Evolution of Neuromarketing and Its Applicability in On-Demand App-Based Services in India: A Theoretical Perspective

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Neuromarketing is a multidisciplinary area encompassing seemingly disparate fields of studies like neuroscience, consumer psychology, consumer economics and marketing. Its application sits on the foundation of consumer neuroscience concepts and it relies upon neuroimaging tools and techniques for its application. Neuromarketing goes beyond the research ability to help marketers put into action the insights generated through neuroimaging tools and techniques. This paper explains the foundation of neuromarketing and its areas of application with a focus on new-age on-demand app-based consumer services. The authors point out that existing research under neuromarketing needs a specific case-in-point approach for app-based services due to their inherent difference from traditional products and services. The authors conclude the paper listing the challenges associated with the application of neuromarketing. The authors have relied on an extensive literature study that spans across the fields of neuroscience, neuromarketing, consumer psychology and buying behavior, and on-demand app-based services. This paper would help marketers fathom the applications of neuromarketing in their respective businesses, leading to efficient consumer profiling, which in turn may lead to better returns on their marketing investments.

Introduction

The human brain is made up of more than 100 billion neurons that function in tandem with each other to decide and respond to a lot of triggers. These could be the seemingly simplest ones, like which hand to raise when we want to ask a question, to more complicated ones like which toothpaste to buy from a range of available choices, and to most complicated ones like, which show to pick next to binge on Netflix?

Customers go through a range of emotions and decision-making inside their brain which they express (and sometimes do not) through their purchase journey. For example, as we wander about a supermarket, our brain unceasingly processes loads of inputs in terms of visuals, text, audio as well as triggers from external environment and compares all this information with past experiences to arrive at a decision that you would want to purchase or not purchase a particular brand of product (Eberhart, 2018).

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Difficult as it may sound, the decision-making gets even more complicated in case of new-age on-demand app-based services. This is due to uncommon business models including innovative pricing strategy as well as novel reward and recognition strategies that make information processing about these services more complex and decision making more difficult. For example, the show which you want to binge on Netflix and the toothpaste which you want to pick up from a store may come across similar choices but they are very different due to inherent differences in how these choices are made by the human brain due to the dissimilar landscape in which these choices are laid out in front of the customer.

Marketers have always wanted to look at how customers respond to specific triggers, for example, a particular price or an offer, packaging, or even advertisements. Efforts have been made to try and uncover the mysteries behind the art and science of marketing by understanding consumers' buying behavior (Agarwal and Dutta, 2015). Neuromarketing, which is often considered as a blend of neuroscience and marketing (Olteanu, 2012), aims to achieve that by better understanding a consumer's brain and explaining how consumer motivation, emotion, preference, and intention take shape in it (Uprety and Singh, 2013).

Neuromarketing has been preceded by the advancement in the field of neuroscience and its application in the domain of consumer psychology.

Thus, consumer neuroscience as an interdisciplinary field combines psychology, neuroscience, and economics to study how a consumer's brain is affected by various marketing stimuli, and is the foundation of neuromarketing (Lee *et al.*, 2007).

Consumer neuroscience, in itself, is helped by the development in the field of neuroimaging, which refers to the visual scanning of brain as a response to external triggers in the marketing mix, like pricing and advertising. These tools record electrical or magnet activity in the brain aided by neurons that allow the researchers to identify the parts of the brain that are most activated by an external stimulus (Ariely and Berns, 2010).

These methods have fared better than the traditional methods of consumer research for many reasons. For example, the inconsistency between the actual emotion and the expressed emotion by the consumer, or the inability of the research questions to pinpoint the actual response expected from the consumer for a stimulus (Falk *et al.*, 2012). This is also since subconscious or unconscious processes in the brain play a significant role in decision making which are difficult for the subject himself to point out, even if he tries to (Uprety and Singh, 2013; and Fortunato *et al.*, 2014). Methods under neuromarketing can help in analyzing brain response without requiring an active cognitive or conscious participation of the subject which resolves the aforesaid challenges (Morin, 2011).

Neuromarketing has found its application in various fields of marketing. Researchers have generated insights with the help of neuroimaging tools in trying to understand the response of consumers towards brand responses like brand perception (Litt and Shiv, 2012), brand evaluation (Esch *et al.*, 2012) and brand preference (Venkatraman *et al.*, 2012). Other areas of marketing where researchers have used neuromarketing techniques to explain consumer response towards marketing stimuli are product pricing (Plassmann *et al.*, 2007) and advertising (Treleaven-Hassard *et al.*, 2010).

While researchers have been able to generate insights about consumer behavior triggered by external marketing stimuli, most of this research is on traditional products and services. The new-age on-demand app-based consumer services have not been the target of this research extensively. These services are inherently different from the traditional products and services, as discussed in detail later in this paper; the brain region activity in response to certain triggers may not reflect the correct and complete reality.

For example, new-age pricing methods like freemium and subscription-plus, or innovative rewards and recognition methods may trigger the brain response in a slightly different manner than the normal cost-plus pricing or traditional media-based advertising may trigger. To add, these businesses are social media natives which leads to a natural integration between these app-based services and various social media platforms, which may have implications too.

Neuromarketing and Its Evolution

Brain imagining tools which were once a domain of medical professionals have quickly transcended boundaries and come to the rescue of consumer researchers, also in the process expanding the field of neuromarketing. These tools help researchers in understanding the functioning of the nervous system better. Their application in disparate fields, including that of the consumer psychology and marketing, has only added to its diverse nature of their application (Garcia and Saad, 2008). This laid on the hope that neuroimaging as a methodology would optimize marketing efforts by revealing more accurate consumer preference that were otherwise difficult to identify (Ariely and Berns, 2010).

