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On the hierarchy of choice: An applied neuroscience perspective on the AIDA model

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Abstract: Application and significance of neuroscience and its related techniques to comprehend and analyse consumer behaviour and psychology have recently attracted the interest of researchers and practitioners. In doing so, models of consumer choice and communication effects that were originally conceived during a non-neuroscience psychology era should now be challenged with the recent and plentiful advances that neurobiology has made in reshaping our understanding of the human mind and decision-making processes. This study aims at providing an update of exactly these updates, and to use this novel understanding to challenge a dominating category of consumer choice and communication effects, going under the headings such as "response hierarchy models". By using examples of these models, we will demonstrate that even the basic assumptions in these models need to be reconsidered, and that the overall tenants of the models are equally problematic. Based on our overall understanding and an in-depth analysis of the modern neurobiological basis of decision-making in humans, it can be concluded that AIDA model is not applicable and substantially problematic. Therefore, it can be asserted that a reframing of the model needs to encompass both conscious and

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PUBLIC INTEREST STATEMENT

Although the world of advertising has become aggressively competitive, the principles behind consumers' responses to advertising arguably remain intact and relevant. Traditionally, advertisers, consciously or unconsciously have been applying four steps of so-called AIDA model of marketing communication such as Attention, Interest, Desire and Action to persuade customers to buy. Recently, "Neuromarketing" has gained importance amongst major companies, revolutionized the advertising sectors and is now emerging as a discipline that not only rivals the impact of traditional research methods, but outperforms these approaches in terms of causal theories, measures of consumers' responses and in providing novel means to affect consumers. It is timely to employ this approach to provide a novel and more scientifically updated perspective of one of the classic models of consumer choice, the AIDA model, to see whether the model can stand these updated views, or need either a complete redesign or even must be rejected.

unconscious streams of action. Consequently, the model shall consider massively parallel systems, where A, I, D and A have two parallel systems, a conscious and an unconscious. The conscious system must only occur for certain level of unconscious process, whereas unconscious processes can occur without the necessity of consciousness. The reframed model suggested in this study can be the interest of both scholars and practitioners.

Subjects: Neuromarketing; Behavioral Sciences; Marketing Research; Consumer Behaviour; Marketing Communications

Keywords: response hierarchy model; consumer psychology; neuromarketing; neurobiology; marketing communication; consumer neuroscience; framing effects, attention, emotion, decision-making

1. Introduction

In understanding consumer behaviour and communication effects, scholars have constructed models that consider the decision-making mechanisms at stake, by combining traditional economics with psychology, often referring to "behavioural economics" basically applying psychological insights to advance our understanding of human behaviour, including consumer behaviour (Camerer, Loewenstein, & Rabin, 2004). However, as psychology has moved on to include neurobiology in its understanding of the human mind, recent efforts have also sought to include this part of psychology into economics and consumer science, leading to disciplines such as neuroeconomics and consumer neuroscience (Camerer, Loewenstein, & Prelec, 2005; Glimcher, Camerer, Fehr, & Poldrack, 2009; Glimcher & Rustichini, 2004; Hsu & yoon, 2015; Kenning & Linzmajer, 2011; Loewenstein, Rick, & Cohen, 2008; Plassmann, Ramsøy, & Milosavljevic, 2012; Plassmann, Yoon, Feinberg, & Shiv, 2011; Smidts et al., 2014). In doing so, models of consumer choice and communication effects that were originally conceived during a non-neuroscience psychology era should now be challenged with the recent and plentiful advances that neurobiology has made in reshaping our understanding of the human mind and decision-making processes.

Here, our aim is to provide an update of exactly these updates, and to use this novel understanding to challenge a dominating category of consumer choice and communication effects, going under headings such as "response hierarchy models". By using examples of these models, we will demonstrate that even the basic assumptions in these models need to be reconsidered and that the overall tenants of the models are equally problematic. However, before introducing these novel insights and their implications, we first consider the response hierarchy models in their own right.

1.1. Marketing communication models: A retrospective exhibit

Within a highly dynamic and fiercely competitive global marketplace, marketers need to scrutinize the extent to which consumers may be affected by marketing communication models. Marketing scholars have frequently argued about the roles of communication and its effectiveness on influencing consumer thought, preference and choice. Hence, a strong consensus of the opinions supports that understanding consumer psychology, comprehending consumer behaviour and an effective means of communication are of utmost important chains in marketing management (Butler & Peppard, 1998; Kotler & Keller, 2011). Two models are functional in marketing communication, namely Macro-Model and Micro-Model. The Macro Model of communication process encompasses nine elements (Duncan & Moriarty, 1998; Stern, 1994). Figure 1 depicts the nine Macro Communication Models' components.

The Micro-Models of marketing communication focus upon consumers' typical responses to communication. These models hold very specific assumptions, in presuming that the buyers cross through three stages: cognitive, affective and behavioural. Buyers' perception includes three sequences (Vakratsas & Ambler, 1999):

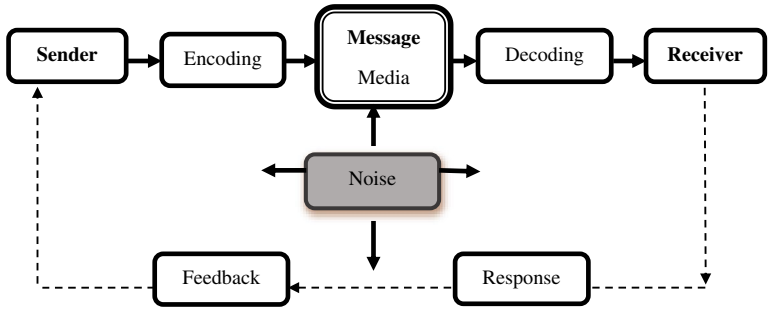


Figure 1. Elements of macro model of communication process.

Source: Duncan and Moriarty (1998), Stern (1994).

- First, "learn-feel-do" occurs when the potential customer has high inclusion in a product class and perceives that there is a serious differentiation.
- Second, "do-feel-learn" sequence tends to be relevant when the potential customer has significant participation but perceives slight or no distinction within the product category.
- Third, "learn-do-feel" refers to a situation in which the potential customer has low involvement and perceives a fundamental distinction without a difference within product cluster.

Through being decisive and being selective towards choosing an appropriate sequence, the marketers can come up with a clever plan to obtain an efficient communication. Four Classic Response Hierarchy Models are depicted in Figure 2; AIDA Model (Strong, 1925), Hierarchy-of-Effects Model (Lavidge, Steiner, & Gary, 2000), Innovation-Adoption Model (Rogers, 2010) and Communications Model (Kotler, 1984).

The AIDA model identifies the cognitive stages and to some extent emotional stages, which an individual goes through during the buying process (Lewis, 1908; Lewis & Elmo, 1899). It performs like a purchasing funnel where the buyers go to and fro at each stage. Through this mechanism, the AIDA model supports the buyers in making the final purchase. Although the model was developed a

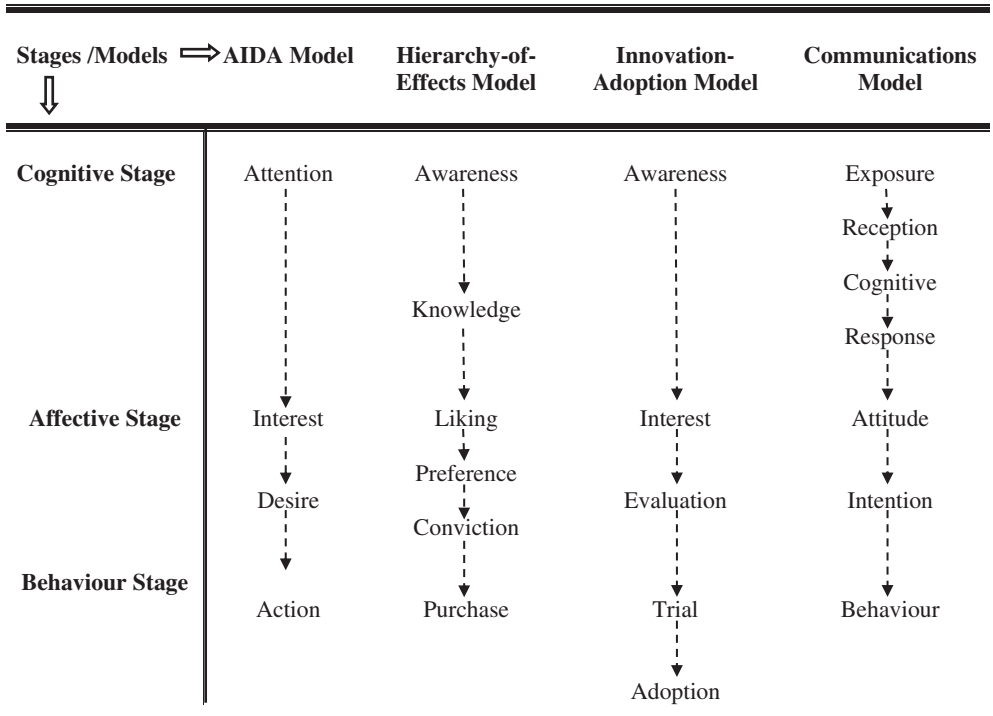


Figure 2. Response hierarchy models.

