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# Application of Neurological Sciences in Neuromarketing Technique

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## 1- Abstract

Every scientific research requires tools and a path to achieve the intended goal. This path and our relationships among discussions in interdisciplinary researches are rather more sophisticated than pure researches in just one scientific field. As mentioned in this article, the neuro-marketing technique is an interdisciplinary study in marketing knowledge. Therefore, the researchers in this field are concerned about how to make relationship between discussions of neuroscience and marketing. This article can perform as a guideline for researchers of neuro-marketing.

## 2- Keywords

Marketing, Neuro-Marketing, Neurological Sciences, Biological Psychology, Consumer Psychology

## 3- Introduction

In neuro-marketing, information in the field of consumers' ideology and behavior will be received directly from their brain using hardware and software tools. To analyze such information, many sciences are involved such as marketing (specifically consumer's behavior), psychology, neurological sciences (specifically neurophysiology, neuroscienc, and biological psychology), physics, electronics, and computer. To better understand the relationship between neurological sciences and neuro-marketing technique, below discussions are required.

### 1-3- Interdisciplinary Sciences

In recent years many efforts are made regarding providing a precise definition for "interdisciplinary studies" term by experts and specialists and, at least, these efforts are led to obtain two general approaches in this regard. The first approach, which is older, is suggested by individuals such as Joe Moran, Lisa Lattuca, and Donald G. Richards. This approach considers interdisciplinary studies as just a discussion among various fields of studies which are typically used in human science and social science studies. The second approach, which is newer, is offered by Julie T. Klein, William H. Newell, and Allen Repko (Repko,2007,2008) and tries to provide an appropriate definition of this concept based on coalition of fields of study, scientific and approved hypotheses of cognitive sciences. In this approach, interdisciplinary studies are formed based on coalition of two or more thought and discipline and has hits specific nature and framework. Recently, based on "the common ground of Clark (Clark,1996)", Repko and others have succeeded to suggest an interesting definition for "interdisciplinary" which describes and establishes the properties and various dimensions of this concept appropriately. In this approach, interdisciplinary studies are (Repko, 2007) "the process of answering question, solving a problem or paying attention to a topic which is that much vast and complex that cannot be addressed by a specific scientific field of study so different approaches form coalition and provide a deeper and more accurate cognition of the discussed topic". Based on the definition, the purpose of interdisciplinary researches is promotion of interdisciplinary knowledge or understanding of a specific topic which is obtained through coalition of thoughts, methods, results and the approach of different fields of study related to the intended topic. Based on the latest researches conducted by NAS, NAE, IM in United States, interdisciplinary knowledge is defined as: "a research method used by individuals or groups in which the coalition of information, data, methods, tools, approaches, concepts, or hypotheses will lead into basic promotion of understanding or solving issues from two or more field of study or specialized body of science. The solution for such issues is out of domain of a specific field of study or a determined research method".

### 2-3- Marketing

From past to present, various definitions are suggested for marketing and each of these definitions cover a division of marketing activities. Philip Kotler, famous commentator of marketing, defines marketing as " a human activity in order to meet the needs and wishes of customers through the process of marketing" ( Hawkins , 2006). The concept of marketing implies the idea that industry is the process of customer satisfaction and not the process of production of goods. An industry begins with its consumers and needs and not by the copyright, raw materials or selling skills (Mouen, Consumer's behavior, page 18).

### 1-2-3- Consumer's Behavior

Nowadays, many companies are competing with each other on market of goods or services. Those which achieve more success believe in this concept : "industry is customer satisfaction, not the process of production"; So an organization can survive only when it could meet consumer's needs by appropriate and comprehensive understanding of customer's opinion. This implies the importance of appropriate understanding of discussions of consumer's behavior for such companies (Kotler, 171).

Having proper understanding of consumers and the consumption process and the way of deciding to purchase, have various advantages. These advantages include helping managers in strategic decision-makings, preparing a cognitive basis through analyzing consumers, helping law-makers to establish rules related to selling or purchasing goods or services, and finally helping consumers to have better decisions. In fact, the principle of consumer priority is a turning point upon which the marketing domain is based. Based on this concept, consumer will be placed at the center of every marketing activity. Peter Draker indicate, "Marketing means doing all business affairs from the point of view of its final results, customer satisfaction (Houston, 1986)". Consumer behavior is the study of the motivation for purchasing goods or services. Actually, consumer behavior tries to respond the question that how, when, and where a purchase has been done. Consumer behavior is an interdisciplinary knowledge of psychology (Bagozzi, 2002), sociology (Foxall, 1974), and economy (Deaton, 1980). Consumer behavior includes a series of psychological and physiological processes which continues before and after a purchase (peter,2008).

### 2-2-3- Consumer Psychology

Consumer's behavior can be predicted by psychology and based upon it we can design products and services. Studying the consumer's behavior based on psychology helps organizations and companies to establish marketing strategies. Only producing a qualified product which has all service features does not guarantee customer satisfaction and competing with other products, but psychological factors of selecting one product among others or replacing one product instead of others are more effective. Aesthetic is one of such psychological factors which makes customer to select a product, among other others with the same quality, which has more beautiful and more colorful packing (in neuro-marketing, proper packing can be designed through receiving brain waves and recognizing it to be pleasant or not).