Lee *et al*. (2007) defined neuromarketing as a field of application of neuroscientific methods to analyze human behavior concerning the markets. This definition presents neuromarketing as a cross between areas of consumer research which is consumer behavior and the area of brain function, namely, cognitive neuroscience. Cognitive neuroscience is used towards utilizing neuroimaging technology as a way to understand the functioning of the mind. But without the actual mapping of brain points, it was challenging to ascertain how and when these spots in the brain stimulated. Bechara and Damasio (2005) and Kenning and Plassmann (2005) have pointed towards the critical role that emotional or non-rational decision-making plays while displaying specific consumer behavior. As researchers recognized the constraints that they faced in their ability to

explain the buying behavior of customers through traditional research (Belk, 1975), the domain of consumer behavior research through neuroscience using brain imaging tools picked up.

Saad (2007) tried to explain the consumer behavior and various underlying attributes like learning, motivation, perception, attitude, decision-making, emotions and personality by recognizing the Darwinian process of evolution. Growing recognition about the concept of neuromarketing has prompted the demand to include examining situational influences on behavior. Consumer researchers have long tried to identify the attitudes, motivations, and buying preference as a part of overall buying behavior of target customers.

Theories and models that are applied for consumer research have evolved dramatically (Bagozzi *et al*. 1999). Qualitative research techniques play an important role when it comes to determining consumer perceptions and motivation which are key aspects in trying to study consumer buying behavior (Richie and Goeldner, 1994) which comes handy for neuromarketing too.

However, it is to be noted that the consumer response to various marketing stimuli is quite different than a conscious verbal response to an imagined marketing stimulus as part of a personal interview or an Focus Group Discussion (FGD). Ben-Akiva *et al*. (2019) posited that direct elicitation of stated preferences, perceptions, expectations, attitudes, motivations, choice and intentions as expressed by the customers is valuable information about consumer behavior but can be misleading. This is because the responses evoked from the customers by direct elicitations differ from responses evoked in the true or similar set of real markets. This is supported by Morin (2011) as he argued that since emotions (and feelings) play a critical role in information processing and response by consumers, it is difficult to pinpoint at the emotional cue accurately. This is accentuated by the fact that decision-making is difficult since there is a cognitive process involved in this response which has conscious (easy to identify and cite) and subconscious (difficult to identify and pinpoint) components to this process.

Indirect factors like the incentives offered to the customers, the time taken in the experiment, and peer pressure do have their effect too. Decision-making research has a lot to gain from the study of perspective preferences of individuals, instead of following the behaviorist tradition of focusing on the observation of what people choose or say they would choose (Yoon *et al*., 2012). However, physiological responses that are to be collected while the consumers are indulging in an experience with a marketing stimulus that would lead to a response, is difficult for the subject, even if the subject tries his best.

This is because the identification and articulation would eventually affect the brain in a different manner than what it would be had there been no interference in the experience. This is amplified by variations in social situations too which will definitely have a powerful effect on subjects (Cacioppo and Petty, 1985). This gap has been looked upon by the researchers for a long time to bridge. Being able to elicit the right response in a natural or artificial setting, hence has to be looked at from a different perspective.

In this endeavor to understand consumer psychology and attributed behavior, researchers have delved deeper into the origin of consumer responses, the brain. Neuroimaging or scanning of the brain to understand its function and which regions in the brain are responsive to what kind of external or personal cue. As this area experienced rapid progress, it led to the emergence of other associated fields like—neuropsychology (understanding psyche through the study of cognitive processes), neurophysiology (understanding the function of our nervous system) and neuromarketing (Morin, 2011).

The term neuromarketing was coined at the advent of this century by Smidts *et al*. (2019) but the concept in itself had emerged much earlier. The advancement in neuroscience research was held back for some time as brain and brain activity was not clearly understood (Madan, 2010). The advent of neuromarketing and its ability to evaluate the neurological aspects of consumer behavior much accurately led to more research in the area. Lee *et al*. (2007) defined neuromarketing as the application of neuroimaging techniques to sell products but that would be too simplistic a way to define something which is much more complex, in application and function. While the end objective of a business can be to sell but it is not a binary operation. Marketing works in a funnel process where the customer is encouraged by internal and external stimuli to take or avoid a step further towards the end of the funnel. Each action that a consumer takes or does not take is a function of cognitive as well as affective aspects related to the consumer's brain. Certain stimuli influence the consumer's brain more strongly than others while some stimuli affects it positively while others do that negatively.

It is worthwhile for marketers to understand what stimuli lead to what results and hence which are more important stimuli for eliciting a favorable action from the target customer. Neuromarketing, with its tools that can map the brain and its underlying activities, can help in doing just that. This is quite similar to another application of neuroscience called neuroeconomics, which is the application of neuroscientific methods to analyze and understand economically relevant behavior of consumers (Kenning and Plassmann, 2005).

Lee *et al*. (2007) expanded the definition of neuromarketing as the application of neuroscientific methods to analyze and understand human behavior about markets and marketing exchanges. So neuromarketing aims to identify and study various parts of the brain when it is exposed to external marketing stimuli.

By doing this, researchers can pinpoint the areas in the brain which are stimulated, and what usually ignites them, for example perception, feeling or emotion. This allows for a more detailed and targeted study of the anatomy of the brain in context with decision-making including but not limited to purchase decisions (Adolphs *et al*., 2005).

