisements connected to emotional images are remembered better compared to those advertisements that use exclusive rational arguments. The cognitive pictures of experiment using magnetoencephalography showed a higher activation in posterior parietal areas and superior prefrontal cortex that are used for working memory whereas affected images activated VMPFC, OBFC as well as amygdala (Ambler et al., 2000). The neural correlates of branding identified the influence of consumer decisions by brand information (Ailavadi & Keller, 2004). The fMRI scans of Deppe et al., 2005) examined the neural activation in the brain during the processing of the brand information that resulted in contrasting results to the previous studies. A reduced activity in DLPFC, posterior parietal and occipital cortices; the areas that are linked with working memory and logical decisions in the choice of brands provided information over similar brands which did not give brand information. DLPFC is the primate brain region responsible for working memory that integrates intellectual function of motor planning and organization with action.

When the brand personality theory of Keller (2006) was examined to find the usage of product descriptions corresponding to similar human traits for better advertising, it was found that prominent brain areas distinguished the identity of a human personality from the personality of an inanimate brand. Here consumers and brands are in the similar level when brands are quasi human entities where human qualities like emotions and thoughts are attributed to the brand. Celebrity endorsement in advertisements is a prevailing method of leveraging a brand's association (Keller, 2008). Due to the association of mirror neurons with empathy and imitations, consumers attempt to impersonate the celebrity. The mirror neurons are activated to mimic and copy the purchase behavior and product choices of high status individuals. When brands get such strong images which are socially acceptable to a particular social class, it influence the cerebral activities related to a perceived expression that is linked to human memory/social preference. Yoon *et al.*, (2006) also addressed similar questions to check the brain activation towards semantic judgments about persons and objects. He found that an individual's characterization gave a stronger activation to MPFC compared to a brand's characterization. Nevertheless, activation in the inferior frontal gyrus (IFG) which is a part of the mirror neuron system suggests that test subjects behave by associating themselves with objects and people displayed on the advertisements.

In his study Plassman *et al.*, (2008) evaluated the neural activation in the medial prefrontal cortex (MPFC) and anterior cingulate cortex indicated significant activation differences based on the higher price information. MPFC is likely to be activated by affordable prices and DLPFC codes the final purchase decision. Consumer neuroscience enables investigation of cortical areas that are activated during consumer's decision making process in order to reassess the existing theories. Effective logos communicate what the brand represents; like the "swoosh" symbol of Nike is a simple design that conveys energy and movement that is appropriate to the brand's high performance sportswear. Also the area of brain that correlates with visual attention leads to get insights on brand logo perception which are beyond our conscious mind (Santos *et al.* 2012; Keller & Lehman, 2006). To assess the linguistic encoding and information retrieval process in the brain with unfamiliar/weak brand and familiar brands, Esch *et al.* (2012) use declarative and experimental information. For unfamiliar brands, the neural correlates of linguistic encoding were higher; whereas for familiar brands, neural correlates for information retrieval were lesser. The fMRI signals also showed that weak and unfamiliar brands were simultaneously activating both the process. Moreover, strong brands activated the pallidum that is linked with positive emotions and weak unfamiliar brands activated the insula, which is associated with negative emotions. These findings demonstrate that consumers use more of experienced emotions instead of declarative information for brand evaluation (Fisher *et al.*, 2010). Therefore brand experiences ought to be considered as a major determinant of brand equity in addition to brand awareness and brand association, which are cognitive in nature (Keller, 1993; 2008). Based on various advertising images and celebrity endorsers, brand images and perception are created in the consumer's mind. The social influence of brand image is involved in the neural activation for an emotional response (Santos *et al.* 2012).

Most of the branding theories being derived from cognitive neuroscience, it is argued that reduction of perceived risk and increase in customer based brand equity are the outcome of brand association, brand awareness, brand image and perceived quality results (Aaker, 1991, 1992; Chaudhury and Holbrook, 2001; Keller, 2002; 2003). Based on information economics approach, minimizing the perceived ambiguity and information cost is proposed to drive brand preference (Erdem & Swait, 2004). In the case of choice ambiguity in brand preference, the neural activation in VMPFC is triggered due to an interaction of choice ambiguity and brand information (McClure *et al.*, 2004; Deppe *et al.*, 2005; Koenigs and Tranel, 2007). To investigate the role of choice ambiguity in brand preference, Plassman *et al.*, (2008) empirically shows the neuronal activation triggered by brand information processing and ambiguity are VMPFC and anterior cingulate (AC). Anterior cingulate is generally associated with emotions, response selections, intuition and reward based learning. It is also involved in cognitive and emotional regulation in decision making process (Deppe *et al.*, 2007). The evaluative function of assessing sensory information and episodic memory activates the posterior cingulate cortex. The visual stimuli activation in OBFC studied the role of packaging as a visual stimulant (Stoll *et al.*, 2008). While comparing the impact of attractive and unattractive advertisements on its perception, the visual stimuli of attractive advertisements activated the visual cortices, posterior cingulate cortex, nucleus accumbens and MPFC (Kenning *et al.*, 2007). Amygdala in brain is involved in processing the emotional behavior related to joy or fear. The frontal medial cortex is another part to process emotional response. Several studies reveal that the participations of these regions that are involved in the assessment of brands and feeling the brands.