Todays, by better understanding of position of neurological sciences, psychology, and its subbranches, big and transnational companies better perform in decision making and predicting consumer behavior. Producers, marketing researchers, and all who are active in business world are interested in the knowledge of consumer behavior, because by having better understanding of consumer's behavior and decisions, they can produce or offer a proper product or service which meets consumer's requirements. In fact, it can be said that consumer's behavior is actually the marketing psychology and success is studying consumer behavior cannot be achieved without having knowledge on the role of this science.

Therefore, according to the importance of the knowledge of consumer behavior and to study human behavior in any environment some concepts should be understood and studied including feeling, perception, excitement, and our relationships among these concepts in neurological science (especially Neuroscience), psychology (for marketing) and their subbranches such as biological psychology (for neuro-marketing technique).

**1-2-2-3- Concepts of Feeling, Perception, and Excitement**

The topic of feeling and perception in todays psychology is addressed as sensory perception based on empirical sciences achievements, especially physiology and empirical psychology. In these sciences, sensory perception is considered as a process which starts from physical and chemical environmental stimulations and ends with the manner of the reaction of the living mechanism and analysis and psychological interpretation which causes its adaptation to its environment. It means that by the help of environmental stimuli, body can receive information about changes and transformations of outside (stimuli such as light, sound, smell, and strikes) and inside (the feeling of hunger or thirst) environment and by reacting to them it can show better and faster adapted behavior (such as the sensation of burning skin due to fire and its behavioral reaction which is distancing the area from fire of the hunger feeling and its behavioral reaction which is responding to this feeling by having food). The complex nervous system in human includes many nerve cells that lead to different behaviors in general reaction of living organism based on location or temporal stimulation (Iravani, Khodapanahi, p 18).

The relationship between human body system and outside environment depends on the performance of recipient organs (sensory organs such as nose, ear, skin, eye, and tongue) and responsive organs. The transmission of the effect of stimulus from sensory recipient to the central nerve system, which is objectively traceable, is called feeling. This feeling has no cognitive value and is absolutely physiological.

This is what can be obviously observed and tested in animals and human infant (this discussion refers to neuro-marketing as crawling brain or old brain. Feeling occur in two pace, the first step is inside or outside stimulus and the second step is the impact of sensory organ which is obtained by one of senses (five senses and inside senses) and will be transmitted to nerve centers and spinal cord using central nerves and cause feelings. (five sense organs include eye as eyesight, ear as hearing organ, nose as sense of smell, tongue as organ for sense of taste, and skin as the organ for sense of touch) The organs that are triggered by environmental stimuli are called receiver and the responsive organs will react to these stimuli. This reaction is usually accompanied by secretion of the hormone from glands and muscle contraction (Iravai, Khodapanahi. P19).

From psychological point of view, feeling, as a primary and primitive phenomenon, is considered only in relation with a central nervous system. Thus, there will be different feelings in the number of neural pathways. Therefore, feeling can be concurrent with the action of recipient cells and transmission of messages which enter perception realm. So feeling can be considered as receiving environmental stimuli through recipient organs (sensory) and transmitting them by neural network and deliver to the nerve centers (brain). Feeling can be considered as a biological process and the reaction of recipient organs to environmental stimuli. Environmental stimuli have energy and to be triggered, recipients should have certain amounts. Feeling involves four factors: 1) environmental stimulus, 2) sensory receiver, 3) delivering nerve (neural interface), 4) neural centers (respondent) (Iravani, Khodapanahi, p 20).

In todays psychology, perception means mental or psychological process that is actively responsible for selecting and organizing sensory information and finally gives meaning to them. In other words, the perception criteria is a mental process during which sensory experiments will be meaningful; it is the interpretation of feelings and through this way, human can understand the relationship and meanings between affairs and objects. This action takes place quickly enough in the human mind that seems to be concurrent with the feeling. In this action, sensory experiments, concepts and imaginations derived from it, individual's motivation and the location in which the perception is done are involved. Therefore, one can

study perception when sensory variables are maintained to be constant and differentiate the specific answer from a series of processes (Iravani, Khodapanahi, p 25).

When we speak of perception, we should consider that human is not affected by only one stimulus. But also, a series of stimuli related to the sensory recipients of location and time and their cooperation within a specific situation, will shape a phenomenon in his mind. Thus, there will be no perception without selecting specific stimulus and without perception organization and continuous mental activity. Therefore, mind, with the help of its potential capability and existing data, categorizes the entered information and prioritizes them. Also perception will not occur following separate feelings from each other, but individual's mind finds them out as a meaningful and interrelated series. In the process of choosing this or that collection, pre-perception assumptions, prior experiments and learnings and motivational states arrive quickly at the moment of perception and play a decisive role in perception.