Source: Kotler (1984), Lavidge et al. (2000), Rogers (2010), Vakratsas and Ambler (1999).

century ago, in spite of a variety of modifications, the basic principle of the model is still intact and relevant. The AIDA model's relevant stages are:

- The cognitive level in which the users' attention can be drawn;
- The effective level that refers to a stage in which consumers have an interest in offered services and figure out what is being offered, so that, it leads to the desire to purchase the product or service; and
- The behaviour level in which the action takes place.

Using a system like this gives marketers a holistic perspective of how to communicate with prospective target markets effectively. Passing through one step to another one collectively increases the odds of success.

This research paper provides novel synthesized insights into response hierarchy models, with a specific exemplification through the AIDA model, which introduces and includes considerations from cognitive neuroscience. Neuroscience, neurobiology and systematic biological factors are made to manifest their roles within marketing context as a "Magnifying Glass" with the aim of enabling marketing researchers to have better comprehending of the extent of customers' minds and how they trade off, how they are impressed by advertising and ultimately, how they are involved in the purchasing process. With regard to these "HOWs", the following perception may be drawn; the emergence of neuroimaging techniques and neuromarketing concepts has revolutionized marketing science. Therefore, marketers are well equipped with scientifically proven tools to analyse the underlying consciousness of the customers.

Although the world of advertising has become aggressively competitive, the principles behind consumers' responses to advertising arguably remain intact and relevant. In fact, one can argue that the understanding of consumer choice and advertising effects now have an unparalleled access to consumers' unconscious responses, something that is increasingly being utilized in both academic and commercial market research. Traditionally, four steps have been suggested that copywriters and advertisers use in their shaping and understanding of ads to persuade customers to buy: consciously or unconsciously, they apply four elements of the so-called AIDA model of marketing communication, with steps such as Attention, Interest, Desire and Action. Recently, the application of neuroscience tools and insights, leading to genres such as "Neuromarketing", has gained importance amongst almost every major company and it is at a current pivotal point of its history. However, there is still much scepticism amongst practitioners and scholars towards applied neuroscience, and the "molecular consumer journey" that this emerging multidisciplinary area provides. Contrary to these notions, Neuromarketing has revolutionized the advertising sectors through an unparalleled access to consumers' unconscious minds, and is now emerging as a discipline that not only rivals the impact of traditional research methods but in every way outperforms these approaches in terms of causal theories, measures of consumers' responses and in providing novel means to affect consumers.

However, the neuroscience in marketing has rarely researched the marketing communication models, more specifically AIDA Model, besides alluding to that these models may be anachronistic and of lesser value in understanding the true causal mechanisms of consumption behaviours. As such, someone seeking a better understanding of the domain and operation of AIDA model, which is informed and updated by neuroscience facts, would likely to have a difficult time because there is not much literature that looks at AIDA model from neuroscience vantage point. Thus, the neurobiological basis of AIDA model remains rather opaque as the efficiency of its sequences have not been well articulated as one might hope. Therefore, this paper aims to specifically illustrate the association of various brain activities and molecular makeup of individuals with pinpoint accuracy, which leads to different behavioural activity and decision-making of a consumer, in order to find out if there are scientific reasons behind each and every step of AIDA model. The objectives of this study

are; to demonstrate the relevant areas in the brain related to consumer neuroscience, and to discuss whether AIDA model has a neurobiological proof to be effective in marketing fields. The advantage of this approach is that the different types of information processing in the human brain, which guides the individuals to identify their preferences, have been discussed sensibly.

2. The mutual influence of marketing and neuroscience spheres

The efficiency of marketing efforts is tied to the ability to predict target markets' behavioural performances towards marketing strategies and advertisings with the aim of determining what consumers really want and how they are affected by marketing communication strategies (Lee, Broderick, & Chamberlain, 2007). To do so, the multidisciplinary approach of consumer neuroscience, combining psychology, economics and neuroscience, has emerged and has crossed the borders of the controversial marketing methods (Ariely & Berns, 2010; Kenning & Plassmann, 2008; Plassmann, Ambler, Braeutigam, & Kenning, 2015). Indeed, consumer neuroscience is at the pivotal point in its history that concerns the individual's behaviour coupled with uncovering the underlying psychological pathways behind the consumer's actions under certain circumstances (Braeutigam, 2005; Kenning & Plassmann, 2005; Rustichini, 2005). The certain circumstances here can be interpreted as wherever individuals are required to evaluate the existing options, to compare options' values, to choose and consequently, to make a suitable decision for their purchases (Camerer, Loewenstein, & Prelec, 2004; Plassmann et al., 2012).

Neuroscience itself is the study of the nervous system structure and function, known as not only an extremely complex but also an extensive field that ranges from a molecular to behavioural neuroscience (Smidts et al., 2014). Generally speaking, neuroscience and neurobiology seek to illustrate the biological basis of the human and non-human behaviour. Moreover, the consumer neuroscience is capable of monitoring the brain functions in response to various stimuli such as product, picture and advertisement, even when the brain is processing below the level of conscious awareness (Calvert & Brammer, 2012). Notwithstanding its efforts, the marketing research cannot provide as much as information due to the fact that people do not always like or able to explain their preferences through the research methods like interviews or questionnaires within marketing contexts (Ariely & Berns, 2010).

2.1. Human brain activity: Functional associations relevant for marketing

Identification of the human brain's functions has provided a better understanding concerning the biological basis of individual's behaviour, activities, abilities and expressions to external stimuli. Different regions of the brain operate in an interconnected way in order to perform particular tasks in various contexts. Central to debate on the idea of "neuromarketing" is the question of how the "brain function" and the often-associated meaning and use of the words "behavioural differences and responses to stimulus" are interpreted in marketing. The most renowned regions of the brain related to human behaviour traits, emotional processing abilities, memory, cognition and decision-making are highlighted, in this section. These factors are currently of central importance in marketing fields. Central nervous system (CNS) and peripheral nervous system (PNS) control every single part of our daily life from breathing to helping to memorize. Sensory nerves gather the information from the internal or external environment and send them to the spinal cord in PNS. The spinal cord then speeds the message to a brain in CNS. Therefore, the brain makes sense of that message and expresses a response. The cerebrum as the largest portion of the human brain is responsible for higher level brain functions in human, such as action and thought. The cerebrum is conveniently split into various folds including five dominant regions, namely insula, temporal lobe, occipital lobe, parietal lobe and frontal lobe. The functions and locations of the identified lobes in cerebrum are tabulated in Table 1.