Neuromarketing requires brain imaging which allows for visual mapping of the brain concerning a response evoked due to marketing stimuli. Subsequently, with the help of

the visuals of brain activity at the time of the experience, it helps in analyzing how the brain sees choices and makes decisions (Burne, 2003).

It is essentially based on mapping a specific (or a set of) neural in the brain with a specific buying behavior attribute such as brand preference or emotion (Madan, 2010). Neuromarketing, due to its effective mapping between external marketing stimuli and the evoked consumer response, has an advantage over more traditional forms of market research techniques (Kosslyn, 1999; and Taher, 2006). While a major part of extant research on neuromarketing is restricted to the study of brand and consumer behavior (Lee *et al*., 2007), there have been some specific areas where neuromarketing has been used for research purposes. Some of these are exposure and preference for TV advertisements (Young, 2002),

Neuroscience for Neuromarketing

Consumer neuroscience is considered to be a result of cross-learning and application between consumer psychology and neuroscience (Kenning and Plassmann, 2005; and Lee *et al*., 2007). It is a study of the nervous system to understand the biological basis of consumer behavior (Plassmann *et al*., 2012). It helps in analyzing how different regions of a brain participate and engage in response to a stimulus (Morin, 2011).

Humans are predominantly visual creatures and most of the incoming information received by the brain is visual in nature (Koch, 2004). Inside the human brain, the visual system usually takes two ways to process information that is received. First, the dorsal visual pathway is activated during spatial sense deployment. Which means it is activated for responses to the questions like 'where' and 'how'? It cuts through the visual cortex, occipital lobe, posterior parietal cortex and up to the dorsolateral prefrontal cortex (dlPFC).

The second way is when the information passes through the ventral visual pathway, when the brain is looking to the answer object recognition questions like – "What is it?".

Some of the regions in the brain which are responsible for processing external stimulus are critical when it comes to understanding consumer psychology. The cerebellum is a small part of the brain which is responsible for emotional and cognitive functions. The occipital lobe gets a heightened activity whenever there is a visual input that is to be processed by the brain. The temporal lobe, on the other hand, is responsible for responses like product recognition, brand and product memory (experience), and even episodic memory which is significant in recalling a particular experience. The parietal lobe is responsible for self-awareness which plays an important role in self-expression and can lead to how consumers behave in a public setting. The frontal lobe and prefrontal cortex are responsible for various functions like working memory, brand or product preference, and most importantly, decision making. The parietal part of the brain has a sensory strip which is responsible for responses to stimulation. Plassmann *et al.* (2008) concluded in their study on the impact of choice ambiguity on the brand preference that the brain

areas that were involved in brand interaction during choice ambiguity are ventromedial prefrontal cortex (vmPFC) and anterior cingulate (AC).

On a similar line, the medial prefrontal cortex (mPFC) has been linked with brand familiarity as well as a product familiarity, apart from being a critical link between brand information and response (Madan, 2010). Research also suggests that activity in reward-related regions of the brain, notably the lateral orbitofrontal cortex (lOFC) and ventral striatum (VS) are predictive of future purchasing decisions (Berns and Moore, 2011). The ability of individuals to hold a certain piece of information, in particular, engages the dlPFC, the area responsible for working memory. It is important in keeping together an experience that may affect the association of a customer with a particular brand. The vmPFC is another critical brain region that is believed to be important in the assessment of brands preference after decision making (Santos *et al*., 2011).

The part of the brain that is involved in memory and emotions, is the hippocampus. Table 1 summarizes these regions of the brain which are of importance when it comes to studying consumer psychology (Harmon-Jones, 2003; Knutson *et al.*, 2003; Chib *et al.*, 2009; and Plassmann *et al*., 2012).

Table 1: Different Parts of the Brain That Respond to Specific Consumer Behavior Attribute During Neural Activity Triggered by External Marketing Stimuli

Brain Region	Emotion Demonstrated
Dorsolateral prefrontal cortex (dlPFC)	Preference, Memory and knowledge Favorable association
Medial prefrontal cortex (mPFC)	Preference Familiarity Judgments
Lateral orbitofrontal cortex (lOFC)	Experience Reward function Decision prediction
Ventral striatum (VS)	Learning Preference Motivation Reward function Decision prediction
Nucleus accumbens (NAcc)	Learning Preference Motivation Judgment of loss versus gain
Hippocampus	Memory and knowledge

Table 1 (Cont.)

Brain Region	Emotion Demonstrated
Anterior cingulate cortex (ACC)	Response resolution Conflict Ambiguity
Ventromedial prefrontal cortex (vmPFC)	Value judgment Prediction Experience Favorable associations Preference Processing emotions for decision-making
Insula	Favorable associations Judgment of loss and gain
Ventral stream	Object identification
Dorasal stream	Potential action to a stimuli
Occipital lobe	Visual attention
Stratum	Long-term favorable emotion Favorable association
Parietal cortex	Long-term favorable emotion Favorable association

Tools and Techniques Used in Neuromarketing

While the connection between brain activity and consumer cognition was established much earlier (Alwitt, 1985), it was the advancement in the fields of neuroscience and neuroimaging that has led to strides in the area of neuromarketing. The development of sophisticated neuroimaging tools to analyze the brain activity of consumers in response to an external stimulus has strengthened these advancements. Neuroimaging tools allow researchers to observe and compare brain activity during a specific event and hence identify specific areas of brains based on response to a stimulus. Researchers then can pinpoint the impact of an external stimulus like packaging, pricing, promotion offers and advertisements, etc. by looking into the neural activities in brain.