Therefore, we cannot consider perception as a completely clear answer, leading to a specific stimulus; because the perceiver do not mentally infer and decides with specific attention and a general activity. In such decisions, cognitive processes such as memory and thought have decisive role. Regarding the mentioned contents, you will see discordance of the result of blind test and market reality of Pepsi challenge. In case of lack of knowledge of blind test in which the brand name of Coca Cola and Pepsi is not determined, the brand of Pepsi was the choice of examinees. This result was due to better taste of Pepsi and occurred only based on sense of taste and perception of taste with the reaction of old brain. But in the market, the leading and succeeding brand is Coca Cola. We see this result because Americans have a particular bias on the Coca Cola brand and they percept with their mental information and this mental information, during perception and recognition of prominent brand, will be prior to the information of brand's taste.

Excitement is known as pleasant or unpleasant experiment along with a specific physiologic activity pattern (Schacter, 2011). In other words, excitement means general reaction of organism toward a situation along with a pleasant or unpleasant emotional state. Excitements are composed of three components: 1) cognitive component: thoughts, beliefs, and expectations which determine the type and intensity of emotional response. Whatever is very pleasant to someone may be boring to someone else. 2) physiological component: including physical changes in body. For example, in terms of excitement, body will be motivated through fear or anger and heartbeat increases and eyes will be wide open and respiratory rate increases. 3) Behavioral component: refers to expressing excitement states. Facial expressions, organs state and movements and changes in voice tone. Facial expressions are the most common form of emotional connections. Emotions include physiological response patterns and special behaviors. Typically, from people's point of view, excitement is the emotions that individual feels. Excitement is a behavior, a private experiment and a phenomenon that plays a role in survival and reproduction (Huffman, p165). In 1937, Papis stated that excitement is controlled by a interconnected neural structure called lombic. Papis believed that emotional states occur due to effectiveness of other lombic structures on hypothalamus and will be felt through effectiveness of lombic structures on cerebral cortex.

Some brain area are involved in excitement. "pupa" quickly responses to emotional stimuli, many physical alterations occur in excitement, as a result of the activity, a part of autonomous nervous system emerges. Pupa receives information from all sensory devices and interprets and keeps the emotional meaning of sensory signs. Pupa is composed of some cores which are called pupa's complex. Pupa is a combination of dozens of major areas which have sub-areas. Each of these sub- areas have different structures and connections. What makes the problem more complicated is that pupa's anatomy is so complicated that there is no consensus on how to divide it into its components (Pinel, p 594). Some pathways transfers signs from pupa to brain stem structures which controls emotional responses. For example, the pathway which goes toward gray Pira's object of midbrain duct invokes the proper defensive responses (Bandler, 1994). While the other pathway which runs through lateral hypothalamus invokes proper sympathetic responses. The

sympathetic of a part of this system plays an important role in physical alterations during emotions by releasing epinephrine and norepinephrine hormones. In general, the right hemisphere plays a role in expressing and recognizing excitement (Kalat, 2007).

Lombic system, the prognostic logic that surrounds the thalamus are important for excitement. Researches on the role of autonomous nervous system in excitement mostly focus on two topics: the amount of relationship of the activity of autonomous nervous system in excitements and the effectiveness of indexes of autonomous nervous system in polygamy. Many scholars have researched on excitement. William James is the first researcher who provided a physiological pattern for excitements and Charles Darwin was one of the first scholars who studied excitement systematically. The universality of facial expressions during expressing excitement, confirms Darwin's claim stating that reactions are intrinsic and they have perfect histoty for excitement (Etkinson & et. al, p 63). Excitement is a continuous general reaction distinct from internal or external events which has especial meaning for organism and makes it move. During the time when emotions are going on, coordinated reaction occur from body organs which include language mechanisms, physiological mechanisms, and behavioral and neural mechanisms. Graham states about excitements, "All excitements are a chain of emotional reactions, but are different in some aspects" (Graham, 2014). Many theories described excitement and its origin and cause in the form of neurobiology, experimental, functional, and behavioral. Using tools for motivating and expressing excitements, many researches have been conducted. Generally, devices like PET scan and FMRI scan have contributed significantly for effective study in the process of excitement in brain. (Cacioppo ,Gardenr ,1999).

A major part of the cerebral cortex also reacts to emotional situations. Researchers use PET or FMRI to determine different area of brain during getting involved with various excitement. A study indicated that areas of forehead lobe, temporal lobe and the cerebral cortex have more activity in special excitements (Kringelbach, 2005). Other researches investigated brain activation during other excitement states including love, embarrassment, moral judgment, expectation of receiving reward (Greene,Nystron,2004; Williams, 2004;Takahashi,2004; Aron,2005). Another method is the usage of EEG device and studying electrical activities of various points of brain when individuals react to emotional stimuli such as pictures, sounds, and so on. Different excitements activate different brain areas in 0,5 seconds after receiving stimulus. Another method is using cranial magnetic stimulation for temporarily unavailing an area. A study revealed that inactivity of middle forehead cortex disrupts the ability of recognizing the effects of anger (Harmer, Thilo, 2001). In the conducted psycho-physiological researches, the direct relationship between excitement activity in the forehead lobe in the right hemisphere and forehead lob in the left hemisphere was revealed. Positive and optimistic reactions lie in forehead lobe of the left hemisphere and the activity of forehead lobe of the right hemisphere involves negative excitements (Niemic, 2002). We can refer to conducted studies in terms of behavior and reaction of body organs: Ekman focused on parameters of facial expression and individual's voices to recognize various types of excitements and believed that, in different types of excitements, peoples' facial expression follows a specific pattern (Ekman, 1965). Recently, psychologists are at the first steps of experiments and researches based on body language (body organs' movements) during excitements. In a conducted study, Bull concluded that there are significant relationships between impatience and involvement and agreement and disagreement (Bull, 1987). Also Pollick meaningfully inferred that there is a relationship between human arm movements and types of excitement (Pollick, 2001). Another study on body organs' movement during excitements indicate that in case of fear, some of body organs get contracted, surprise leads to anxiety or attraction to someone or something and individual's attention will also increase, in the joy excitement the speed of the forearm increases (Boone, 1998). As mentioned before, excitements have automated and physiological reactions that reflect in human behavior. These reactions will automatically emerge in body organ movement, facial expression, or even voice tone. For example, recently in a study, the effect of excitements on the way of walking and moving were investigated and revealed that the excitements which have high stimulation, such as anger, will lead to the