Conceptual Model

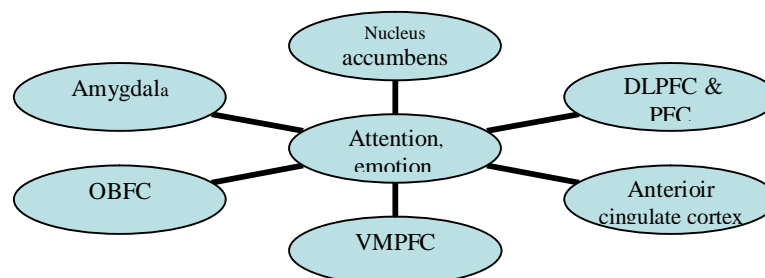


Figure 4 Parts of Brain that are Involved in Consumer Response to Marketing Stimuli

The conceptual model framed through article reviews consider the interplay of attention, emotion and memory in building brand association, brand preference, perceived quality and brand association from Aaker's brand equity model (1996) leading to customer experience. He relates brand awareness with brand recognition and brand recall. Loyal customers are those who consistently buy and remain committed to the brand. The former is the behavioral approach and the latter is the cognitive approach. Brand association includes brand image, brand attribute and functional and emotional benefits. Brand-customer relationship mediates the overall feeling, purchase intention and brand preference that results in perceived quality which is the key driving force in brand equity assessment. Hence the diagram shows how overall customer experience is generated through brand customer relationship. Two vital emotions to be considered in building relationship being trust and loyalty this model specifies neural correlates of brand image, brand association and brand awareness in offering customer experience through customer brand relationship. Insights from measuring neuronal activities of both spatial and temporal lobes and the activities of caudate nucleus can enhance the firm's ability to explore the determinants of trust. A major research gap (Kenning & Plassmann, 2005) is that the relationship and trust building studies using neuromarketing, is limited to trust building on marketing claims. The neurobiology of trust reveals that reputation and degree of trust that affects the social aspects of economic exchange activate the hormone oxytocin (Ariely & Berns, 2010). Plessis (2011) explains how a brand loyal brain function is closely similar to the brain biology of a person's love affair. The misfired gold card programs of Starbucks state that true loyalty is based on emotions; it cannot be built with predictable freebies (Forbes magazine, 2011). The consumer brand relationship study of Fournier (1998) elaborates to define a relationship signifying the reciprocal contribution of both customers and brands as she explains strong implications of trust on building consumers brand loyalty (Fournier, 1998).