The main conclusion to be drawn from Table 1 is that many of the recognized functions of each lobe have been identified to be significantly in correlation with consumer behaviour, action and decision-making. Each lobe consists of subdivisions with specific functions, which are robustly connected with consumer behaviour. The most important of these subdivisions are (Zurawicki, 2010):

Table 1. Identified cerebrum regions; locations and main functions in the brain

Cerebrum regions	Position in the brain	Responsibility
Frontal lobe	Forehead area	Associated with planning, problem solving, short-term memory, creative thought and judgement, voluntary muscle movement, concentration, behaviour, emotions, reflection, sense of smell, thinking, personality
Occipital lobe	Back of the brain	Associated with visual processing
Temporal lobe	Near the ears, extending frontally towards the eyes	Associated with; • Assigning the emotional value to stimuli such as music, fear, situations, associative and declarative learning and language • Controlling long-term visual and auditory memories face recognition, and behavioural elements • Object processing and recognition
Parietal lobe	The top-back part of the brain, behind the frontal lobe and above the occipital lobe	Associated with tactile sensation, stereognosis, spatial memory, attention, body awareness and self-awareness.
Insula	Medial side of the brain, the insulated area between the parietal, temporal and frontal cortex	Associated with ability to deal with emotional information, and information from bodily emotional responses (Craig, 2009)

Source: Zurawicki (2010).

(1) *Broca's area*[1], which is located in the triangular and opercular section of the inferior frontal gyrus in occipital lobe and helps the brain in generating of speech and languages,

(2) *Wernicke's area*, located in temporal lobe of the cerebrum, formed around the auditory cortex and helps in language comprehension,

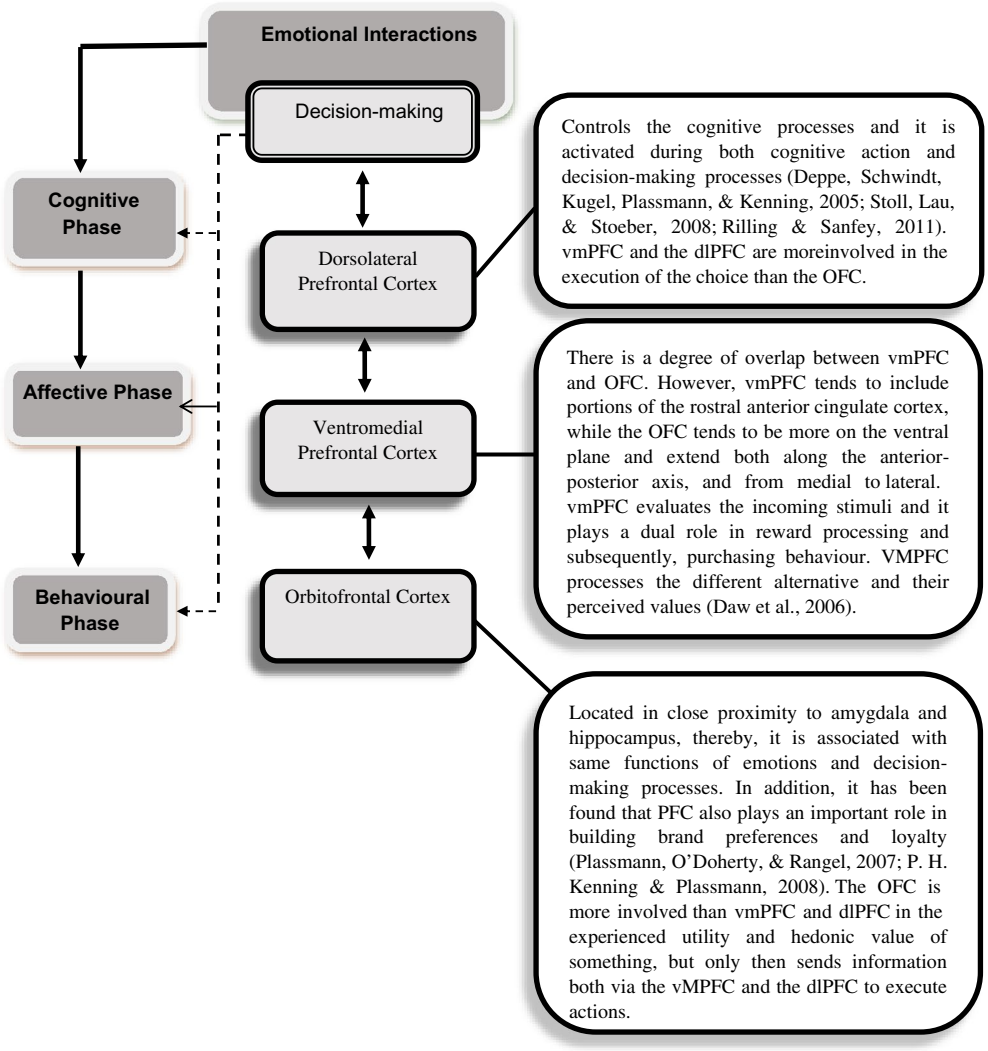
(3) *Sensory cortex*, which has a detailed (somatosensory) mapping and representation of each of the body parts, and

(4) *Motor cortex,* located in inferior most parts of the frontal cortex, also showing a sensory-like mapping of the body and is crucial for controlling body movements.

The prefrontal cortex, which is the front-most part the frontal lobes is split into various regions such as the Anterior Cingulate Cortex (ACC), Orbitofrontal (OFC), Orbitofrontal Cortex (OBFC), Medial Prefrontal Cortex (m-PFC), Ventromedial Areas (VMPFC), Ventrolateral Cortex (VLPFC), Dorsolateral Prefrontal Cortex (DLPFC), and are deeply innervated with deeper brain regions such as the Ventral Cingulate Cortex, Amygdala, Ventral Striatum and the Anterior Prefrontal Cortex (a-PFC). Figure 3 depicts "Summative Evaluation of Emotional Interaction" in relation to prefrontal cortex within decision-making processes.

Studies have demonstrated certain gradients within structures such as the orbitofrontal cortex. Here, it has been found that more basic pleasures, such as the taste or sight of something tangible (e.g. a delicious meal or beauty in a face) engages more posterior parts of the OFC, while tasks that involve processing of more abstract and even future rewards (e.g. money) engages the more anterior OFC. This anterior–posterior gradient demonstrates that different types of decisions rely on specific mechanisms of the OFC and beyond (Kringelbach, 2005). More specifically, the cerebrum is split into two symmetrical halves (left and right) with slightly different functions, known as hemispheres, which are connected to each other with a massive bundle of axons, so-called corpus callosum. The right hemisphere controls the left side of the body, and where studies have demonstrated some predominance for non-verbal information such as visual imaging, music, art and face recognition as well as the communicating and expressing emotions (Kalat, 2015). On the other hand, the left hemisphere, which is in turn responsible for controlling the right side of the body, has tentatively been

Figure 3. Summative evaluation of emotional interactions of prefrontal cortex in decision-making processes.



implied in processing the information logically and analytically, as well as languages understanding. However, these hemispheric "specializations" are far from being as specific as what is often seen in popular notions of "right brain creative" and "left brain logical".

The functions of these hemispheres are directly linked to "Three Dimensional Advertising" concept, which includes three steps of decision-making: (1) the logical and rational reasons behind making purchase, which is in association with left brain activity, (2) remembering the information in long time memory and (3) the motivational factors as a primary purpose of advertisement to purchase the product. Interestingly, although studies have suggested a right hemisphere dominance for emotional cues (Maddock & Fulton, 1996), more recent studies have collectively demonstrated that a higher engagement of the left, relative to the right, frontal cortex is associated with approach behaviours, and that conversely, right larger than left frontal engagement is related to avoidance behaviours (Harmon-Jones & Gable, 2017; Harmon-Jones, Gable & Peterson, 2010). Motivation and emotion are tied literally together, therefore, the right brain is responsible for this step to generate the emotions in consumer with the aim of incentivizing them to make the purchase (Maddock & Fulton, 1996). However, the basic understanding of hemispheres implies their significance, but the actual functioning of these regions are much more complicated than it was predicted, as the remarkable differences in their processing have been identified between men and women or even left-handed and right-handed individuals (McGee, 1979). The evolutionarily newest part of the

cerebrum is known as the "cortical cortex". The cortical cortex is responsible for enhancing cognitive skills such as working memory, language and speech. Subcortical structures including the basal ganglia, limbic system, thalamus, hippocampus and particularly, cingulate cortex have gained popularity currently in academic research spheres such as motivation, decision-making and preference formation.