increase of pace speed and longer steps and in excitements with lower stimulation, such as sadness, the walking speed decreases and steps will be short (Gross, 2007). The above mentioned occurs because automated reaction in autonomous system leads to increase or decrease of stimulations in organs such as knee, hip, pelvis, and change in walking speed (Saunders,2005).

**2-2-2-3- The tools for studying excitement**

The study of physiological reactions of excitement can be done with special tools and experimenting on human and animals. Devices such as EEG, QEEG, ERP are used for brain waves and FMRI, CT scan, and other measuring devices can be used for blood flow intensity. The blood flow will be studied using cardiograph and pulsator which records heart rate or blood vessels. The volume recorder registers the volume changes of organs, the slow changes caused by muscle contraction of vessels and simultaneous changes of heartbeat and pulse. Barometer measures the blood pressure. Spiro-graph records changes of the size of chest and abdomen which is caused by breathing. Pipes that are sent to the stomach, duodenum and intestines record their contractions.

Galvanometer measures the electrical changes in the skin (Galvanic reflection). Sampling of blood and urine requires typical chemical decomposition method (Pinel, p 574, Pinel, p133-138).

**3-3- Neurological Sciences**

All sciences related to nervous system of livings, the way of physiological, psychological, and behavioral reactions and all nervous-system-related issues are called neurological sciences and include diverse subbranches. It is worth mentioning that to research in the realm of nerves, overlapping of several sub-branches is required. As required, the present study focuses on illustrating some subbranches involved in interdisciplinary neuro-marketing studies.

**1-3-3- Neuroscience**

Neuroscience or neurology is the tudy of structure, function, and sicknesses of nervous system of livings. The topic of neuroscience includes the study of nervous system, livings in different cellular and molecular levels, anatomy, behavioral sciences, and medical pathology.

**1-1-3-3- Subbranches of Neuroscience**

This knowledge is one of subbranches of biology and tt is a basic medical science. Neurology is divided into some subbranches too: 1) Clinical neurology 2) neurology 3) Nervous psychology 4) nervous anatomy 5) cognitive neurology 6) neurophysiology 7) nervous pathology.

Neurology or neuroscience is the knowledge of studying nervous system (Merriam-Webster, 2004). Traditionally, the knowledge of neurology is one of the branches of medical science and biology.

Nevertheless, this knowledge nowadays is considered to be a interdisciplinary knowledge and cooperates with other field of studies such as chemistry, computer, engineering, linguistics, mathematics, medical science, psychology, physics, and philosophy (Zull, 2002). The results obtained from the cooperation of other sciences with neurology can be referred to the cooperation of European brain organization and

Organization of Behavioral Sciences in 1968. Questions such as how brain works? What the brain is? Why people get excited? What happens during excitements?

What are the root causes of psychiatric and neurological disorders? Will be answered in this field. The neurology science is an effort to recognize and understand nervous system including brain, spinal cord, and sensory cells or neurons all around the body. This knowledge is relatively a new field that deals with development, structure, performance, and even pathology of nervous system.

**2-3-3- Cognitive Neuroscience**

Cognitive Neuroscience is the study of the interdisciplinary domain from which some other fields of study are emerged. Psychology and computer science are considerably derived from neuroscience. This knowledge focuses on cognitive processes and is extensively dependent to neuroscience (neurology) methods and findings. Neuroscience is a branch of physiology which deals with brain and nervous system. The difference of cognitive neuroscience with other approaches is that new techniques such as FMRI and electroencephalography are required to study the brain of a healthy individual, not the brain of the people who suffer brain damage, especially, when healthy people are doing mental tasks. Neuro-imaging or brain scan techniques provide images of the brain which is doing special mental tasks. The goal and duty of cognitive neuroscience is describing how to build a conscious mind.