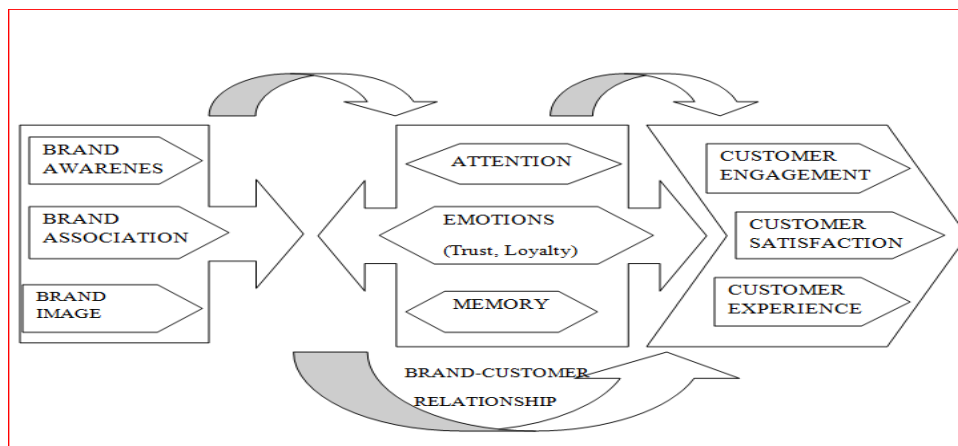


Figure 5 Cognitive Neuroscience of Consumers' Response

The involvement of human emotional system in the processing of brand preference has been studied using car brand logos (Schaefer *et al.* 2006). Evidence for dual decision process, one being reason-based and other being emotion-based was studied by Deppe *et al.* (2005) proved that the preferred brands triggered the neural activation of emotional decision making. Plassman *et al.*, (2008) extended this work, by investigating the neural activation of choice ambiguity of brands in the context of brand preference. These studies display a participation of emotional system in preference decisions, mainly the frontal medial cortex or VMPFC, which affirms the theory that decision process, are mostly driven by emotions. According to social sciences, the brands are analyzed to be symbolic resources for social identity. The meaning of the brand given by the reference group sends meaningful social signals to the individuals. Beyond the basic functional attributes, brand logos carry symbolic meanings as brands are status symbols (Santos *et al.*, 2012). An fMRI based neuroscientific study on the cognitive process of car preferences by comparing sports car with small cars show the self relatedness in the appraisal of car brands (Schaefer *et al.* 2006). Three cognitive processes that are important for brand perceptions are noted as emotion, social relevance and self-relatedness (Santos *et al.*, 2012). Their experiments demonstrate activation of brain regions connected to memory and learning such as hippocampus and striatum where nucleus accumbens is located added to the activation of frontal orbital cortex, anterior cortex, paracingulate gyrus and anterior cingulate gyrus. It also reveals that participation of different brain regions in the processing of decision-making related emotions is not due to a set of choices for brand assessment, rather a single brand was enough to induce the emotional response (Deppee *et al.*, 2005; Plassman *et al.*, 2008, Santos *et al.*, 2012). This was supporting the study conducted in the patients with lesions in OBFC (Koenigs *et al.*, 2007). The findings showed the tendency to construct utilitarian judgments without social and emotional components, is the reason for their poor decision making ability. While the emotional system of feelings is activated by the perception of brand, the preferred brand activated the areas linked with emotional inducers and self-relatedness. These findings on the choice of favorite brands were contrasting the findings of Kenning *et al.*, (2002), that found the allied brain regions were deactivated. Hence this valuable information for market researchers can be examined to reinforce customer-centric strategies for brands (Santos *et al.*, 2012).