2.2. Limbic system

Comprehensive neurobiological perspectives on consumer behaviour are of essentially central importance in marketing fields. There is empirical evidence that the evolutionarily old subcortical gland structures, which involves in emotional processing, fear, learning and memory are contributing

Table 2. Taxonomy of limbic system elements

Elements	Locations, functions, and contributions
Thalamus	*Location:* Located in the centre of the brain, lies in the middle of the cerebrum and brainstem
	Function: Considered as information "hub" that treats incoming information in a rapid decision-making (i.e. it processes visual information with its lateral geniculate nucleus, which is an important thalamic nucleus or it plays a role in processing information in the amygdala and habenula in emotional responses). Moreover, its other functions are: playing a role in nonverbal memory tasks; spreading activation across the brain to other cortical structures via cortico-thalamo cortical loops, and modulating of sensory information by integration of brainstem and relevant cortical information. Ventrolateral thalamic stimulation also affects short-term verbal memory
	Contribution: Thalamus also contributes to attention and it controls the attention span. Moreover, it plays a vital role in emotional decision-making processes as well as modulation of both the verbal and non-verbal memory
Hypothalamus	*Location:* Positioned below the thalamus
	Function: It performs the vigorous functions in regulation and controlling the hormonal processes in the body. Moreover, through controlling the pituitary glands (responsible for secreting two important hormones of oxytocin and vasopressin) hypothalamus connects the nervous system to endocrine system. This region also controls some senses such as thirst, hunger, and temperature, coupled with this it is responsible for sexual maturation and motivation in individuals
	Contribution: The hypothalamus plays a role in emotion through its lateral parts and median parts. The lateral parts are related to pleasure and rage. On the other hand, its median parts are interrelated to aversion and displeasure
Amygdala	*Location:* It is an Almond-shaped collection of nuclei, which is located under the surface of the front, medial part of the temporal lobe
	Function: It is dedicated to emotional responses, and tightly connected to arousal responses. The amygdala responds to both positive and negative stimuli, and is therefore seen as a "relevance barometer", not only for fear but also reward-related functions (McClure, Laibson, Loewenstein, & Cohen, 2004; Plassmann et al., 2007). Moreover, it plays a key role in evaluating task relevance and value estimation (Gelskov et al., 2015). Amygdala is also responsible for loss averse decision-making
	Contribution: It plays a vital role in actual comparison, decision processes, and signalling the "appetiteveness" of an option (McClure et al., 2004). Moreover, it plays a vital role in the mediation and control of the expression of mood coupled with this it is important in risky and emotional decision-making circumstances
Hippocampus	*Location:* It occupies the basal medial part of the temporal lobe, next to amygdala in the brain
	Function: It is of central importance in declarative memory and learning, particularly, it is associated with the conversion of short memory to the permanent long memory, which is thought to be distributed throughout the brain. The hippocampus is in conjunction with the adjacent medial temporal structures, are involved in coding both object identity and spatial memory. Moreover, it is engaged in an automatic association of its sensory inputs(Hulme, Skov, Chadwick, Siebner, & Ramsøy, 2014)
	Contribution: The hippocampus allows comparison of current probable experiences with similar past experiences, thus leading to choose the best option (this trend refers to an ability to learning from experiences, so-called lesson learned)
Cingulate Cortex	*Location:* It is located in the medial aspect of the cerebral cortex in prefrontal and parietal cortex
	Function: It is composed of posterior and anterior cingulate cortex (PCC and ACC), and is responsible for integrating of motivational and emotional information in the decision-making processes (Bush, Luu, & Posner, 2000). It is thought to be involved in monitoring and resolving motivational conflicts
	Contribution: The cingulate cortex is an essentially integral part of the limbic system, which is involved with emotion creation and processing, learning, and memory (Hadland, Rushworth, Gaffan & Passingham, 2003; Stanislav, Alexander, Maria, Evgenia, & Boris, 2013; Kozlovskiy, Vartanov, Nikonova, Pyasik, & Velichkovsky, 2012)
Basal Ganglia	*Location:* It is known as a group of nuclei, positioned in the subcortical white matter of a frontal lobe
	Function: It is composed of ventral striatum, putamen, caudate nucleus and globus pallidus, which are critical in understanding motivation and choice. Moreover, it is associated with inhibition of undesired and release of the desired movement. It plays a key role in the assimilation of emotional, reward and attentional information into learning and movement. The Basal Ganglia is of central importance in both habit learning and working memory
	Contribution: It is considerably associated with a processing of the emotional, rewards and motivational information, which leads to the creation of behavioural traits and action in individuals

substantially to consumer behaviour and choice. Neuroscientists have traditionally referred to these structures as the "Limbic System" which is a conglomerate of structures and are located deep in the subcortical parts of the cerebrum. The limbic system includes the thalamus, hypothalamus, amygdala, hippocampus, cingulate cortex and basal ganglia, which positioned above the corpus callosum. A taxonomy of Limbic System elements is tabulated in Table 2.

3. The mutual influence of marketing and psychophysiological personality traits

Analysing the individuals' behaviour and their preferences in various demographic areas considering cultural diversity and ageing can create most suitable marketing strategies, in target market setting. The correlation between personality traits of individuals due to their neurobiological differences and consumer behaviour are scrutinized in this section. Moreover, it has been demonstrated that how different preferences and personal characteristics result in different kinds of actions, choices and subsequently decision-making in consumers.

3.1. Personality traits; what we know

The neuroscience provides a conclusive proof that the variation of behavioural traits in individuals lays on the cellular basis of the brain, so that, the dimension of individuals' personality can be influenced by genetic per se (Hariri & Holmes, 2006). It seems certain that individual psychological differences, when they are reliably measured, are considered as heritable, moderately to substantially (Ramsøy & Skov, 2010). Today the roles of genetic and environmental influences on human behaviour are clarified, substantially than a few years ago. Research in human behavioural genetics has evolved and diversified tremendously (Plomin & Crabbe, 2000; Rose, 1995). So that, covering the whole field is quite not possible in a single research. The scientifically proven classification for personality traits is the "Big Five" personality traits, also known as the five-factor model (FFM) which is used by psychologists with the aim of describing the human personality and psyche (Costa & McCrae, 1992; Goldberg, 1993). The Big Five factors have been characterized as *openness to experience*, *conscientiousness, neuroticism*, *agreeableness* and *extraversion*. These classifications have been measured based on responses of the humans to different sorts of stimuli, either positive or negative, which evoke the emotional sensitivity as well (Costa & McCrae, 2008).

Openness to experience refers to a phase of being proactive and grateful of experience as well as seeking, tolerating and exploring unfamiliar (Piedmont, 2013). This factor highlights a contrast between conventional, analytical and inartistic individuals with those who are creative, curious, untraditional and original (McCrae, 1994; McCrae & Costa, 1985). To illustrate, individuals with a higher score of openness have been shown to be more curious and have more interest in new ideas, art and imagination, as well as higher variation in their choices. On the other hand, lower score individuals have been found to be more conservative in their choices. It has been illustrated that there is a connection between intelligence and openness in the individuals, especially where the intelligence is related to creativity such as thinking divergently (McCrae, 1987), which associated with the activity of DLPFC in the brain (DeYoung et al., 2010). The role of motivation in openness to experience is not deniable as open people are intended to actively pursuit the novelty as well as enlarge their experiences (McCrae & Costa, 1987).

Openness encompasses six dimensions or facets, namely fantasy, aesthetics, feeling, actions, ideas and values. The openness to fantasy refers to individuals who have not only a bright imagination but also a vibrant lifestyle. On the other side of the coin, individuals who have a low degree of openness to fantasy tend to be more pragmatic and are short-sighted. The openness to aesthetics refers to individuals with a deep level of gratefulness for art and beauty. They are impressed by poetry and gazed by art. The openness to feelings is of central importance in individual's inner feeling, and emotions. People with a high degree of openness to feelings tend to value their feelings as well as they are empathic and emotionally responsive. However, individuals with low intensity are characterized as insensitive and unemotional. The openness to actions refers to those who are spontaneous and curious of trying various activities such as discovering new places and trying new foods. They prefer novelty and diversity compared to familiarity and routine. The openness to idea deals

with intellectual curiosity. They are more into open-mindedness and a readiness to satisfy their curiosity generated from new ideas. The openness to values refers to have an instinct capability of willingness to re-scrutinize religious, political and social values and norms. Individuals who have this fact, are open-minded, tolerant, nonconforming and broad-minded. On the other hand, closed individuals intended to honour tradition and say yes to authority. Understanding of the biological conditions of intelligence has been helping the researchers in identifying the necessary skills in marketing, such as problem-solving skills that lead to different patterns of decision-making, particularly in buying decision-making and rating the values of the products after purchases. The intelligence is influenced by genetics and associated with the processing capabilities of the individuals, which is a necessary factor in making a decision about the existence options. Customers with lower processing abilities have difficulties to reach a firm decision, so that, their decision-making processes are tied with taking an emotional and mental shortcut. In contrary, the customers with higher processing abilities have high self-confidence and more perfectionism preferences.

