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Chapter

Neuromarketing: The New Dawn and Disruption in Marketing Research

Kovvali Bhanu Prakash and Appidi Adi Sesha Reddy

Abstract

The 21st Century is termed as the 'Century of the Brain' and the 'Human Brain' has 100 billion neurons and each neuron is connected to 10000 other neurons. 'Meme' is a unit of information that is stored in the brain and these units are effective at influencing a person who is making choices and decisions within 2.6 seconds. The 'Neuromarketing' is emerged from the realms of 'Neuro Science' as a new dawn and digi-driven disruption in the arena of 'Marketing Research' that studies the cognitive and emotional brain responses to marketing stimuli. The 'Consumer Neuro Science' by instigating brain wave tools figuring out what customers' thoughts and brain responses are towards a product, service, advertisement, or even packaging. Neuromarketing mapping the activities in specific regional strata of the brain, capturing and predicting the psychological as well as physiological behavioral changes of buyers and/or consumers at a point-of-sale. The chapter intends to present the conceptual focus of 'Buying Brain' *viz.,* Neuro Marketing, the role of 'Memes' in buying decisions, besides the tools and techniques adopted in persuading Buyers as Consumers and/or Prosumers that remain unearthed and unexplored.

Keywords: EEG, fMRI, MEG, PET, SST

1. Introduction

The 'Mind' is what the 'Brain' does and the 'Brain Science' was emerged from the realms of Neuro Sciences. The Neuro Science deals with the 'Mind' while Neuromarketing corroborates the 'Brain Responsiveness'. The impressions created in mind are stimulated and expressed by brain. A unit of information stored in 'Brain' is referred as 'Meme' *i.e.,* the basis for Neuro Science and 'Neurons' are the cells that fire together, wire together and responsible for the biological basis of our cognitive responses. 'Memes' influence buyers to make choices and decisions within 2.6 seconds and stayed in memory are targeted by Market Researchers (**Table 1**) [1, 2]. Neuromarketing is a relatively nascent and inter-disciplinary field in Marketing Research emanated from the Neuroscience, and Psychology. The Neuromarketing assesses the needs of consumers, monitors and measures the cognitive and emotional responses to various marketing stimuli [3, 4]. The Neuroscience is considered to be in its infancy, and Neuromarketing will be clearly at an embryonic stage [5].

• Human Brain weighs about 3.3 pounds (1.5 kilograms)
• Mass of a Human Brain is 2 per cent of Body Mass Index (BMI)
• Cerebrum makes up 85 per cent of Human Brain's Weight
• Neurons' are the cells that fire together, and wire together (Axons and Dendrites)
• Human Brain has 100 billion neurons, and each neuron is interconnected to 10000 other Neurons
• 'Meme' is a unit of information stored in Brain
• 'Memes' influence buyers to make choices and decisions within 2.6 seconds

Source: Ref. [3].

Table 1.
Human brain - the factsheet.

1.1 Neuromarketing: the premiere

The fusion of Neuropsychological and Marketing Sciences was trace back at the beginning of the 21st century when Neuroscience and Economics integrated as Neuro Economics [6]. Neuromarketing is an ontology of Neuroscience that reveals the true motives, real intentions, or inner essential truth of the naked, unconscious or intuitive consumer [7, 8].

The analytics and applications of Neuroscience have been facilitating the product marketing from the stages of introduction to decline *enroute* growth, and maturity [9–11]. Marketing is an activity and a kingpin that sets the economy revolving (Adam Smith) *prima facie* creating and delivering standard of living to society (Paul Mazur and Malcom McNair). The journey towards moment of truth to moment of promise is merely for the fulfillment of immediate needs and wants, promising customers, clients, partners, and society at large keeping in view the futuristic outlook and direction *i.e.,* Neuroscientific Research [12].

The term 'Neuromarketing' is at first coined by Gerald Zaltman of Harvard University and conceptualized by Ale Smitds of the Erasmus University of Rotterdam defined it as a 'Consumer Neuroscience' mapping the activity of conscious, sub-conscious and unconscious state of the brain stimuli [13]. The exhibited external behavior of the consumer is naked and unreliable, yet, the brain response *i.e.,* pre-frontal cortex is real and reliable [14–16].