Experimental Studies on Neuromarketing

1. 'Pepsi paradox' is the most remarkable scholarly work on neuromarketing conducted by Read Montague from Baylor College of Medicine by observing the neural activities of 67 people in fMRI machine on a blind test to find their taste preference of Coke versus Pepsi (Neuron, 2004). It was found that they preferred the taste of Pepsi when blind folded. Later when they were informed that they were drinking Coke, seventy five percent of them said that Coke tasted better; also there were changes in their brain activity. It showed neural activation in the medial prefrontal cortex, an area linked to complex evaluations and self-image. The preference to Coke was due to the brand image that affected the customers' choice instead of the taste itself. "Coke's long-term advertising had succeeded in activating the brain regions that influence personal preferences" (McClure *et al*, 2004). These findings revealed that neuro scientific data can help to overcome consumers' self-reporting bias and could remove their lack of ability to articulate the difference between conscious and unconscious thoughts. A strong brand has the power to activate the prefrontal cortex (PFC) which is the seat of attention, short term memory and executive function like planning; and ventromedial prefrontal cortex where the feelings of rewards are processed. It was noticed that the lateral and medial prefrontal cortex, the area that governs high level cognitive powers and hippocampus which is related to memory function were found activated indicating that they were thinking of the impressions and memories related to Coke. According to the results from the anonymous tasting, Pepsi should have half the market share of soft drinks. But in reality, Coke is preferred which not due to its taste preference. Rather, the emotional associations and image recalls of Coke's marketing activities is found to change the neural activities when they were made aware of the brand. With the interpretation that brand awareness removed the uncertainty about the brand they tasted; Dr. Montague inferred that it might be the activation of memory related areas such as hippocampus and dorsolateral prefrontal cortex (DLPFC) that retrieved their prior consumption experience.
2. In the most notable Daimler Chrysler experiment, Henry Walter did brain mapping with fMRI on 12 young males while showing 66 black and white photographs of sports car, sedans, and small cars. The scan showed that nucleus accumbens (NAc) in the brain was significantly active when they were watching sports cars. This tiny region in brain is the center for self reward which is activated by the signaling molecule, dopamine and releases substance linked to pleasure. In this experiment, the object of trigger for the release of dopamine was the perceived desire for powerful sport cars. This desire is connected to the learning and understanding from advertisement that sports cars are highly desirable for men. The major insight from this study could help car makers to examine the neurological findings that could augment the traditional market research. Similar studies were conducted to investigate which car model or which advertisements prompted the strongest emotional response (Erk *et al*, 2002). Accordingly, brand associations and advertisement campaigns could be designed to draw attentions and retain brand memories among the target customers. The fMRI results indicated that activation of reward related brain areas for the status symbol cars are associated with social dominance and wealth. The most intense neural activation was measured while the respondent watched sports car and the least activation for small cars in those areas associated with motivation, prediction of rewards and decision making. The visual stimuli of car pictures triggered the left anterior cingulate, left orbitofrontal and prefrontal cortex. Nucleus accumbens, a collection of neurons that form the main part of ventral striatum in the PFC area was activated thus inferring that attractive product design is a strong visual stimulus to activate reward systems in brain. Under the influence of anticipation of gains, nucleus accumbens gets activated by product preferences and product design that partially helps in subsequent purchase behavior.
3. Carnegie Mellon University conducted a first of its kind study recently testing the ability of brain to identify the distinct emotional states with greater accuracy and assess the emotional response to almost any kind of stimulus. This experiment goes beyond locating specific areas of brain and connecting them towards a specific emotion. According to CMU scientists, this study identified patterns of neural activities across many areas of the brain that represented specific emotional states. They used CMU's theatre school actors to emote disgust, anger, etc. The findings were analyzed to read the neural activation of how people feel about a brand by showing an image of brand and finding whether they feel disgusted or happy. The commercial use of this technique can offer better accuracy well above chance than fMRI to identify emotions (www.cmu.edu, 2013).
4. In the blind-sight studies conducted in Geneva University Hospital shows how individuals blinded by brain damage, navigate around the obstacles, though there is no conscious knowledge of how it is done. This explains that in addition to main visual processing systems, a more primitive secondary system feeds directly into subconscious. For the maximum brand recall from the customers, seeking attention and engagement without they being aware of brand information processing is the solution. The subliminal reinforcing of brand message insists on the positive associations of the brands, colors, shapes and scents may be subconsciously processing and storing them without consciously paying attention. Hence the subliminal image research suggests that any exposure is better than none as it can help in causing a positive impact later.
5. Baba Shiv's experiment (2005) on simple investment decision- making aims to untangle the emotional circuitry. He compared the emotion processing regions in the brains of healthy adults with that of patient with some forms of brain damage. The rule of the game was that each losing bet would cost \$1 and each winning bet would earn \$2.5 out of 20 turns of coin tossing. It was found that most of the healthy people were risk averse and with every subsequent coin toss fear mounted in them to gamble further. "The pain of loss is much greater than the pleasure of equivalent gain". Contrary to the healthy person's loss aversion who gained lesser, the patients who earned more since they remained least bothered by the fear of loss throughout the game.

6. Baba's another "frinky science of mind" as his studies are called, investigates the effect of emotions on the decision making. His experiment on chocolate cake versus fruit salad led his team to coin the term "neuroeconomics" based on their work in decision neuroscience. The participants who were asked to memorize seven-digit number were found to be more likely to choose chocolate cake over fruit salad. Whereas those who had to memorize only a single digit number had the brain power to resist the lure of the cake, since the cognitive load in remembering single digit was lesser. This result not only confirms the philosophical findings of Plato and Descartes that emotion is the enemy of reason. As Gladwell quotes in his book *Blink* (2005), that "lesion patients are fearless, bizarre and irrational decision makers who repeatedly failed to learn from their mistake." Whereas Baba argues that brain damaged patients can make better decision than healthy persons by studying the neuromechanism of their unconscious choices. "Emotions are by nature fleeting. So people have very limited insight into their own feelings and hence self reports aren't a great measure" (Shiv *et al.*, 2005).
7. In his book "*Buyology*", Lindstrom (2008) explains the study conducted to prove how cigarette warning labels were identified to be a visual stimulus for smokers which encouraged them to light up more cigarettes. Instead of curbing their craving for smoking, it gave the benefit of an advertisement that triggered the desire for smoking in the brain area that anticipates pleasure and reward called nucleus accumbens.

7. Managerial Implications

Attention, emotions and memories need to be addressed in creating customer experience and in building customer- brand relationship. According to Aaker (1999), brand equity consists of brand awareness, brand loyalty, perceived quality and brand association. Though mood and feeling are interconnected it is difficult to articulate which mood create which feeling because expression of our experiences can be different (du Plessis, 2011). "We are not thinking machines that feel, we are feeling machines that think" (Antonio Damasio). By drawing convergent information about human behavior from brain imaging and computational neuropsychology that combines neural and behavioral information a new form of cognitive theory can be framed in order to study the neural substrates as well as the overt behavior of the resultant neural network (Ralph, 2004).