Neuromarketing tools which measure brain activity could be categorized into – (1) tools that record metabolic activity in the brain; and (2) tools that record electrical activity in the brain (Calvert and Thensen, 2004; Kenning *et al.*, 2007; and Zurawicki, 2010). While multiple techniques fall under each of these two categories, some of the critical ones under each category, specific to consumer neuroscience and marketing applications are:

Tools and Techniques That Record Metabolic Activity in the Brain

Functional Magnetic Resonance Imaging (fMRI): fMRI technique is based on using an MRI scanner to visualize the change of blood flow in the brain. When there is a brain activity, there is a sudden surge in requirement of energy for some regions in the brain. This is delivered to these regions of brain in the form of more oxygenate blood flow, which are recorded by fMRI as BOLD (acronym for Blood Oxygen Level Dependent) signals. This change in reception of oxygenated blood flow by some regions in the brain

distorts the magnetic field emitted in our blood which is recorded by fMRI scanner. In a typical marketing application, researchers use fMRI to observe the mapping of blood flow to different areas of the brain to understand more intimately the brain activity during a particular response, for example, a purchase decision. Researchers observe the regions of the brain where neural activity is increased and the brain draws a bigger blood supply in these regions (Eser *et al.*, 2011). The fMRI technique uses a giant magneto to track the blood flow throughout the brain as test subjects respond to visual, audio, or even taste cues.

Running an fMRI scanner costs researchers up to $1,000 per hour, and studies often use 20-30 subjects (HBS Working Knowledge, 2013). State-of-the-art MRI scanners cost approximately $1 mn per Tesla and have annual operating costs of $100,000-$300,000 (Ariely and Berns, 2010).

Positron Emission Tomology (PET): In PET scan, the subject is injected with a radioactive ligand into the bloodstream and then the accumulation of the ligand in the brain which is in response to an external stimulus is imaged by looking for glucose distribution or metabolism of the brain. Between fMRI and PET, fMRI is preferred for its precision and ability to be used in different areas (Plassmann *et al.*, 2012).

Tools and Techniques That Record Electric Activity in the Brain

Electroencephalography (EEG): A human brain has billions of neurons which form neural circuitry in the brain that produces electric signals in response to external stimuli. Hence, EEG measures the electrical activity happening in the brain, right under the scalp. EEG is conducted with the help of electrodes which are attached to a helmet that is worn by the subject. However, since it measures electrical activity right under the scalp, it has a poor spatial resolution, that means it cannot locate the actual internal regions of the brain which are responsible for a particular response (Morin, 2011). On the bright side, it has a very high temporal resolution (milliseconds) and can, therefore, detect brief neural events too (Ariely and Berns, 2010). However, since the customer can move around with the helmet (HBS Working Knowledge, 2013), this technique allows a test where mobility can be a factor, like tracking response to external stimuli during retail shopping. EEG equipment however cost much lesser at less than $10,000 a unit as compared to fMRI set up (Ariely and Berns, 2010).

Magnetoencephalography (MEG): This is a much more expensive technique but has an advantage of higher temporal resolution and also since it measures the magnetic field, has a better spatial resolution than EEG. Brain activity is a function of electrochemical signals between neurons. Neural activity creates a magnetic field that can be amplified and identified by MEG.

Due to this, the spatial resolution of MEG and temporal resolution are both better than EEG. Further, MEG is most sensitive to superficial cortical signals and hence can

even measure the weak magnetic signals in the brain. A MEG set-up costs approximately $2 mn (Ariely and Berns, 2010).

fMRI due to its superior ability to image deep brain structure is the most frequently used brain imaging technique for neuromarketing. This although its temporal resolution is slow. fMRI scanners are also quite expensive but more widely available than MEG equipment. Hence, fMRI has quickly become the preferred option for the application of neuroimaging and neuroscience in the field of consumer research and neuromarketing (Morin, 2011).

Application of Neuromarketing

While a major part of extant research on neuromarketing is restricted to the study of brands and consumer behavior (Lee *et al.*, 2007), there have been some specific areas where neuromarketing has been used for research purposes. For example, exposure and preference for TV advertisements (Young, 2002). In this experiment, the ad was broken into multiple small moments and then measured attention to each of these smaller parts from the subject. In another research, Rossiter *et al.* (2001) studied if certain specific visuals have a disparate influence on how information is processed by memory. It also showed a differentiated recognition of different visuals expressing familiarity and association.

The brand familiarity which has been defined by Campbell and Keller (2003) as habituating (or getting used) to a brand has been another area for application of neuromarketing. It has allowed researchers to understand how the familiar and unfamiliar (new) brands elicit a response in the brain from a target customer (Schaefer *et al.*, 2006; and Schaefer and Rotte, 2007). Another research tried to understand product preference which is argued as a factor of positive association accomplished by the brand or the product. Kable and Glimcher (2007) argued that preference for a product or brand is related to the mPFC.

Also, activity in mPFC was found to be a measure of predicting future purchases by the customer (Knutson *et al.*, 2007). When consumers are required to choose between brands with one of the brands being a preferred brand, ventromedial prefrontal cortex (vmPFC) sees heightened activity (Deppe *et al.*, 2005).

The same research also pointed out that the activity in the anterior cingulate cortex (ACC) could predict if a person is biased towards a brand name. Similarly, when a customer is asked to imagine driving his favorite brand's car, the VS observes heightened activity. Not surprisingly, activity in this area also correlates with perceived luxury (Schaefer and Rotte, 2007). Interestingly, patients with a damaged or dysfunctional vmPFC showed no observable bias due to brand information while comparing between Coke and Pepsi during open tasting research (Koenigs and Tranel, 2008). In a study specific to brand recall, Klucharev *et al*. (2008) found an increased brand recall for

expert endorsement, which was associated with the left hemisphere, the ventromedial prefrontal cortex (vmPFC), and medial temporal lobe regions of the brain.