Neuromarketing is an interdisciplinary and a relatively nascent field in Marketing Research that was connected by Neuro Science, Behavioral Economics and Social Psychology [17] to study consumer reactions and responses to specific marketing related stimuli [18]. The prime objective of Neuromarketing is to study how the brain is physiologically affected by advertising and marketing strategies. The application of 'Neuroscience' and adoption of 'Neuromarketing' tools and techniques intelligibly touched and touted the 'Marketing Mirrors' during 1990–2000 and thereafter gained momentum [19–21].

The Neuromarketing or Consumer Neuroscience is defined as an application of Neuroscientific tools and techniques viz., fMRI, EEG, MEG, Eye Tracing, SST, PET, Eye Tracking, IAT, SC, Facial Coding and other brain wave tools to assess, analyze and gauge the consumer decision-making and brand consumption-comprehension processes and figuring out the customers, consumers as well as prosumers thoughts towards a product, service, advertisement, or even packaging [22–25]. The revolutionary and radical shift termed as Moment of Promise (SAS, Google) steering prosumers than targeting consumers or users. This seismic shift from near sighted Marketing Myopia (Theodre Levitt) *i.e.,* Moment of Truth ('I Want To Know-Go-Do-Buy) (A.G. Lafley, Pete Blackshaw - P&G, Google) to Moment of Promise (apple).

1.2 Neuromarketing: from the lens and mirrors of neuro science

The Human Cognitive Neuroscience and Psychology is the basis for Neuromarketing (Neuroco and Neurosense in UK, Bright House Neuro Strategies and Neuro Insights in USA Sales Brain in France, and Neuro Insight in Australia), and it studies the 'Consumer Behavior' from a brain perspective. Neuro Imaging as a standard tool or technique in Marketing Research adopted to analyze the situations-scenarios of Cognitive Psychology. The Neuroscience has widely applied by Economists in economic decision-making [26–30].

Neuro Science is in primitive stage while Neuromarketing still in infancy. The Frontal Lobe is the seat of Executive Function (EF) that controls short memory, and does the best of thinking *i.e.,* planning. The Frontal Lobe is responsible for the emotional instinctive behavior. The R-Complex or the Reptilian Brain is the critical component and responsible for buying behavior. The Reptilian Brain focuses on pre-verbal processes of virtual stimuli without the use of visual cortex *i.e.,* image preference over words and experiences over explanations. The mass of a 'Consumer Brain' is 2 per cent of Body Mass Index (BMI) and it burns 20 per cent of energy. The remaining 80 per cent of 'Brain Energy' is necessary to sustain rest state or default mode that continues to be perplexing for Neuroscientists (**Figure 1**).

The individual preference to brand familiarity [31, 32] and product preference [33, 34] have been correlated with neural activity in Neuromarketing. The 'Brand Image' awaken the emotions that can become more powerful than the direct effect of the product. The medial Pre-Frontal Cortex (mPFC) as a repository of linkages between factual knowledge and bio-regulatory states translating the product information into experiences and linked the positive affect in advertising [35, 36].

1.3 Neuromarketing: the triune signal system (TSS)

The Triune Brain is a signaling system and a key instigator of the 'fight and flight' mechanism [37, 38]. The Triune Brain (3-Imbricate Structures) consisting