Being seller-centric is identified as the major source of marketing ineffectiveness by Mitchell (2002). Outstanding neuroscientific experiments that offer evidence to the emotional and rational thinking channels and its brain science contribute corporate houses to pay attention to customer-oriented marketing mix. A wide variety of commercial applications of neuroscientific methods associated with marketing exchanges are born from the marriage of cognitive neuroscience and marketing research. The methodological alternatives that marketers gain from the neuroimaging techniques offer valuable insights on the subconscious processes in the consumers' brain. The contribution of neuroscience to a better understanding of psychological process behind human decision making has been explored by several researchers (Hubert and Kenning, 2008; Lee, *et al.*, 2007; Plassman *et al.*, 2007). Neuro scientific findings on consumer psychology research can be applied for understanding preference of consumers (Fisher *et al.*, 2010). Apart from the limited disadvantages of physical noise and dependence on BOLD (blood oxygen level dependence) signals which are considered as an indirect measure of neural activity, fMRI is a predominant technique in neuro scientific studies. Contrary to other brain function based research methods, it is a noninvasive method devoid of any radiation or chemical substances. Effective designing of the marketing mix before the commercial launch of the products, based on the neuropsychological findings can help customer-centric decision-making. Hence the most enterprising application of neuroimaging methods can be the neural data collection when the brand is in its idea development stage (Ariely & Berns, 2010). Instead of examining the emotion-based information after the decision is made, it is worth studying the observations of the neural functions during the process of decision-making. Neuro marketing triggers strong criticism due to the fear that it can unlock the hidden secrets below the level our conscious mind from the ethical perspective, there appears to be some barriers to neuro marketing as its investigation of consumers' emotion is an infringement into the privacy of consumers' thinking.

In the tradeoff between costs and benefits of this research based on the hope of marketers are that the data from brain imaging is measured during the actual performance toward a marketing stimuli (Babiloni, 2012). Such methods complement the traditional consumer research for further investigations of a specific buyer behavior. Though neuromarketing augments customer-orientation and facilitates the right choice of marketing communication it cannot be considered as a standalone strategy. This research tool maximizes the returns on marketing investments (ROMI) as it enables in predicting the consumer behavior with precision. By looking beyond what meets the eyes and into the fissures in the brain has more to unfold in consumer research

8. Scope of Future Research

Further research can bring more aspects of customer- brand relationship with empirical evidences supporting the proposed model in this study. Being interdisciplinary in nature, collaborative research with experts in neuropsychology and marketing can add momentum to the application of neuromarketing in brand management. Erik du Plessis who authored "*The Advertised Mind*" and "*The Branded Mind*" specifies that the future of neuromarketing is in the better understanding of customer moods and how neurological responses differ according the different moods. While he asserts that 90% of our decision making is subconscious, the mysterious existence of "buy-button" is strongly dismissed by explaining the multiple levels of awareness during a brand choice. According to his definition, an emotion happens as fast as survival reflex, whereas a mood is a state of mind or particular reaction to an emotion. Since reaction is inseparable from a state of mind, neuromarketing may have limitation in studying how to quantify the changes in mood which makes the predictability of buyer intentions more elusive.

Apart from fMRI, advanced techniques for more precise brain reading may improve the reliability of data for commercial usage. MVPA (multi-voxel pattern analysis) which has the statistical assessments of complex neural associations, more precise understanding on the customers' mind can be obtained (Morin, 2010). Other than locating the mythical buy-button in the brain and creating irresistible or memorable advertisement, the scope of neuro marketing research can be widened to inter and intra organizational research beyond consumer response. To facilitate fMRI solutions for commercial marketing problems, academic research institutes needs to initiate relevant investigations. Within the context of larger universities having considerable facilities for brain imaging, magnetoencephalography (MEG) or galvanic skin resonance (GSR) can help in exploring potential neuro marketing awareness. The complexity of consumer decision making based on the emotional, situational and informational resources can be recorded and monitored by latest computerized light-weight, neuro-feedback monitoring system called Nexus-10 and Nexus-32. Instead of a product suffering from market rejection, marketers can monitor the target customers' response to the design, ads, package, logo, jingle etc with such sophisticated non-invasive tools. Companies will be looking forward for frugal advertisement initiatives and judicious return on marketing investment measures in a recession hit economy (Swaher, 2012). Moreover, its multidisciplinary perspective on decision making can open unprecedented research opportunities (Yoon *et al.*, 2006, 2012). This area also intersects with biomedical engineering.

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