Researchers have also looked at various aspects of sales negotiations and have concluded during a negotiation that emotion as well as cognition play an important role. There is also a heightened activity in the brain when the consumer perceives that the offer or deal in question is unfair. This may help to reduce post-purchase cognitive dissonance among the customers by making the negotiation smoother and coming up with deals that are perceived as fair by the consumers (Sanfey *et al*., 2003).

Ambler *et al*. (2000) studied the differential activity in the brain when the subject is exposed to two different kinds of advertisements. They studied this using MEG experiments and concluded that different cortical centers are activated when the nature of the advertisement is cognitive or affective. The fact that different parts of the brain are activated for different kinds of advertisements also means that the way the information is processed, stored, and later recalled may also be different. This can help in creating advertising elements that trigger positive feelings upon exposure (Senior and Lee, 2008; and Ohme and Matukin, 2012). It can also help companies to avoid those elements in advertisements that cause consumer aversion for the products (Fugate, 2007).

Efforts have also been made to analyze the nature and rationale for consumer choices using neuroimaging research. Braeutigam *et al.* (2004) studied how choices made are different based on predictability. It was concluded that different regions of brains are activated when the choice made is predictable versus non-predictable. Unpredictable choices made see heightened activity in the brain region which is associated with rewards.

In another research conducted in Germany, a team of scientists published a study showing how the brain unconsciously prepares our decisions, several seconds before we consciously decide what we are going to do. And the scientists argued that the outcome or a decision taken can be predicted by looking at specific regions of our brain (Hannaford, 2013). This can find tremendous application in forecasting and prediction science.

One of the most significant studies done in the consumer research space in the domain of neuromarketing is the study done by McClure *et al*. (2004). The researchers experimented using fMRI to understand the neural correlated behavioral preference between Coke and Pepsi. The experiment was conducted in two different conditions – (1) anonymity concerning what beverage the respondent was consuming; and (2) available information cue to respondents about the drink they were consuming.

Interestingly, in the first case, lack of brand information led to sensory feeling-based predictions, while in the second condition, the brand knowledge about Coke had a dramatic influence on the expressed behavioral preference. The associated emotion,

feeling and preference of the brand played a significant role when the brand knowledge was stimulated due to the information cue before the experiment.

This experiment sheds light on the difference in brand preference when brand information is known and not known. In case the brands are kept anonymous, the preference is based on the sensory information, which is reflected in the activity in the vmPFC region of the brain. But when the brand knowledge is shared, in this case about Coke and Pepsi, sensory information played only a limited part, while a major part in creating a preference is played by the hippocampus, dlPFC and stratum.

Several brands have applied the insights from the data emerging from neuroimaging techniques as part of their neuromarketing endeavor. Frito-Lay used the EEG technology to determine that consumers respond strongly to the fact that eating Cheetos turns their fingers orange with residual cheese dust. This led to the creation and launch of a campaign to engage the customer with the brand mascot and several tasks. It was well received and went on to win the Grand Ogilvy Award from the Advertising Research Foundation (HBS Working Knowledge, 2013).

In an experiment conducted by Berns and Moore (2011), the researchers found that by using fMRI the relative popularity of a music track could be predicted with the help of brain response. The brain response-based predictions were then matched with the popularity of these songs after three years.

It was found that the activity within the VS of the brain was significantly correlated with the number of units sold. Another research study by Innerscope Research in 2012 showed 40 film trailers to more than 1,000 volunteers. Then they measured various physiological and neural pointers like heart rate, breathing, how much they sweat and motion responses—as well as what they focused on using eye-tracking technology. Eventually, with the help of this data, they were able to predict the box office collection and the money that these movies would most likely make (Hannaford, 2013).

The Emergence of On-Demand App-Based Services

On-demand app-based services have seen a rise in user penetration in the past decade. These apps offer service to the user with the help of a strong technology component (Bhave *et al.*, 2013; and Bond, 2014).

On-demand app-based services offer a solution while leveraging their core competency, the technical expertise. These services more often than not bring together two different sets of customers. One set of the customer is usually the supplier of the service, while the other set is the buyer of the service. These have often been referred to as multi-sided platforms (Evans and Schmalensee, 2016). A key difference between the on-demand app-based services and traditional services is the interdependence of demand between the supplier and the buyer of the service. These services are based on the more

contemporary problem-solution construct and not on the product consumer one (Wani, 2013).

Customers adopt these on-demand app-based services for their convenience and reliability. These are also the factors that ensure repeat use of the app-based services by the users. This is aided by the ease of access and usage as well as trust laid upon by the users on this service (Jeon *et al.*, 2016). Sundararajan (2016) cited the sustained growth in hardware power, bandwidth, storage and miniaturization of digital devices as a key enabler in the rise of these services and penetration. Rising penetration of social media among the population has also helped several digital platforms grow at a fast pace.

Hence, these services are required to build trust and be able to recognize social cues so that the young users of these apps let them into their 'social circle'. On the same lines, online reviews operate as governing and sometimes even as self-regulating mechanism for these companies. The social-ness in the landscape has led to a recast in the hierarchies of businesses where the social buzz created due to the C-to-C conversations may replace these hierarchies. The role of data analytics is critical due to minimum to no human face in the delivery of the service and also because of heavy reliance these platforms have on data to generate actionable insights. Analytics sitting in Big Data enables efficient user-tracking that helps in behavior prediction which in turn improves decision making (Akter and Wamba, 2016).