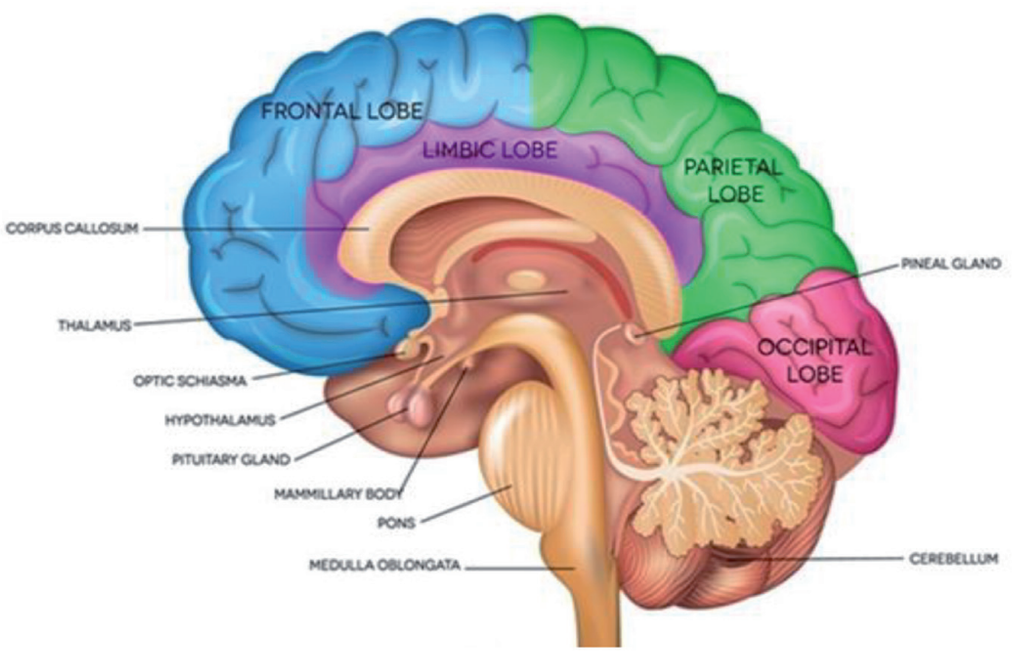


Figure 1.
Human brain—the anatomy.

of (i) R-Complex (Reptilian) or Primitive Brain; (ii) Limbic System or Emotional Brain; and (iii) Neo-Cortex or Rational Brain focus on primitive emotions that are overruled by conscious thoughts (**Figure 2**) [39].

1.3.1 The R-complex (reptilian) or lizard or primitive brain

The consumer psychology has been the bedrock for marketing strategies and R-Complex helps Marketing Researchers to understand how consumers' Reptilian Brain reacts and responds to the moment. In order to satisfy the 'Need Hierarchy' (physiological, safety and security needs), the Primitive Brain responds very quickly with a strategic intent (act, react, withdraw or wait). A well- developed and healthy Neo-Cortex monitors the R-Complex in smart and sentient buying [40–45].

1.3.2 The limbic system or emotional brain

The Limbic System or Paleomammalian Cortex is a set of brain structures that deals with emotions, feelings, attention, general attitude, pleasureor annoyance, agreeable or disagreeable experiences, and memory. It regulates autonomic or endocrine function in response to emotional stimuli [46–48].

The Limbic Structure is composed of hippocampus, amygdala, thalamus, and hypothalamus. The Limbic Brain is at the seat of the decision-making and value judgments that exerts a strong influence on Buyers' Behavior (**Figure 3**).

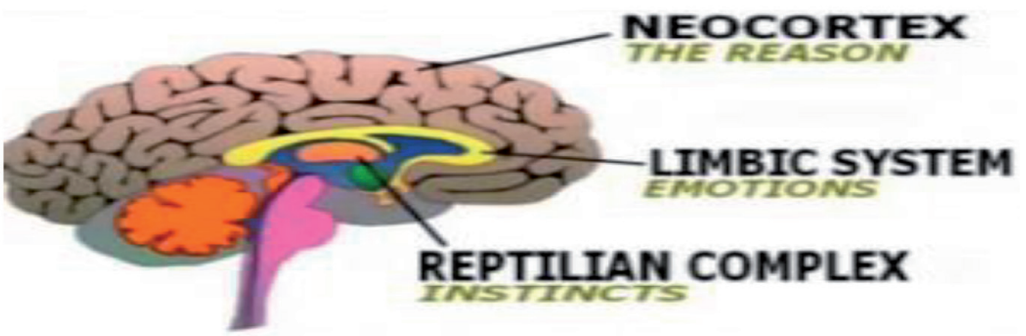


Figure 2.
Triune brain - the neuro warning signal (NWS). Source: The triune brain, science of psychotherapy, 26th Oct, 2016.