**3-3-3- Biological Psychology**

An important part of findings of psychiatry science and psychology are indebted to researches and studies of researchers and scholars of neuroscience. A part of these scientific and research activities has led to creation of a separate scientific branch entitled as behavioral neuroscience or biological psychology. This scientific branch, using biological principles (especially neurology), deals with the study of physiological, genetic, development systems of behavior in human and animals. Neurology studies are focused on nervous cells (neurons), nervous transmitters, brain circuits, and basic biological processes which are the basis for normal and abnormal behaviors. The scientific study of behavioral biology is called cognitive psychology or biopsychology (John Pinel, p4). This term means the study of psychology with the approach of biology. Psychology is the scientific study of behavior. It means that in psychology, all obvious activities of organism and internal processes will be investigated as the basis for external activities of organism (for example, learning, memory, motivation, perception, and excitement) (pinel, p4). Biopsychology is one of the subbranches of neuroscience (Kandel, Pasez, 2000). Biopsychologists are neuroscientists that use knowledge of behavior and behavioral research methods in their studies. The ultimate purpose of human nervous system is to produce, control, and behave, therefore, the role of biopsychology is very important (Pinel, 2007, p5). Biopsychologists receive knowledge from other sciences (neurosciences) and use them in their studies. Biopsychology comprises of six subbranches: 1) physiological psychology, 2) Psychopharmacology, 3) Neuropsychology, 4) Physiopsychology, 5) Cognitive Neuroscience, 6) Comparative Psychology (Pinel, p 12).

Biopsychological studies are divided into three principles: 1) human and non-human subjects, 2) pure or functional, 3) official experiments or non-experimental studies. Non-experimental studies are also divided into two categories: 1) case studies, and 2) quasi-experimental studies. Due to the complexity of human brain and limitations of subbranches of biopsychology, studies will not be solved by one or a series of experiments. Progress will be achieved when an issue is investigated through various approaches, therefore, approaches will cover each others weaknesses. Such combined approach is called convergence of operations

(Pinel, p14). One of the goals of biopsychologists is to describe intangible processes by which the nervous system controls behavior. Biopsychology uses experimental methods in this path. Scientific deduction is the experimental method of biopsychologists and other scholars for their studies (Pinel, p 15). Scientists precisely measure invisible events and then set the measurements based on logical deduction.

Biopsychologists collect and measure data and cues related to behavior and nervous activity in order to understand the nature of regulating nervous processes of behavior (Pinel, p 18).

**1-3-3-3- Registering Physiological Psychological Human Activity**

The purpose of registering physiological psychology is the registration of physiological activity of body level. There are different methods of measuring physiological activity of body level including measuring brain activity (EEG), measuring body nervous system (muscle elongation and eye movement), and measuring autonomous nervous system activity (conduction of skin and cardiovascular activity) (Pinel, p 138).

**4-3- Neuro-marketing**

Neuro-marketing is, in fact, the result of combination of three knowledges of economy (marketing), neuroscience, and psychology (Lee, 2007). Neuro-marketing is a marketing based on nervous processing of customer. In other words, neuro-marketing is a new branch of marketing science and is based on modern techniques of neuroscience and has led to recognition and understanding of brain mechanisms of customer in line with the business organizational efficiency (Gazzaniga, 2008).

Hardware and software tools are used in neuro-marketing to receive brain waves. These waves will be analyzed to understand and recognizing ideology of audiences (customers) compared to the cases that marketer or designer of product has in his mind. Also , neuro-marketing can be defined as“ a method that benefits from nervous imaging techniques to understand human behavior in relation with market and marketing exchanges by using special part of brain’s cortex (Lee, Broderick,2007; Winstein, 1984).

In various organizations, neuro-marketing means are used to better understand consumer’s behavior in order to improve marketing researches. Tools such as EEG or MFIR, in terms of hardware, are the same in neuroscience and neuro-marketing, but in terms of software mathematical calculation, flowchart calculations, and interpretation, they are different. Because in neuroscience almost every perceived data from brain have physiological and cognitive importance, but in neuro-marketing there is no need to all received information from various parts of brain, due to this, they have a little difference in software calculations, but they are not in opposition.

Store information in deep layers of human brain, compared to surface layer information, are more effective in the process of decision making (Lee, 2006). Antonio damasio, the famous neurologist, claimed that human uses emotional parts of brain in his decision-makings in addition to logical parts. Currently, researchers use FMIR technologies that show blood flow in different parts of brain during purchasing. The way it works is that the purchasing region of brain begins to work (in response to purchasing stimulus, the nervous activities of brain increases). To support its reactions, brain sends more blood to these regions (milliseconds to milliseconds) which is obvous in FMIR scan. According to researchers, decision to purchase occurs in 5.2 seconds (Witchalls, 2004).

Additionally, neuro-marketing is intensively dependent to the ability to visualize events that are seen by human brain, are chosen and decisions will be made and provides immediate images of brain activities in sensitive moments of big and small purchases (Burne. J, 2003). Activities of brain regions such as acombens, insula, and the middle cerebral cortex of the brain provides information about how consumers response to special stimuli (Moore K, 2005). Various researches are conducted on brain wave changes in different regions of brain based on business brand and decision-making of individuals (Jose Paulo,2010,2011;Milorad,2010,Amanda,2012;Christophe, 2011). The researches indicate that 95 percent of our decisions are made unconsciously and relying on emotions (Ciprian, 2009). Neuro-marketing offers methods for discovering customer's mind without conscious and informed participation (Morin, 2011). The ideology that lies behind neuro- marketing is that decision to make purchases is not necessarily a logical decision, but this decision is formed deep in brain and is a combination of thoughts and feelings (Williams, 2010). Thus, the best way of motivating feelings (for example, from hearing sense), is working on old brain. By stimulating old brain which includes the amygdala, to some extent, we can obtain the brain key (in excitements) (Zurawicki, 2011).