Some of the global giants in their respective domains that offer on-demand app-based services are Airbnb, Uber, Khan Academy, Netflix and Tinder. In India, such multi-sided, on-demand app-based service platforms are in various domains like food aggregators, on-demand cab, over-the-top platforms, online education and e-commerce. For example, Swiggy and Zomato, the top food aggregators in the country are bringing together two different sets of customers, the restaurants (the seller of the service) and the buyers (the buyers of the service). Ride-hailing apps like Ola as well as Uber, have been competing for the top spot ferociously in the Indian market.

Many more such services are there competing in the Indian market in domains like entertainment (Hotstar), online learning (Byju's), and online dating (Bumble, etc.). In the following section, literature in these domains is reviewed to understand the motivation and buying behavior of customers engaging with these apps.

Consumer Buying Behavior for On-Demand App-Based Services

Unlike traditional products and services, on-demand app-based services are different in multiple aspects. On-demand app-based services are multi-sided platforms that often skip over the human touch. This means that there is a technological interface to interact with not just during the operation but also during the feedback. Tay *et al.* (2014) argued that trust plays an important role in the acceptance of technology (or technology-based service). On-demand app-based platforms have technology and automation at

the core of their service, hence it is imperative that the consumers are able to trust these platforms (Glancy, 2012).

The consumers of the app-based platforms which functions as the marketplace has to trust not only the service but also the platform. However, this trust is not one-sided. While the consumer has to trust the service provider, the service provider has to trust the consumer too when access is provided by the platform (Airbnb hosts are offering access to guests, while Zoom cars offer cars to the customers) (Hawlitschek *et al*., 2016). Barbu *et al.* (2018) cited trust as the most important factor that plays its role in shaping consumer behavior towards on-demand services.

Thus, the presence of a rating system which in turn leads to building trust between the service provider and the customer is critical for these apps. Looking at regions in brain which correspond to heightened activity related to favorable association and preference, the dlPFC, VS, hippocampus and stratum can be studied to understand the response function to trust enabling factors. Since on-demand app-based services are accessed from smartphones, it makes it 'almost' integrated to other apps in the users' phone. This means that the distance between the service app and social media apps are practically nothing. Individuals like to share their lives on social media that encompasses brand and services they use. This means that the service performance and experience is not confidential between the service provider and the customer but is also exposed to everyone who is engaged with the customer through one of the other social media platforms or review pages.

The need to share social which could be sharing information, reviews, feedback and even a 'check-in' has been well documented by various researchers (Sethu and Saini, 2016; and Koufie and Kesa, 2020). While the growing trend of electronic word-of-mouth (e-WOM) communication on purchasing intention and buying behavior of millennials is established, altruism was a major factor leading them to that (Koufie and Kesa, 2020). Social sharing could be a function of seeking validation or sharing the reward or recognition experience due to association with a service or product as part of a social value demonstration. The lOFC and VS which are responsible for experience-based reward function as well as motivation are closely associated with the need for validation sought by the consumers.

Another aspect concerning certain on-demand app-based services is a wide variety of options available in terms of the service provider and almost absolute control on certain apps as to what does the user want to engage with. This forces the consumer to make more decisions than they would make in case of a traditional service, and that too with much more choices at hand. This is especially critical since the brain activity related to choice and decision-making is at play multiple times when the service is being accessed (Glancy, 2012). The choices activate the brain functions related to decision-making based on information processing for evaluation of probable loss or gain. The lOFC, VS, nucleus accumbens (NAcc), vmPFC and insula are some of the regions of the brain which see heightened activities during information and emotion processing and decision

making. Analysis of these areas could predict the preference among the consumers for various marketing stimuli.

The value offered by on-demand app-based services can be categorized into – (1) convenience (2) time advantage (3) control over choices (for sellers as well as payment) and (4) economic value (due to competitive prices offered by the app-based service). Time advantage and convenience identified as valence helps in releasing time and money resources for consumers, hence reducing the search and transaction frictions (Quinones and Augustine, 2015) that affect consumer satisfaction positively (Barbu *et al.*, 2018). This is in line with the research by Möhlmann (2015) which showed that user's self-benefit, cost-saving and utility affect the satisfaction and purchase intent of the consumer. The economic part allows the customer to choose an option based on their analysis with regard to the value being offered in terms of predicted profit or loss. This utility analysis influences satisfaction which in turn affects consumer purchase intention (Barbu *et al.*, 2018).

This has been supported by Panse *et al.* (2019), in their study, about consumer behavior towards food aggregators. They found that a significant motivation to use food aggregators was the value that they offered in terms of convenience and cost advantage. The analytical decision-making based on utility, or probable gain or loss activates NAcc, VS and mPFC and insula, while vmPFC works to process the judgment based on the value offered during the transaction.

The role of influence a customer has from friends and family over his or her choice for service is also explained by Sethu and Saini (2016). This is the behavior shaped to reduce the risk and possible loss in the transaction (Fung So and Hudson, 2017). The VS and NAcc is activated as the user learns about the new product or brand from his/her connections, while the mPFC shows activity when a familiar brand is invoked. However, their own experience, learning, judgment and memory about the experience play a critical role in the choice of food aggregator by the customers. dlPFC mPFC, hippocampus and vmPFC respond to these emotions in brain. Rubenking *et al.* (2018) argued that binge-watching on Netflix is a result of anticipation, arousal and excitement, escapism, and social goals like co-viewing, discussing content with others, and even social sharing. These emotions activate the lOFC and VS which are responsible for experience-based reward function in the brain. The social sharing aspect after binge-watching Netflix content has also be corroborated by the research conducted by Matrix (2014).