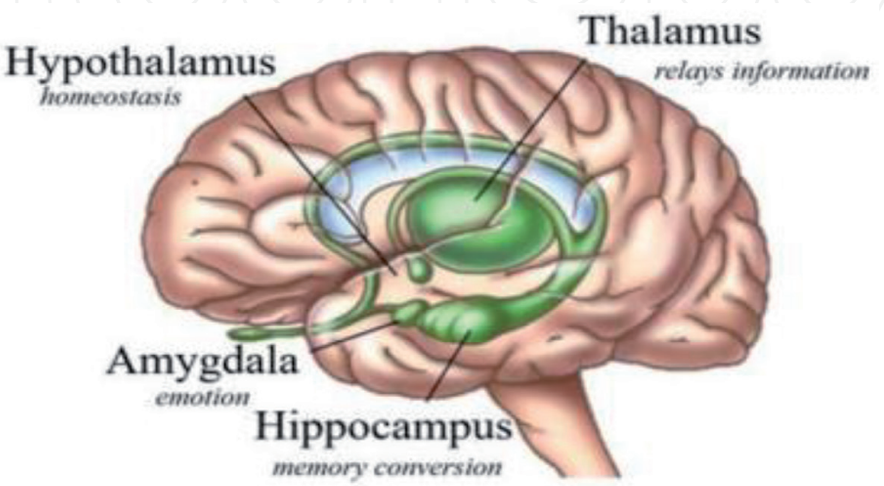


Figure 3.
Limbic brain - the anatomy. Source: Ref. [50].

1.3.3 The neo-cortex or rational brain

The Neo-Cortex or the Rational Brain positioned in between two large cerebral hemispheres that are playing a dominant and responsible role for the development of human language, abstract thought, imagination, and consciousness. It analyses the choices of the products and/or services and suggest the best choice amongst alternatives based on the need rather than the features of the product.

The Neo-Cortex has the features of rationality, flexibility and infinite learning abilities that are used to solve problems logically and develops innovative and rational thinking. The Rational Brain thinks, the Emotional Brain feels and the Reptilian Brain makes decisions (**Figure 4**) [49–52].

The activation of medial Pre-Frontal Cortex (mPFC) is an effective corollary measure that affects the fear conditioning [53], eating disorders provocation [54], and startle responses [55]. The reward system [56–59], money [60–63], brand preference [64], price and quality can also influence the consumers in a placebo-like manner [65].

1.4 Neuromarketing: the analytics & applications

Today's Experience Economy (EE) has been effectively monitoring and measuring the efficacy of emotions, feelings and opinions of Buyers as well as Consumers. The non-invasive and intrinsic to Neuroimaging Techniquesfor measuring and mapping the brain activity *inter alia* include: a) functional Magnetic Resonance Imaging (fMRI), b) Electro EncephaloGraphy (EEG), and c) Magneto EncephaloGraphy (MEG) [66, 67]. These 3-Neuro ImagingTechniques are non-invasive and therefore can be used safely for Marketing Research purposes (**Figure 5**).

The other prominent and prevalent Neuro Scientific Methods are: Steady State Topography (SST), Positron Emission Tomography (PET), Eye Tracking and Galvanic Skin Response (GSR). An fMRI peer deeps into brain by using strong magnetic fields to track changes in blood flow across the brain. But, an EEG reads the brain-cell activity using sensors over fractions of a second. Unlike both EEG and MEG, the fMRI modality scans and catches the BOLD Signal (Blood Oxygen Level Dependant) Flow Image of the brain *i.e.,* the prime source of intervention and intermediation [68, 69].