**1-4-3- The relationship of neuro-marketing tools and neuroscience**

The basis to work with different devices in neuroscience which are used in neuro-marketing is that changes in oxygen flow in blood is in relation with nervous activity rate. When the nervous cells are active, consumes the oxygen which is carried by blood's hemoglobin. The local response to this reduction of oxygen is the increase of blood flow in the regions in which the nervous activities are more. On the other hand, due to neural activity and transmission of neural signals, an electric current is generated in which a magnetic field will be produced based on Markof rule. Based on the researches conducted on neuro-marketing in the field of nervous imaging techniques in neuroscience revealed that 70 percent of methodologies are used the imaging method with functional magnetic resonance or FMIR while 25 percent have used brain electrical imaging (AIG). Specifically, AIG and MIG is used as the preferred method when high temporal resolution in the process of TV advertising is required in every moments. In addition to these techniques, two methods with the combination of imaging method and psychophysiological means such as Electromyography are focused on galvanic response to the skin and heart rate (Kable, 2011).

The diagram 1 illustrates the means that are used in neuroscience to record brain metabolic activities, brain electrical activities and without registering brain activities. These tools will be used as neuro-marketing means if, based on the neuro-marketing definition, directly evaluate brain activities.

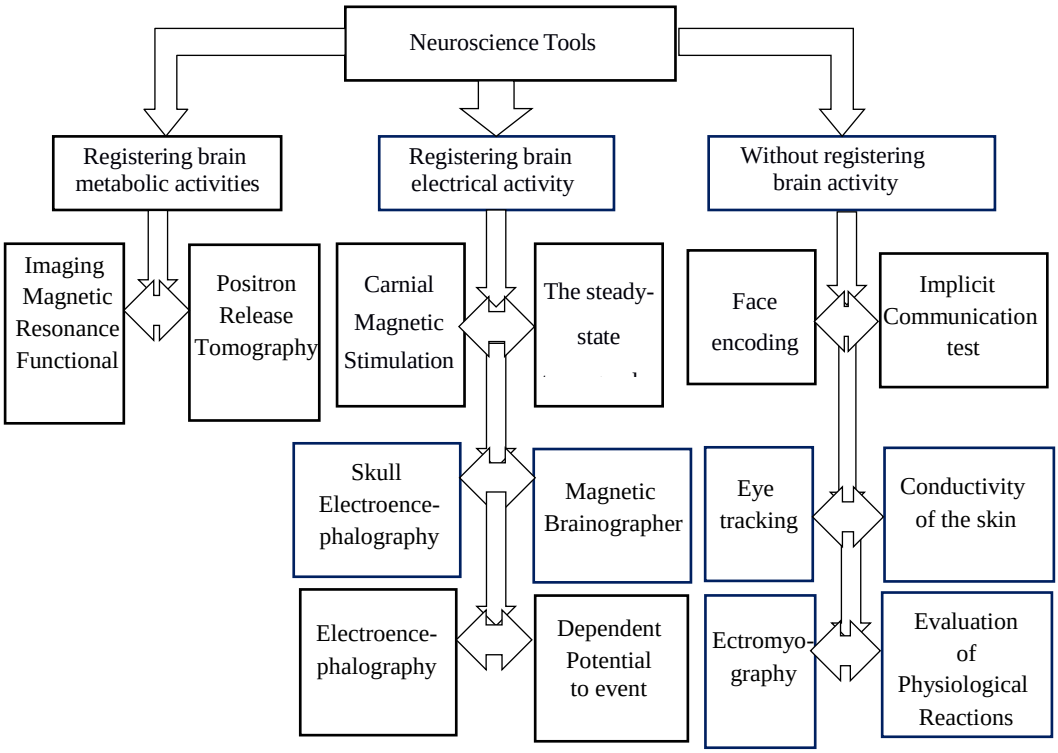


**Diagram 1: Neuroscience tools based on the type of brain activity**

## 4-Results

To analyze the behavior of consumer, the study of concepts of psychology is required, but in neuro-marketing technique, biopsychology, which is a subbranch of psychology and neuroscience, should be used to analyze the consumer's behavior. Thus, in order to investigate human behavior through biopsychology, the study of concepts such as neurophysiology, human nervous system anatomy, and the performance of human nervous system is required. In the topic of human nervous system anatomy which is from discussions of human neurophysiology, we should pay attention to the two parts of central nervous system and peripheral nervous system, because what we observe from individual's behavior is due to the excitement that its information is received directly from different regions of human brain and using neuroscience means in the form of brain waves or 3D images.