Extraversion has been found to be a crucial factor in consumer behaviour studies. In 2005, Cohen has been demonstrated that both anatomic and genetic characteristics are forming this trait through releasing the dopamine hormone in the brain (Cohen et al., 2005). It seems certain that there is a mutual connection between extraversion and grey matter volume in the left amygdala (Omura, Todd Constable, & Canli, 2005), thereby, individuals with this trait would confront a lower risk of depression. On the other hand, it has been found that there is an inverse relation between extraversion and the thickness of both right anterior PFC and right fusiform gyrus regions, which used as the evidence to conclude that extroverts represent the lower resting activity in their frontal lobes (Wright, Butlin, & Carlborg, 2006). In contrast to introverts, the extroverts are characterized as individuals with; fast and strong responds to various stimuli, different reactions to exciting situations and sensitive reflection of rewards (Revelle & Wilt, 2013), capability of preserving the positive mood and shortening the negative mood (Lischetzke & Eid, 2006). In addition, the word studies have been illustrated that the word categorization has a different effect on extroverts, in a way that makes them consider the meaning of the specific positive words, as more synonymous than a negative valence words (Revelle & Wilt, 2013).

Neuroticism has been shown to have an opposite effect as extraversion on a behaviour of the trait carriers in various contexts and it has been proved that the individual with neuroticism trait responds contrary to the stimuli (Paunonen, 2003). Many factors have been discovered in the brain, which leads to the appearance of neuroticism in individuals, such as (1) deficiency of grey matter in the right amygdala (Omura et al., 2005) and (2) genetic variation affecting the serotonin miss-regulation (Canli, 2008). Moreover, the negative life experiences have been found to exacerbate the susceptibility of individuals to neuroticism. Such these factors influence the individual behaviours towards the negative reaction to depressing images due to either strength of brain activity or longer prolonged activation in the MPFC (Canli, 2008). Neurotics are moody, unstable and sensitive to negative stimuli, under stress and negative emotions in daily life.

Agreeableness has been studied less than the other traits. It has been shown that the mutation of hormone vasopressin receptor gene (AVPR1a gene) results in the appearance of a distinct feature in individuals, such as a focus on trust and bonding, friendliness, ability to suppress hostile reaction and tendency to compassion, which is in association with agreeableness trait. The linkage of agreeableness and marketing management has been demonstrated in various situations. For instance, it has been proved that the agreeable individuals are tending to compromise more on a deal in the market compared to less prosocial people.

Conscientiousness consists of six sub-characteristics; self-efficacy, orderliness, dutifulness, achievement striving, tendency to show self-discipline and cautiousness (Aluja, García, & García, 2002). People with the conscientiousness traits are highly organized, have a strong sense of duty and they are perfect planners, which usually makes them be successful in their choices.

3.2. Personality and behaviour linkage

As mentioned earlier, understanding the basic components of human behaviour helps a lot in a prediction of the individual response in marketing. For instance, it has been observed that neuroticism increases the sensitivity of individuals to the emotional effect of music; thereby, it shows music is a vital factor to regulate the emotions in neurotics. On the other hand, individuals with the traits like conscientious and openness experience the music in more rational manners and they tend to be more judgemental in techniques of the artist or structure of the song. Different preferences in people are due to their distinct personality. In addition, a large diversity of personality profile in the social environments has increased the complicity of analysing the consumer behaviours in marketing.

The individual differences associated with their emotional responsiveness have been measured through the valence-specific brain response, thereby, in order to gain this goal, the "affective styles" has been proposed. The affective styles include some indicators related to responding such as the threshold and the magnitude of responding, the rise time to the peak of the response, the recovery function of the response and the period of time that response continues (Davidson, 2006). This style has been greatly helpful for the advertisers. Furthermore, it has been highlighted that not only the personality traits of individuals are important to be analysed, but studies of their particular behaviour, preferences and actions in certain task and context are much more essential (Zurawicki, 2010).

4. Findings and discussion

4.1. A brain mechanism for attention

According to the AIDA model, the term "Attention" is the first suitable step to be considered in marketing, which in general has been defined exhaustively as a mechanism for which it is responsible for the selection of the relevant and preferential information from a particular stimulus within societal context (Gazzaley, Cooney, Rissman, & D'Esposito, 2005). Success, in terms of marketing achievements in today's media-filled world, is tied to quick reactions as well as grabbing individual's attention. There is empirical evidence that "Attention" are interconnected with selectivity (which can change by ageing), limitation and capacity in human, thereby; the individuals are capable of not only filtering out unnecessary information but also ignoring either endogenous or exogenous distraction. This collective psychophysical mechanism help individuals to be more concentrated upon the information that really matters to them, therefore, the only useful information comes into their sensory system under various circumstances (Kahneman, 2011). Different studies over the years have revealed that the older adults when compared to younger adults, have a difficulty of suppressing irrelevant information or even in some case relevant stimuli, which was found to be related to either their decreased memory capacity or visual system deficiency (de Fockert, Ramchurn, van Velzen, Bergström, & Bunce, 2009; Rissman, Gazzaley, & D'Esposito, 2008; Wild-Wall, Falkenstein, & Hohnsbein, 2008).

There are two brain systems that control attention, system 1 and system 2. To pinpoint, system 1 is involuntary response to the stimuli and processes; moreover, system 2 is a voluntary part of the brain that gives individuals the capability of making final decision-making to allocate their attentions or their processing resources. In doing so, we elaborate four fundamental conceptualized components of attention, perception and psychophysics from the neuroscience vantage point (Knudsen, 2007) as Bottom–up/ Saliency Filters; Top–down Control; Competitive Visual Selection and Working Memory.

(1) *Bottom-up/Saliency Filters:* depends on some fundamental factors such as low-level characteristics of the visual inputs like; colour, orientation, size, shape and movement. These factors allow the consumers to automatically choose the most important information amongst all existing information in the environment (Itti, Koch, & Niebur, 1998; Wolfe, Horowitz, Kenner, Hyle, & Vasan, 2004). In addition, there are some higher level factors in this attention mechanism such as Faces, Texts and Novelty, which result in gaining both automatic and preferential attention in individuals. All the mentioned features will combine in the brain and lead to the creation of the saliency map in the visual fields for further processing. It has been proven that

the significant stimuli around the consumers attract the initial eye movement in the individual, which later leads to the onset of the certain behaviour in consumers (Van Zoest, Donk, & Theeuwes, 2004). Thus, marketers must find out the basic features that influence the people to pay attention in the first place, which can lead to consumers to look further towards upper and right visual fields that are highly important at the point of purchasing (Durgin, Doyle, & Egan, 2008; Glaholt, Wu, & Reingold, 2010).

(2) *Top down control:* is depends on three factors of Internal and External States, Goals and Expectations. Expectation and personal goals can control what consumers need to pay attention by activating the certain structure in the brain, such as dorsolateral cortex, fronto-parietal control network (FPCN), cerebellum and rostrolateral prefrontal cortex (RLPFC) (Egidi, Nusbaum, & Cacioppo, 2008). Basically, the personal need and internal requires can modulate the individuals to pay attention to some particular information than others and segregate the relevant from irrelevant information. Moreover, the goals can strongly influence the patterns of eye movement and subsequently the visual scan path when consumers see the marketing materials, and it has been found that the differing goals can result in different tendencies to look at the same visual inputs (Glaholt et al., 2010; Pieters & Wedel, 2007).

(3) *Competitive Visual Selection:* on the other hand, occurs when the consumers chose the most important information from all the potentially important data that had been pre-scanned. It has been found that when the number of options increases, the consumers become more and more selective in processing the stimulus information (Payne, Bettman, & Johnson, 1993).