1.4.1 Neuromarketing: the functional magneto resonance imaging (fMRI)

The functional Magnetic Resonance Imaging (fMRI) has been widely used neuroimaging technique since mid-1980s'and its rapid application in mapping the

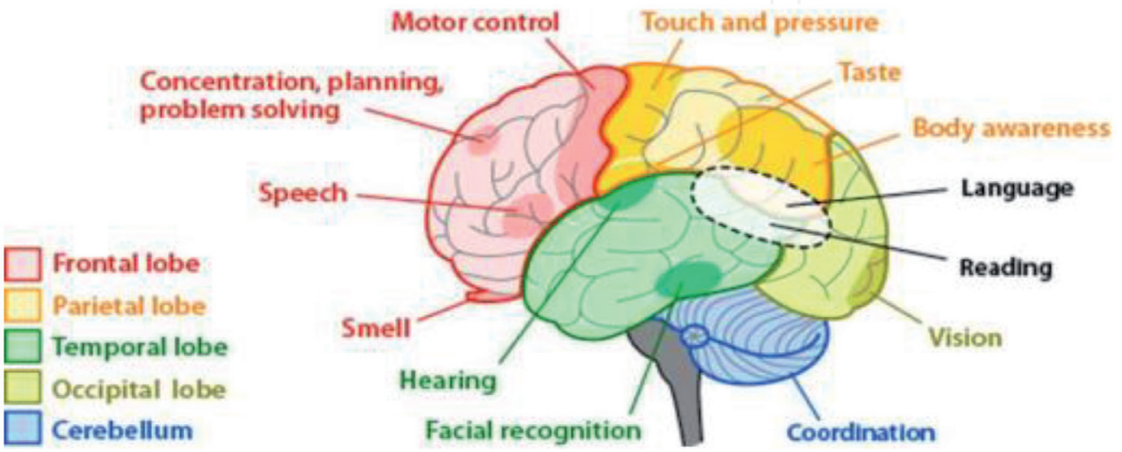


Figure 4.
Neo-cortex/rational brain - the regions. Source: Ref. [55].

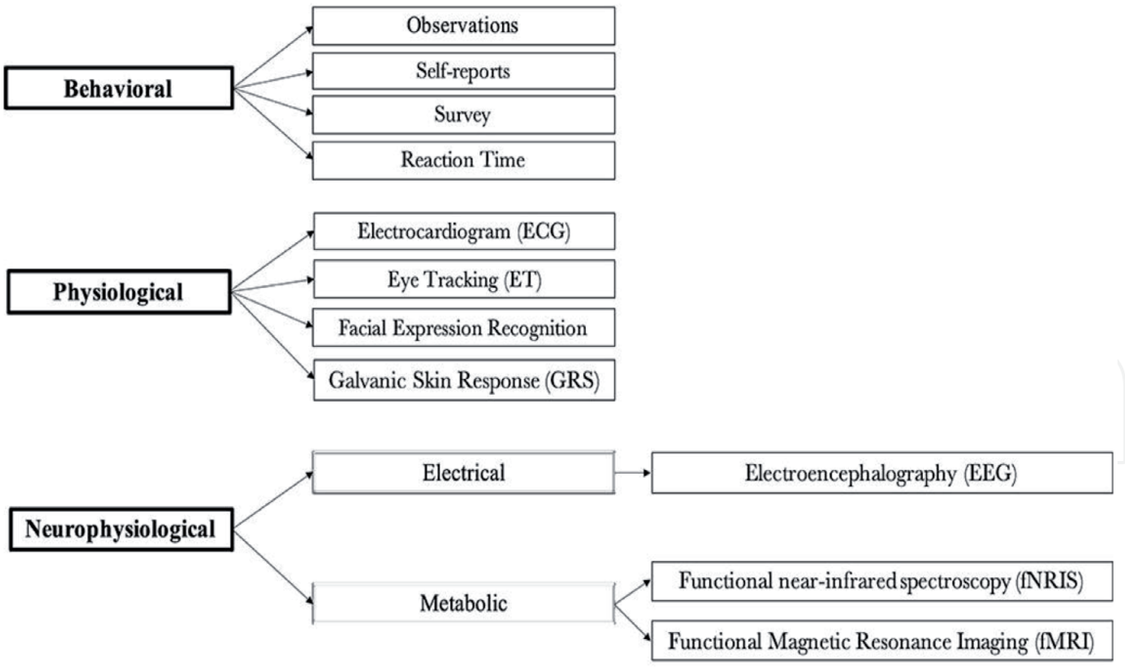


Figure 5.
Neuro-imaging tools and techniques - an overview. Source: www.frontiersin.org.

brain's circuitry fueled the growth of Neuropsychology (study of cognitive processes), Neurophysiology (study of nervous system), Neuroethology (evaluationary and comparative study of animal behavior and human nervous system) and Neuroanotomy (study of neural structures of human nervous system).