The received information from brain are the nervous system reaction to internal and external environmental stimuli which are perceived by the five senses and the inner senses (the senses of hunger and thirst) and transmitted to central nervous system and after feeling (in the form of unconscious or conscious – in the state of conscious level, individual completely understands the stimulus meaning that stimulation has high intensity, but in the state of unconscious level, individual does not notice the stimulus, meaning that stimulation does not have relatively high intensity, but in two states excitement intensity is higher than sensory threshold level- example: the music which is played with low volume in the store, people will hear it but they do not fully understand the content or even the song itself but the music affects human brain

without being noticed by them which is unconscious) and perception (in some materials, perception occurs through stored information in mind and with thinking on these information and sometimes only the initial feeling is taken care of; it refers to the topic of Pepsi challenge) in the form of excitement (it is possible that behavioral label could be objectively visible , is dependent on the amount of excitement). This excitement can be identified with brain waves or 3D images of brain.

diagram ۲ illustrates the above mentioned:

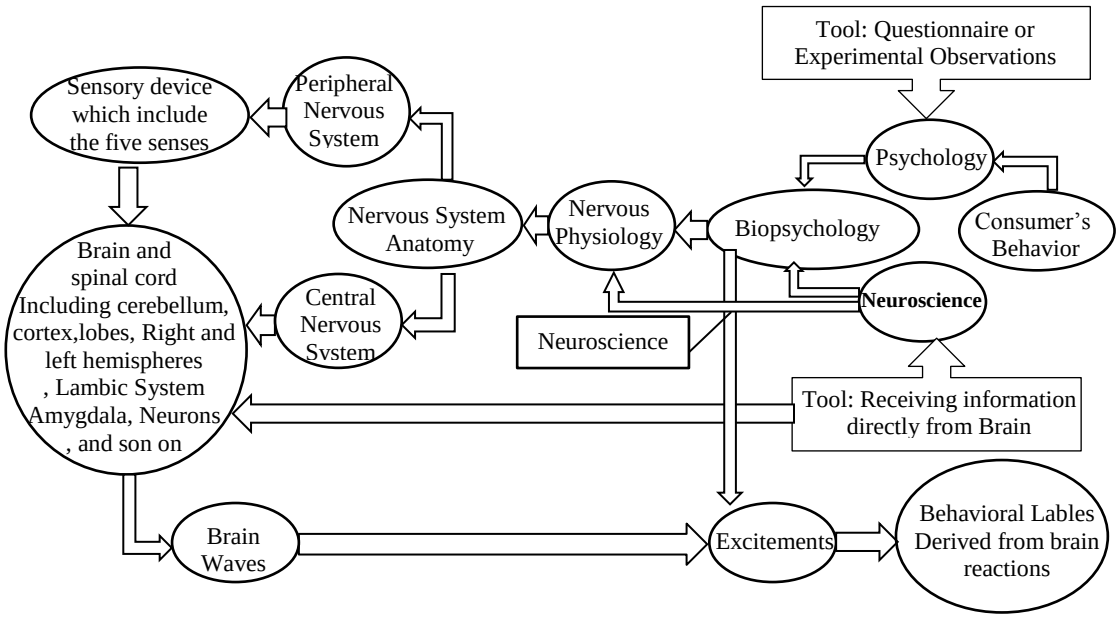


**Diagram 2 : The application of neuroscience sub branches to investigate consumer's behavioral**

## 5 – Discussion

Different knowledges such as psychology, marketing, and neuroscience are cooperating with each other in neuro-marketing technique. But due to overlapping and complementing each other, they cannot be precisely divided in researches to recognize the cognitive function of the brain. Thus, the below diagram generally illustrates the relationship between used knowledges in neuro-marketing researches which include: 1) nervous physiology which deals with the way nervous systems perform in order to recognize the reaction of central and peripheral nervous system during responding to environmental stimuli (external) and internal, 2) cognitive neurology which is the understanding approach in psychology and neurology looks to the issues of this approach from nervous processes window in order to describe behavioral response and body reaction based on nervous system and activity of brain neurons towards internal and external reactions, 3) biopsychology or biological psychology which is the scientific study of biology of behavior. In this knowledge, all obvious activities of organism and internal processes, scientifically investigates the essential external activities of organism (for example, learning, memory, motivation, perception, and excitement)

(Pinel, p4). Biopsychology is one of the sub branches of neuroscience and psychology (Kandel, Pasez, 2000). The ultimate purpose of human nervous system is to produce, control, and behave, therefore, the role of biopsychology is very important (Pinel, 2007, p5).