To encourage and engage its users, these services also offer rewards and recognition to its users while also encouraging them to share it on their social networks. For example, Khan Academy offers rewards to its users on solving certain questions or group of questions. This would activate the lOFC and VS of the brain. The same is also true for the other online platforms that offer rewards and recognition in the form of a certificate to its users completing the course. The associated reward function here is the ability to

share these certificates online with your friends and peer that makes it lucrative for people. Hence, the motor function in the brain in the region VS and NAcc will be activated with these actions (Thompson, 2011).

In their research on motivation for young people to be on Tinder, a dating app, Sumter *et al.* (2017) found that the users are motivated to join Tinder for reasons such as love, casual sex, ease of communication, self-worth, validation, thrill and excitement and trendiness. These motions act as motivations and hence would activate the VS and NAcc regions of the brain which are witnessing heightened activity in these areas when the motivations are analyzed before making a decision, like deciding to create an account on Tinder, while vmPFC would be activated when the emotions and information available is processed for decision making. It is to be noted that there is a fair share of judgment process about loss and gain before a decision is implemented which activates Insula, NAcc and mPFC in the brain. These regions are also activated when consumers try to reduce their acquisition risks by following the bandwagon effect (Vonhaz, 2020) which encourages users to adapt to these apps and use them due to adoption by initial adopters or by a large group of people (Talukdar *et al.*, 2002).

Most decisions that consumers take are driven by one or many factors as discussed in this section. The neural network in the brain is activated and shows heightened activity in a specific region of the brain, depending upon what information is fed as an input and what is the expected outcome. Consumer psychology for the acquisition of app-based on-demand services is comprised of various triggers, inputs and responses. Underlying elements like emotions, feelings, motivations, judgment and experience shape consumer response which shows in the concerned regions of the brain. An understanding of relation between the stimuli and neural activity, specific to on-demand app-based platforms, could shed light on underlying processes that lead to decision-making with respect to preference and purchase intention for service brands.

Applicability of Neuromarketing for On-Demand App-Based Services

On-demand app-based services have a different value landscape than traditional products and services because these platforms often offer the convenience, flexibility and control, aided by factors like reliability and speed of service, which is the core of the service. The value offered in these terms may invoke the emotions differently leading to the activity in the brain but in a different manner. More critical is the definition of the terms used to express the mapping of the response with a region in the brain. For example, the definition of loss and gain becomes subjective in new-age on-demand app-based service. This is due to (1) unconventional business models (2) innovative payment structure and (3) high engagement through rewards and recognitions associated with these services.

Unconventional Business Models

Most of the on-demand app-based services are based on the multi-sided platform concept as explained by Evans and Schmalensee (2016) where they have two sets of customers,

one which will provide service (without the platform's direct involvement) and the other one which receives service. While the platform is trusted for the service, the actual service is performed by someone else. It has two major implications. First, it means there may be different service workers (one who is performing the service) (Zeithaml *et al.*, 2012) every time the service is consumed. Second, this service cannot be directly attributed to the platform one is using. The implication is what happens to the consumer behavior elements like familiarity, experience, knowledge and trust when the service provider is changing every time, even when the service platform is the same. Also, who gets the benefit and blame for good or bad service and how much? Does it translate into added or subtracted brand preference or brand loyalty for the platform or the service performer?

App-based platforms are dependent on enablers which ensure the overall service speed and reliability of the service. These enablers, though are part of the overall eco-system of the service, are not part of the services cape, for example, the data provider who provided data with a reliable network and acceptable speed or Google Maps which provides help with the direction for the location. These play a critical role to ensure that the service performance is satisfactory.

However, in an event of service failure, which can be attributed to these enablers, does it then change underlying elements of consumer behavior towards the service platform like experience, memory and preference?

Innovative Payment Structure

On-demand app-based services do not have the same price structures as traditional businesses that have a simple sell-buy equation. These apps bring two sets of entities on board. One which sells and the other which buys.

Hence, unlike a simple question which the traditional businesses have to ask – "At what price should I sell to make enough profit", on-demand app-based services have multiple questions to ask (Evans and Schmalensee, 2016). They need to know whom to charge, how much to charge and how to set relative prices for the two entities. Since the two entities on the platform are interrelated, prices on either side affect the demand on the other side. To add, pricing realities for these platforms may also be based on external factors like delay sensitivity and entity interdependence (Taylor, 2018).

Due to the pricing complexities associated with on-demand app-based service platforms, the judgment about the loss and gain may not be easily comprehensible for the customers, which on the other hand can be easily mapped to NAcc and insula in the brain. Such pricing structure may also lead to ambiguity among the customers, especially since the pricing structure and magnitude keeps on changing with these platforms. Finally, price perception's influence on consumer behavior (Liao *et al.*, 2008) makes this critical to be analyzed differently than the traditional services.

Higher Engagement Through Rewards and Recognition

On-demand app platforms are modeled to not just engage with the customers but also encourage customers to share and advocate, in order to grow. These apps encourage cross-communication between apps, especially the platform, social media, and the review apps (including iStore and Google Play Store) aided by rewards and recognition. Trust has been established as a major source of motivation for customers to use on-demand app-based services.

Hence, customer-to-customer conversations online, i.e., e-WOM, are an essential part of the service communication. While implicit in nature, these play an important role in the overall experience, leading to association and preference. However, it must be noted that social sharing may not always be about genuinely reviewing a service but simply be a factor of the bandwagon effect or worse merely for rewards and recognition. Hence, the need and the motive for sharing in case of on-demand app-based service may not be assumed in line with sharing in case of traditional products and services, and hence need a relook with platform-specific responses.