The fMRI studies the refractions of magnetic field and radio waves thereby producing a signal that allows viewing the brain structures in detail [70]. The first empirical study on fMRI and its impact and incidence on Neuromarketing inferred that different brain areas are activated when people know the 'Brand Consumed' compared to when they do not know it (Coca-Cola Vs Pepsi) [71]. Further, stated that when people knew the brand Coca-Cola over Pepsi their 'Frontal Lobe' was activated, an area that coordinates attention, controls short-term memory and directs thinking especially planning. However, when they did not know the brand, they have reported that they prefer Pepsi, and the 'Limbic System Structure' activated *i.e.,* responsible for emotional and instinctual behavior. The findings emerged from the study revealed that emotional stimuli used as a product brand affects the cortical activity in 'Ventromedial Prefrontal Cortex' and thus can influence the buying behavior (**Figure 6**) [72–74].

1.4.2 Neuromarketing: the electro encephalography (EEG)

The Electro Encephalo Graphy (EEG) is a non-invasive brain imaging technique detects the brain activity using different electrodes placed on the scalp [75]. An EEG reads and measures the brain-cell activity by using sensors and tracks the changes in brain activity over fractions of a second. The analytical insights and operational owes by adopting EEG can be helpful to assess triggers, and motivators in the entire brain. A left–right asymmetry of the Frontal EEG signals (an indication of happiness or amusement) reflects the consumer desirability of a product. The brain image of EEG is considered in Brand Selection Research i.e., shift in brand preference by a TV Advertisement, Brand Positioning and Processing and Product Selection. In Consumer Neuroscience Research, the EEG investigates the cognitive processes such as attention, arousal, emotion, engagement, excitement, memory, reward, sensory perception and valence [76–80].

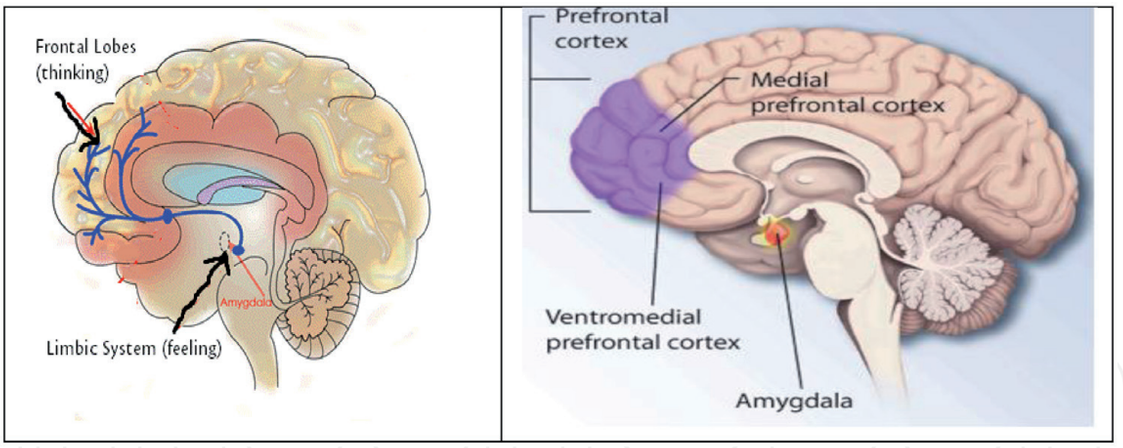


Figure 6.
Neuro science - the science of consumer behavior. Source: Ref. [78].