Bio psychologists receive knowledge from other neurosciences (cognitive neuroscience) and use them in their studies. The sub branches of biopsychology involved in this field of study include: 1) Psychological Physiology: the study of relationship of physiologic activities and psychological processes in human with non-aggressive physiological registering (like AIG) (Pinel, 2007, p 11). Most psychological physiology are focused on recognition of psychological physiology such as memoty, excitement, and processing central information, 2) Cognitive neuroscience: the study of cognitive nervous mechanisms (such as memory, attention, and complex perception processes) in human which are mostly done by the help of functional brain imaging (Pinel, p 12). sub branches of marketing which are used in neuro-marketing technique are consumer's behavior and marketing researches. It's very important to recall that this field of study almost has no specific boundaries ad to obtain answers for experiments, some knowledges should be applied simultaneously. If analytical psychology is used in marketing researches for investigating consumer's behavior, questionnaire (quantitative) or field study (qualitative) will be applied. But if researcher intends to use neuro- marketing technique in marketing researches and improving them, this leads the usage of study and analysis method through knowledge and tools of neuroscience. The diagram 3 reveals that neurology and biopsychology are sub branches of neuroscience which are used in neuro-marketing technique. In neurology block, in the process of identifying unconscious and conscious mechanism of responding to brain reactions, first nervous physiology and then cognitive neuroscience are involved. In the block of biopsychology, according to the effect of essential and basic concepts of psychology on this field of study, sub branches of biopsychology, such as psychophysiology and cognitive neuroscience are involved in the process of identifying excitements and behavioral labels and physiological reactions of brain toward excitements. Both process of identification which are used in the block of neurology and biopsychology for recognition of human behavior, and are utilized in marketing for recognition and investigation of consumer's behavior. This study of consumer's behavior with the knowledge and neuroscience tools (hardware and software) will be used for improving marketing researches which are called neuro-marketing techniques. It is worth mentioning that in some other researches in basic neuro-marketing, the possibility of using other sub branches of neuroscience exists, but this diagram (diagram 3) shows the relational situations in most marketing researches of basic neuro-marketing.

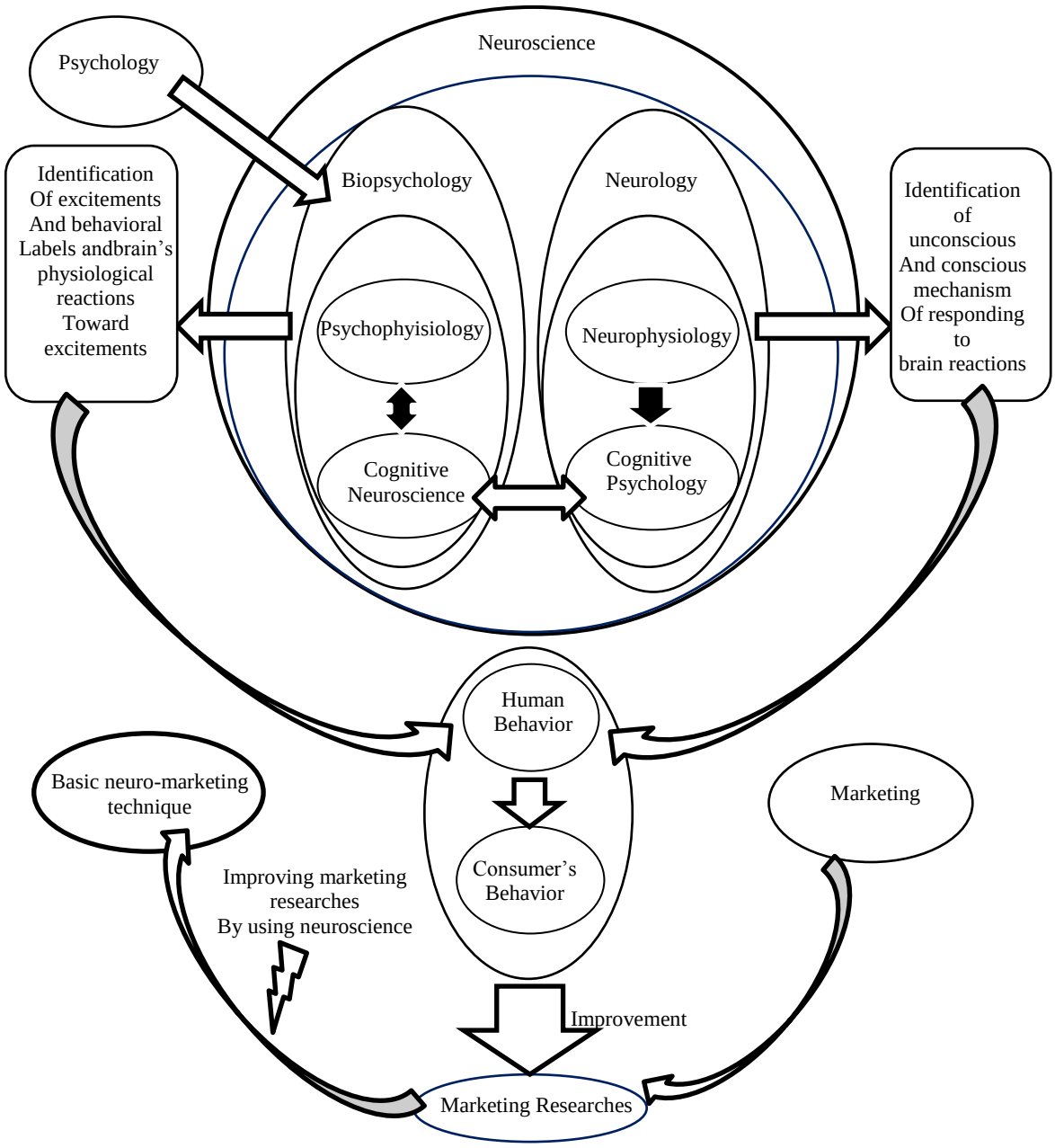


**Diagram 3: The relationship of basic neuro-marketing technique with neurosciences**

**6-Resources:**

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