(4) *Working Memory:* can also result in increasing the attention to certain types of data. Memory-related mental processes expose some useful findings that might influence the consumer behaviour such as product experiences, brand awareness and advertising recall. Thereby, the hippocampus and basal ganglia, which both play an essential role in memory processing and the formation of different types of memory can lead to various consumers' behaviour in the market (McGaugh, 2000). In addition, the closely related regions of amygdala also play an important role in memory processing, thus having a vital effect on the individuals' behaviour. The neural basis of selection in attention mechanisms starts in the neuron of the occipital cortex, which acts as a feature detector. The features of a certain product or processes stimulate the group of cells in the retina called receptive fields and subsequently map them onto specific neurons in the cortex. All these changes in receptive fields have been found to be controlled by thalamus. In sum, it has been illustrated that the stronger activation of the pulvinar thalamus nucleus anterior and the cingulate gyrus in the frontal lobe, which controls the responses, decision-making and other cognitive tasks, acts as a supervisory attentional system, inhibits the automatic responses and aids in the selection of the correct response (Armstrong, Fitzgerald, & Moore, 2006).

In addition, *emotion and sentiment* are the other factors that can be used as stimuli by marketers in order to gain the attentions in consumers and significantly affect their behaviour. Negative emotions such as anger, sadness, disgust and fear can promote the avoidance and defensive behaviour in consumers, whereas the positive emotions like trust, joy, and anticipation can facilitate their attention. Generally, identification and detection of the emotional state by marketers would allow them to have a better understanding of peoples' opinions on their launched products and subsequently help them to measure the satisfaction percentage in the market.

It has been demonstrated that there is a strong connection between the cortical cortex of prefrontal and temporal lobes and the subcortical limbic structures. When the individuals receive the stimulus through their sensory system, the information starts processing in the cortex and then directly influences the wide regions of brain like limbic system and areas implicated in attention, memory and regulation of emotion-triggered behaviours such as amygdala, hippocampus, ventral striatum, insula (involved in the central mapping of autonomic and visceral reactions associated with emotions), orbitofrontal and hypothalamus, which generates the emotional states and automatic responses in individuals (Cerqueira et al., 2014). Amongst these areas, the amygdala has been

demonstrated to play an essential role in processing emotional information and emotional functions, especially emotional learning and memory through transmission of sensory inputs between amygdaloid subregions to cortical and subcortical regions (LeDoux, 1992).

Emotional memory has been studied and modelled by LeDoux (1993), in which he asserts that this phase deals with learning and storing given information concerning the emotional significance of events. The amygdala and its other connected structures have been found to be critically involved in these processes since it has been identified that some emotional processing can take place in amygdala even without voluntary attention and awareness. The cellular mechanistic studies of the inputs' pathways by LeDoux have been revealed that the areas such as the thalamus and cortex have been identified to mediate the emotional learning in a situation involving specific sensory cues via transferring the inputs by using amino acid glutamate in synaptic transmission to the lateral amygdala (lateral nucleus). Whereas hippocampal has been found to be responsible for learning about the emotional significance of more general, contextual cues.

Crucially, in a study by Ramsøy and Skov (2014) demonstrated that subjective preference for brands affected the likelihood of detecting the brand when presented briefly. This finding provides a clear indication that emotional responses, even in the form of acquired preference for cultural objects, can affect the way in which something is detected and attended. In itself, the implication of emotion already at the stage of attention suggests that the AIDA model, if it is not to be entirely discarded, must encompass a more dynamic understanding of the first "A" (attention) in the model. However, instead of invalidating the AIDA model itself in this stage; we suggest that the model should incorporate this finding with a more dynamic understanding of each individual step, and the relationship it holds to other steps in the model.

4.2. A brain mechanism for interest

Based on AIDA model, right after grabbing target audiences' attention, the model provides a chance and enough time to engage with audiences in which marketers are capable of transferring their developed messages, providing more detailed information, and attracting audiences' interest into discovering more about given product or services.

Howsoever, from neuroscience vantage point, "interest" cannot be classified as a distinct stage in the human brain, and should be re-classified as "emotionally driven attention". According to our discussion in Attention section, the amygdala has been demonstrated to play an essential role in processing both emotional information and emotional functions. This assertion has been confirmed by Jacobs, Renken, Aleman, and Cornelissen (2012). It has been also demonstrated that the amygdala is involved in updating the "relevance features". Critically evaluation of brain uncovers that, Amygdala as an emotion processor (LeDoux, 1992; Sergerie, Chochol, & Armony, 2008) is engaged in processing of incoming emotional information and to the execution of emotional responses in an automatic, unconscious and fast matter (Dolan & Vuilleumier, 2003; Öhman, Carlsson, Lundqvist, & Ingvar, 2007). So these characteristics emphasize on the bottom–up processing of stimuli (Jacobs et al., 2012). Concomitantly, the empirical evidence has shown that the magnitude of amygdalar activation is tied to the task performed by the observer. Therefore, this process can be implied that the amygdala exerts top–down influences on perception *per se*. Apart from its implication in both bottom–up and top–down processing, the amygdala has been also implicated in selective attention as well (Jacobs et al., 2012). The selective attention here involves the differential processing of different stimulus aspects or different stimuli (Dayan, Kakade, & Montague, 2000). Therefore, the amygdala appears to be involved in a process, known as "reorienting to relevant information" (Davis & Whalen, 2001). The top-down effects on the amygdala may mediate amygdalar guidance of this form of attention. Moreover, it has been illustrated that amygdala responds to features/to elements can be distinguished based on features (Jacobs et al., 2012). The feature relevance may not be stored in the amygdala, but it may be stored in the sensory cortices where the relevant features gain an enhanced salience (Phan, Wager, Taylor, & Liberzon, 2002). The enhanced salience can be temporary, as long as the features are more permanent or relevant for the task at hand, especially, when

features have known to be generally relevant in life. Therefore, it can be asserted that all features get access to the amygdala because all features need to compete for attention, where their relevance is adjusted and assessed if necessary. Since one can only orient to one place at a time, then the most salient features will influence the spatial orienting behaviour, which is initiated in amygdala and executed through the brainstem (Jacobs et al., 2012).

Based on these finding, Jacobs et al. (2012) have developed a Schematic model of "Attentionally relevant" afferents to and afferents from the amygdala, considering its attentional function. Based on this model, it has been depicted that sensory cortices, which code the featural information provide an input to the amygdala. The amygdala, therefore determines the relevance of this information through interactions with the orbitofrontal cortex. However, in the case where features need to be updated, these inputs need to transfer back to sensory cortices, where the feature detectors' sensitivity may be modulated. The most salient features have been found to be capable of activating amygdalar efferents to the brainstem. It has been concluded that the different weights given to different features in each individual could have been depicted by different height in the sensory cortices (Jacobs et al., 2012).

Each individual with different temperaments exhibits different levels of motivation tendencies, sensation seeking, reward dependence and novelty seeking, which are the major factors in today's market. Therefore, approaching to consumers requires different techniques. Marketers usually use rewards and motivational offers to enhance interest (which is known as emotionally driven attention in neuroscience) in individuals or to evoke the emotion of the consumers. Neuroscientists have also identified that the rewarding stimulus in the market can significantly affect the consumer's brain and trigger the psychological motivations that influence their purchase behaviour.

To elaborate, a visual stimulus, which is associated with rewards, attracts spatial attention. So, both the motivational significance and location of visual stimuli need to be registered by neurophysiological mechanisms, which mediate this process. Recent neurophysiological evidence highlighted that the amygdala encodes information about both of these parameters; the motivational significance and location of visual stimuli. Notably, the intimate and bidirectional connections between amygdala and basal forebrain (a brain area long implicated in attention) might influence attention. This connection can be seen as a neural pathway towards attention. Similar to the amygdala, neurons in the basal forebrain have been shown to be spatially selective for reward-predictive stimuli. Different routes of reward-predictive stimuli processing, which has been appearing in the ipsilateral and contralateral fields were suggested by an onset of reward-predictive signals in each brain area. Furthermore, tracking of trial-to-trial fluctuations in spatial attention was found by neurons in amygdala but not in the basal forebrain. Based on these findings, the distinct but yet inter-related roles in influencing attention provoked by reward-predictive stimuli was suggested in the amygdala and the basal forebrain (Jacobs et al., 2012).