The functional Magnetic Resonance Imaging (fMRI) points out the changes in activity in parts of the brain while Electro Encephalo Graphy (EEG) and Steady State Topography (SST) measure the brain activity in specific regional spectra of the brain response. The bio-sensors gauge the changes in one's physiological state also known as Biometrics (Heart Rate and Respiratory Rate, Galvanic Skin Response) to know why consumers make the decisions? Which brain areas are responsible for making the decisions? [81].

1.4.3 Neuromarketing: the magneto encephalo graphy (MEG)

The neurophysiological and non-invasive technique *viz.,* Magneto Encephalo Graphy (MEG) presents an analytical view of brain mapping and the neuronal activity in the living human brain (VOXELS) with milli-second precision. The MEG is concerned with the upper most layer of the brain *i.e.,* Cerebral Cortex. By using Magnetic Field Tomography (MFT) the Market Researchers can assess and predict the cognitive processes that govern the buyer behavior. [82–85].

1.4.4 Neuromarketing: the steady state topography (SST)

The Steady State Topography (SST) is another tool used in Cognitive Neuroscience as well as in Neuromarketing Research for observing rapid changes in human brain activity [86]. The SST measures variations in delay (latency) between the stimulus and the steady state that is visually evoked potential response over extended periods of time. This offers new insights based on neural processing speed as opposed to the more common EEG amplitude indicators of brain activity. The following are some of the techniques adopted by the Market Researchers in order to obtain more insights about the buyers' response either to buy a product or to try a product.

1.4.5 Neuromarketing: the positron emission tomography (PET)

The Positron Emission Tomography (PET) maps normal human brain by taking physiological images with spatial resolution similar to fMRI and recording the radiation from the emission of positrons from the radioactive substance administered to the subject (the radio-active chemicals in blood).

1.4.6 Neuromarketing: the eye tracking methods

The Eye Tracking Methods study the behavior and cognition of buyers without measuring brain activity. The Eye movements fall into two categories *viz.,* Fixations

and Saccades. The pause in eye movement in a certain position is termed as a 'Fixation' and 'Saccade' deals with switching of eye movement to another position. The resulting series of Fixations and Saccades are called 'Scan Path', and they are used in analyzing visual perception, cognitive intent, interest and salience. The technique of Eye Tracking can be useful in promotion of advertisements and its impact assessment, concept testing, logo and package designing, online usability, micro-site development and in-store marketing [87].

1.5 Neuromarketing: the biological responses and reactions

The biological reactions to stimuli can also provide information about buying preferences, tastes and behavior of consumer. The Marketing Researchers can predict the emotional state by monitoring heart rate, blood pressure, skin conductivity (affected by sweat, measuring arousal level), stress hormone from saliva, facial muscles contractions and facial expressions of emotions *per se.*

An Implicit Association Test (IAT) can be used to measure individual behavior and experiences towards certain stimuli. The IAT measures the underlying attitudes (evaluations) of the subjects by assessing reaction times of two cognitive tasks and also identifying the speed of two different concepts (stimuli such as advertisements, brands, concepts) to different evaluative anchors (attributes) with which these can associate. It also measures the amount of time between stimuli appearance and its response (response time or reaction time).

The Skin Conductance Technique (SCT) analyses the subtle changes and measuring arousal in Galvanic Skin Responses (GSR) when the Autonomic Nervous System (ANS) is activated. It can also predict the market performance and perfections better than self-reports [88].

The Facial Coding identifies micro-expressions and record these in the form of 'Coding' and measuring non-conscious reactions based on the activity of the facial muscles. Facial expressions are spontaneous and provide real time insights but are based on subjectivity in deciding when an action has occurred or when it meets the minimum requirements for coding. The Facial Electro Myo Graphy (Facial EMG) evaluates the physiological properties of facial muscles, examines voluntary and involuntary facial muscle movements that reflect conscious and unconscious expressions of facial actions and emotions recorded in a bi-polar manner (on both sides of the face) (**Figure 7**) [89, 90].