Furthermore, it has been found that the activation of the striatum, which is a striped mass of white and grey matter located in the basal ganglia inside the forebrain is directly associated with reward processing, and more generally with outcome expectation and labelling, which plays a key role in the "reward system" of the brain. Other evidence then proved the activation of striatum and its components, including putamen, caudate nucleus and nucleus accumbens (also known as the ventral striatum) in reward evaluation with respect to one's expectations (Knutson & Wimmer, 2007). Furthermore, the other region, ventral tegmental area (VTA) has been also found to be participating reward system via transmitting dopamine to other brain regions and enables the modulation of decision-making. It has been found that VTA also plays an important role in the formation of goal-seeking behaviours (Fields, Hjelmstad, Margolis, & Nicola, 2007). The reward processing has been studying extensively. Therefore, the results deduced from these scientific endeavours, illustrate the fact that fronto-striatal-hippocampal interactions are of central importance in enhancing not only long-term, but also short-term memory forming brought about by the rewards, which significantly affect the consumers' decision-making on their next purchase (Adcock, Thangavel,

Whitfield-Gabrieli, Knutson, & Gabrieli, 2006; Murty & Adcock, 2014; Wittmann et al., 2005). Interestingly, the breakdown of a clear "neo-phrenological" (i.e. this is a pejorative, but reasonable, terminology that describes the theory of modularity, that a brain has specialized regions for various cognitive processes) and simplistic view of the brain on the interest shows that structures previously thought to support negative emotions, can play a substantial role in the reward process. For example, in a study by Gelskov, Henningsson, Madsen, Siebner, and Ramsøy (2015), it was found that the amygdala was related to the ease with which a choice could be made. This finding was done equally so for aversive as appetitive options, and supports prior studies that this part of the brain is to be thought of as a "relevance barometer" rather than a purely fear/reward brain structure (Murray, 2007). Indeed, the amygdala, in conjunction and closely connected with the basal ganglia structures, is good candidates for brain networks that signal relevance and thereby interest, and often show responses to novel and unexpected events (Blackford, Buckholtz, Avery, & Zald, 2010). Since emotion is the other main factor, which has been used by marketers to induce the interest in consumers, thus activation of some regions of limbic system such as the amygdala and cingulate cortex, which are associated with emotionally related stimuli and integration of the emotional and motivational information are considerably important in this stage of AIDA model. According to the findings, at this stage, it can be concluded that the AIDA model premise of a sequence from "A —> I", is basically wrong and that the model should rather have a bidirectional element where "A <—> I".

4.3. A brain mechanism for desire

The AIDA model suggests that right after attracting consumers' interest; the next step is to create "Desire" through providing a compelling reason, why they need such products or services in a real way and to motivate them to step forward, which leads them to the last step of decision-making and subsequently taking an action. However, Neuroscientists' studies on the activity of consumer's brain in response to motivational stimuli have revealed that interest and desire cannot be counted as two distinct phenomena, but they should be considered as overlapping phenomena. This statement has been supported by following findings on brain activities when different stimulations have been applied. First neuroscientists have found that just one particular advertisement, which is highly pleasant for audiences, only generates the considerably greater activation in the left frontal hemisphere. Further, experiments suggested that the degree of liking the certain motivational stimuli is related to the activation of the hemispheres in the brain. Later in 2011, Vecchiato et al. have been chosen the advertisement again as a source of motivational stimuli, then they monitored the activity of the brain, and they confirmed that the pleasant and unpleasant advertisements have a different effect on activation of the hemispheres in the brain (Vecchiato et al., 2011). The greater neural activity was monitored in the right hemisphere when individuals were watching the unpleasant advertisement, whereas the left hemisphere was more activated when the advertisement was more pleasant for them. This finding is furthermore supported by studies showing that frontal asymmetry can predict consumer purchase decision long before the actual decision takes place (Ravaja, Somervuori, & Salminen, 2013).

Neuroscientists research to explore the extent to, which consumers show a different neural pattern in response to rational (logical or factual information) and non-rational (emotional) advertisement has been also an evidence for the above-mentioned statement. The findings showed the logical advertisements were associated with higher activation of hippocampus, amygdala and anterior cingulate. Since it has been known that the two regions of the amygdala and anterior cingulate activates, usually in emotional processing, it pops up the question that whether each type of processing could occur in a well-scrutinized set of brain regions, which is still unclear. As it has been also mentioned in previous sections, an emotional response can lead to stronger attention. Measuring emotional responses indicate that any minor changes in emotional responses such as arousal and motivation can lead to minor changes in "interest" as well, whereas strong positive emotional responses of the striatum have been related to brain "wanting" responses, which also leads to stronger interest.

Other studies in emotional advertisement showed the difference in activation of areas involved in emotional response, particularly in the inferior frontal gyrus and middle temporal gyrus (Morris, Weickert, & Loughland, 2009), which also brought up the hypothesis that the different dimensions of emotions relate to specific patterns of regional brain activations. Therefore, the neuroscience uncovers that conscious and unconscious, considering motivation and choice need to be distinguished, brightly (Kahneman, 2003). Here, studies clearly support a view in which unconscious desire is driven by both the engagement of structures such as the amygdala, ventral striatum and often manifested as fast frontal asymmetries. Conversely, the hedonic experience of desire and pleasure — sometimes referred to as the experienced utility — is reflected in the activation of the ventral parts of the frontal cortex, often referred to generally as the ventromedial PFC or more specifically as the orbitofrontal cortex. Here, stronger activation in this vmPFC or OFC region is related to higher levels of subjective (Kringelbach, 2005; Kringelbach & Berridge, 2009).

Other than pleasant offers and motivational advertisement, which directly elicit the desire in individuals, learning due to repeat purchases or regular use of the particular product can also result in gaining experience. Since individuals will gain the ability to make the prediction about the consequences and outcomes of their actions, then, the most satisfying purchase and favoured action at the certain situations will lead to appearances of goal-directed behaviour and desire formation for the next purchases (De Wit & Dickinson, 2009; Tricomi, Balleine, & O'Doherty, 2009). It has been identified that this behaviour can become more habitual and automatic after all. Moreover, it may result is purchasing the certain product in all contexts, even if that purchase will not be as enjoyable as it was in the first experiences (Dickinson, 1985). Besides, desire can be altered in individuals due to their short-term or long-term goals.

It has been identified that the individuals, possessing harmonized balanced activation in an executive decision system concerned with impulse control (i.e. a system which is associated with activities within lateral and media spheres of the prefrontal cortex), and a system for computing the reward value of the outcome (i.e. a system which is directly related to activities within spheres of; as the orbitofrontal cortex/ventro-medial prefrontal cortex and striatum) are capable of resisting an immediate reward and tend to achieve the long-term goal.

However, further studies have shown that this balance between these two neural systems can be disrupted by additional factors such as other competing cognitive demands (Heatherton & Wagner, 2011; Koffarnus, Jarmolowicz, Mueller, & Bickel, 2013; Ward & Mann, 2000).

The following discussion can be drawn out of aforementioned findings that interest in individuals can occur without desire, but desire is always associated with stronger interest. These phenomena bring up the crucial problem for the fundamental assumption of AIDA model, which assumes "Interest" and "Desire" as two distinct stages.

4.4. Brain mechanism for action

The last proposed stage of the AIDA model is the behavioural result of complete awareness and cognition, where the consumers are required to make the decision whether to purchase the specific product/services or not. Based on AIDA model, in the action stage, consumers assess their alternatives based on the given information, benefits and costs. Neuroscientists found that the prefrontal cortex (PFC), which is located in the frontal lobe of the brain, plays a critical role in human decision-making processes. Particularly, it has been shown that the two regions of the orbitofrontal cortex (OFC) and ventromedial prefrontal cortex (VMPFC) are concerned with processing the different choices and subsequently the possible outcomes, as well as assessment of the perceived value (Daw, O'Doherty, Dayan, Seymour, & Dolan, 2006; Tremblay & Schultz, 1999). Moreover, it has been identified that the dorsolateral prefrontal cortex (DLPFC) also plays an essential role in decision-making processes, as it is well known for being concerned with cognitive control over emotions (Rilling, King-Casas, & Sanfey, 2008). The DLPFC forms a network with the anterior cingulate cortex and controls the decision-making in various contexts. The researchers also found that the ventromedial prefrontal

cortex (vmPFC) that also includes orbitofrontal and frontopolar cortex is the other brain area, which is responsible for evaluating the risk, rewards and provides the ability to the consumers to balance rewards vs. risks during decision-making. Previous studies also suggested that another brain region than frontal cortex is involved in decision-making processes, including parietal cortex, which activates when consumers taking actions, planning and making decisions in uncertain situations.