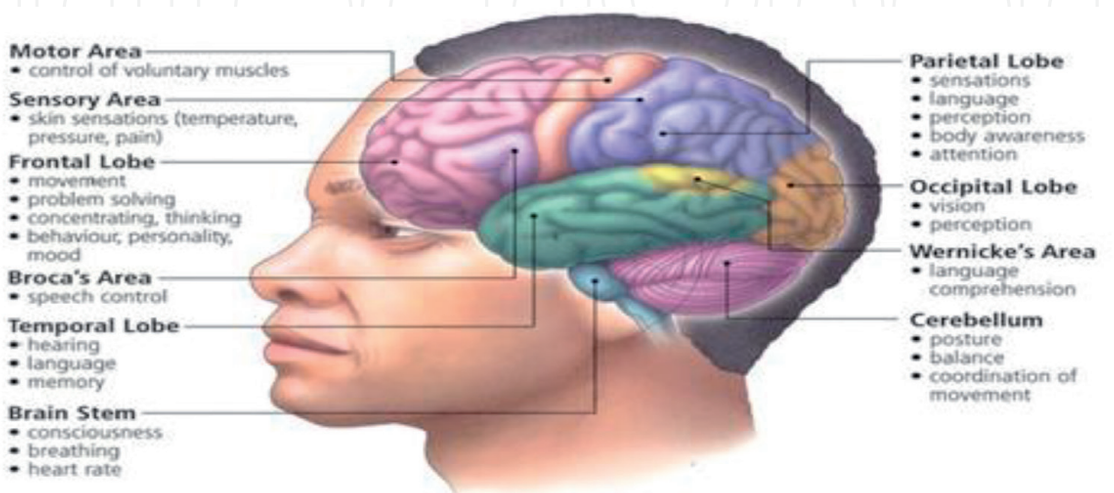


Figure 7.
Neuromarketing - The Functional Areas of Buying Button. Source: Ref. [78].

1.6 Neuromarketing: the dawn and disruption of marketing research

The 21st Century is termed as the 'Century of the Brain' and the Human Brain has 100 billion neurons, and each neuron is interconnected to 10000 other Neurons. The integration of 'Marketing' with 'Neuro Sciences' is undoubtedly a promising and progressive direction in the arena of 'Marketing Research'. Despite of flaws in Neuromarketing, it is evinced that the application of Neuromarketing Tools and Techniques to 'Product Marketing' has recently gained popularity because of Neuro Imaging will become cheaper, faster and it providesreal and reliable information and insights to the Market Researchers at right time, at right place that is not obtainable through conventional marketing methods.

The tools and techniques adopted to persuade the buyers are reliable and valid. However, each of these have specific strengths and weaknesses and also expensive. Keeping in view the ethical, sociological and technological implications, it is suggested that devise and develop new mechanics which are more appropriate to understand the thoughts, emotions, feelings, needs of consumers and prosumers in relate to the marketing of products and offering of services [91].

Neuromarketing provides indelible insights about the decision-making choices of buyers, consumers and prosumers [92], besides assessing their buying behavior, buying pattern, unconscious thoughts, emotions, feelings and desires about purchase decision [93]. The corporate giants *viz.*, Intel, PayPal, Pepsi, Coke, Google, HP, IBM, GITI, Micro Soft *per se* mining and hacking the brains and spending millions to plumb the brains of the buyers (**Figure 8**). Therefore, future research in this arena will focus precisely on understanding the cause-effect relation between the activities of a brain area in general and the (re) actions of the Buyers or Consumers in specific.

Neuromarketing is an ontology of Neuroscience with the dynamics of agility, accuracy and transparency. Mere, 'Humanoids' cannot transform the latent and latest talents and skills. Be ensure the 'Human in the Loop' (augmenting marketing skills by systems to deliver actionable and operational rich insights), ensue Marketing-as-a-Service (MaaS), infuse Emotional Intelligence and instil 'Human Touch'. Be a Market Intelligent and the be an Altruist and above all Be a Humane. The Promises transcend into realities will require a unique 'Customer Experience



Figure 8.
Source: Ref. [93].

Management' that spans channels i.e., the then-versus-now story. Undoubtedly, 'Neuromarketing' emerges as a hope, a utopia, a scintillating scientific and spontaneous drive and urge. This is reality and realism.

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