The traditional concept of free will stated that mind could control body, which is in contrast with modern scientific studies of consciousness, where it has been suggested by Libet that conscious intentions arise as a result of brain activity (Libet, 2009). The further study by Haggard and Eimer has suggested that conscious awareness of intention is linked to the choice or selection of a specific action, and not to the earliest initiation of action processes (Haggard & Eimer, 1999).

Humans have been stating that their intuition can result in a better decision than conscious reasoning. This statement was studied by Benjamin Libet and Patrick Haggard, which demonstrated that brain responses before "free will" choice. Further, other studies have demonstrated a clear unconscious component in driving action (Haggard & Libet, 2001). For instance, Pessiglione et al. (2007) have shown that unconscious brain responses can learn correct actions and choices even in the absence of any awareness of such learning. This assertion has been shown to rely on subconscious associative learning between subliminal signals present in a given situation and choice outcomes. This assumption originally rested on observations that rewards and punishments shape behavioural responses in species allegedly lacking conscious awareness. In addition, studies have found that the "conscious" ventromedial prefrontal cortex seems to come online only after a decision has been made, suggesting that "conscious action" is a misnomer.

These findings highlight another problem in the fundamental assumption of AIDA model, where no difference has been recognized between conscious and unconscious decisions. Moreover, the AIDA model has not also recognized the fact that unconscious decisions are typically prior to conscious feelings of choice.

Pricing as one of the main factors in buying processes has been identified to have a significant effect on individual's brain activity and subsequently their decision-making during purchases. For instance, in the study by Knutson, Rick, Wimmer, Prelec, and Loewenstein (2007), it has been stated that the excessive prices, which evoke negative effect on customers. The excessive price increases insular activities, on the other hand, decreases activity in medial prefrontal regions. This statement confirms the somatic marketing model that has been proposed by Bechara and Damasio (2005). The somatic marketing model declares that individuals' brains outline anticipated results of purchases via interoceptive signals. These interoceptive signals are prior to decision-making, which then direct choice, and ultimately action in customers. In regard to the pricing, two pathways of decision-making and actions by consumers have been discussed by Jones, Childers, and Jiang (2012). The first one has been referred to the familiarity and recollection aspects, where consumers basically use their previously stored information, even the fuzzy memory traces to judge the prices, logically, and take action in the purchasing process (Vanhuele & Drèze, 2002). On the other hand, the second pathway has been referred to the consumer's emotional judgements based on their preferences, where the acceptance or rejection of a certain item has been depending on whether the customers like or dislike that certain product.

Based on our overall understanding and an in-depth analysis of the modern neurobiological basis of decision-making in humans, it can be concluded that AIDA model is not applicable and substantially problematic. Therefore, it can be asserted that a reframing of the model needs to encompass both conscious and unconscious streams of action. Consequently, the model shall consider massively parallel systems, where A, I, D, A have two parallel systems, a conscious and an unconscious. The conscious system must only occur for certain level of unconscious process, whereas unconscious processes can occur without the necessity of consciousness. We suggest that reframed model can be "Au", "Iu", "Du", "Au" and "Ac", "Ic", "Dc", "Ac" where u stands for "unconscious" and c stands for "conscious".

5. Conclusion

Even though the importance of all four stages of Attention, Interest, Desire and Action has been fully signified in neurobiological studies in marketing, this does not comprehensively support the idea of being considered as the suitable sequences in marketing models. Moreover, it does not completely rhyme with the proposed stages of neuromarketing by neurobiological studies. Scrutinizing of AIDA model of marketing communication based on neuroscience in this research revealed that the AIDA model is now can be considered as the outdated marketing model. Therefore, there is a hope that it will be replaced by a neuroscience model that starts with a model from scratch in order to provide more specific details that need to be considered in marketing. The differences of opinion behind every individual action in various contexts itself suggested that much deeper behavioural decision-making studies are required in order to come up with the model, which could cover all aspects of human behaviour in the market. Moreover, according to prior studies, it has been demonstrated that human brain regions are activated differently in each individual based on their genetic variations, personality and traits. Therefore, obviously the neuromarketing model must be substantially more complex from a neuroscience perspective than the proposed process of AIDA model. Based on neurobiological perspective, which is not being fully completed yet, decision-making can be studied in different aspects such as reward-based decision-making, value-based decision-making or goal-oriented decision-making, where researchers specifically focus on only one factor to assign the sequences and steps of decision-making in different context. Thus, it shows how difficult and complicated it is to come up with only one general model in marketing to cover every aspect.

In this article, we combined some of these neurobiological-based ideas according to recent studies to illustrate how complex the comprehensive marketing model can be. The first stage in marketing can be proposed to be representation and attention, where consumers must identify their choices set and saliency of their options. The steps where consumers will realize whether they "want and need to" or just "like to" take an action in order to purchase a specific product. The Researchers have identified various factors that help marketers to grab the consumer's attention in the market, each of which should be focused separately, including reward and motivational processing, which is depending on the activation of brain regions of striatum, vmPFC and ACC, emotional enhancement and attractiveness of an advertisement. However, there are other factors like brand preferences, which lead the consumer's attention directly to the specific product by activation of regions in MPFC and precuneus. The Brand preferences form usually based on the previous experience of the individuals and their memory-associated areas such as hippocampus and dlPFC/SFG. It has been proved that recalling the specific brand in consumers is directly related to the encoding of memory structures in the left brain and the dlPFC, medial temporal lobe structure(Glascher et al., 2012; Rangel, Camerer, & Montague, 2008). After all, the existence choices have been identified and consumers' attention has been grabbed, each individual tends to show different behavioural preferences immediately, which encodes by brain systems such as vmPFC and dlPFC or in some context they tend to evaluate each single choice and subsequently compare the identified predicted values first, and then select an action in order to make appropriate decisions (Camus et al., 2009; Plassmann, O'Doherty, & Rangel, 2007, 2010). Again, it is worth mentioning that these behavioural reactions might differ when different factors are used in attention-grabbing phase. When consumers take an action and make their decision, they generally enter the phase of experiencing, where they also can evaluate the desirability of the outcome of their responses to internal and external stimulus. This has been noted as considerably important stages because it directly leads to the learning process and affects the consumer's future decision-making for a long time period.

In sum, as mentioned earlier the neuroscience studies and understanding of consumer behaviour traits over the past decades don't decline the importance and neurobiological basis of attention, interest, desire and action in the marketing, but it does confirm that this proposed sequences of AIDA model cannot be suitable in the market anymore and there is a considerable need to replace the appropriate model for the marketing fields. To conclude, we have put the spotlight on the new directions in which neuroscience might bring about a revolution within marketing communication models. These directions will constructively revolutionize the AIDA models' sequences towards

altering into an effective and efficient marketing communication model. The proposed stages of "neuromarketing by neurobiological studies" which have been scrutinized in this research effort, should be a cause for significantly changing the model. This research opens a new horizon in marketing communication spheres in which its future direction indicates that the modified version of the AIDA model of marketing communication can be re-modelled considering the proposed stages of neuromarketing by neurobiological studies in this research.

We hope this endeavour provides researchers with exciting new perspectives and ideas for their future work in marketing communication strategies with the aim of advancing our understanding of the psychological and physiological aspects of response hierarchy models.

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Note
1. "Broca's and Wernicke's areas are historical references to certain frontal and temporo-parietal brain regions related to language production and language perception, respectively. Today, the concepts of Broca and Wernicke have been replaced by more contemporary labels and understandings of these intricate systems. However, for the current purpose, the current labels suffice our aims of this paper."

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