Consumer behavior and its expression are also affected by various drivers outside the domain of marketing stimuli. For example, the satisfaction derived out of a service is also a factor of the pre-service expectation and service experience. The expectations, in turn, are dependent on a host of factors that may not be related to the product or service at all. Personal and situation factors could create an aberration in what would normally be a consumer's behavior under ideal circumstances for the given marketing stimuli (Zeithaml *et al.*, 2012). This is especially true with the on-demand app-based services since the precise review management and heightened engagement often hypes up customer expectations from these services.

Neuromarketing can play a critical role in identifying differences in responses to marketing stimuli between on-demand app-based services and traditional products and services. As discussed, multiple factors would warrant a more specific application of neuroimaging-based neuromarketing on on-demand app-based platforms. This can be implemented with foundational segregation of these services based on parameters as discussed earlier. Application of neuromarketing would help marketers make informed choices with regard to various marketing handles, like solution preference, pricing structure and communication, courtesy deeper actionable insights. Neuromarketing can also be fruitful in determining the benefits to customers from both the traditional and app-based services and by using these insights to create customer-friendly hybrid services.

Challenges in the Application of Neuromarketing

There are certain challenges in the application of neuromarketing and converting insights into actions, which must be worked around to achieve desired results. Tools and techniques used in neuromarketing are applied on a small set of subjects, usually due to its cost.

While it is expected to give precise brain activity to understand the response to a particular stimulus, it is not clear if the neural signals of a small group of individuals are predictive of the consumer behavior of a larger population (Ariely and Berns, 2010). This is also of importance since the cost of undertaking this research, especially using fMRI and MEG is high. While brain activity in specific regions of the brain shows the response to particular marketing stimuli, the intensity of activity may be a bit difficult to ascertain. This restricts the wider application of the results.

While the brain may predict the actual response to marketing stimuli, this can still have some contribution from external factors that may be out of control. The extent of these factors and their contribution to the magnitude of the activity recorded in the brain may be difficult to decipher. This may lead to impure insights leading to limited decision-making ability.

Another challenge in the application of neuromarketing and insights generated is the difference between what is experienced and what action is actual taken. While neuromarketing is touted as bridging the difference between what is said 'is liked' versus what is actually liked, this could just be half the problem. The other half of the problem could be, what if the brain response does not corroborate with the desired action? For example, preference for a particular service as depicted by neural activity in the concerned region of the brain is not followed up with the purchase decision. There could be multiple reasons for this divergent behavior between choice and purchase? While one of the simpler explanation to this anomaly is the difference between brand preference and purchase ability to buy, there can be more complex explanations too. Often social and cultural aspects like values, beliefs, and family may influence the final purchase decisions of certain products and brands. For some products, customers may altogether avoid buying them, even though they had shown heightened brain activity during the neuroimaging experiment showing preference for these product, or even showing predictable buying.

So while neuromarketing has tremendous potential in analyzing consumer behavior and its underlying elements, marketers must take cognizance of its limitations and challenges too. By accounting for these limitations, marketers can have more realistic expectations from neuromarketing which can be applied to practical use to improve on marketing efforts.

Conclusion

Neuromarketing has been growing at a fast pace, courtesy advancement in the neuroimaging tools and techniques like fMRI, PET, EEG, and MEG. While there are many other techniques for neuroimaging, fMRI and EEG are the most used techniques.

Marketers have always wanted to be able to look into the human brain to understand why they buy what they buy, neuromagining quite literally allows them to look into

human brains and make sense of how customers decide concerning various product and brands. These techniques allow researchers to look into the brain's activity and generate insights concerning customer's attitudes and feelings about a product, or a marketing stimulus. Marketers, in turn, can decide on new product launches, product pricing, advertising stimuli, and even predict how would a particular product do, pin-pointing at certain areas of the brain and concluding the triggers for activity in those areas.

Consumer behavior and its underlying elements like preference, feelings, motivation and intention are key to defining marketing mix for any organization but there exists a difference between traditional products and services and new-age on-demand app-based services. These apps have a different business model, pricing structure and ways to engage with their customers. To add, these apps do not necessarily offer value to the customers in the same way as for traditional products and services. There is a difference in how and why brain activity gets triggered for these on-demand app-based services, and that makes it imperative that neuromarketing application looks at these new-age services in a different light than how they have seen traditional products and services.

Neuromarketing, given a different consumer behavior journey of on-demand app-based services and varied motivations for the usage of these apps, can find specific usage. Its application may shed light on how brain activity differs for these services, and hence what happens when there is an integration of physical services with a virtual platform, together bundled as a 'service'. More specifically, how do consumer motivation, preference, familiarity, judgment and trust translate in the case of app-based service? On that basis, marketers can incorporate changes to their existing services and also design new products and services.

Neuromarketing for app-based products may also help in understanding the underlying triggers for app-heavy aspects like social sharing and online feedback. This could help in efficient use of engagement and better investment of the marketing dollars. However, neuromarketing like any other field of application has its challenges. The cost of conducting experiments is high and hence mass experiments are not always possible. The magnitude of neural intensity as captured by the brain may not always be decipherable which may present challenges in decision making. Also, brain activity can be affected by uncontrollable external factors which may be difficult to isolate.

There could be a discrepancy between how consumers respond to a trigger in their brain and how they response to that trigger in real world. Neuromarketing despite the cited challenges has emerged as a credible field to understand the consumer behavior in detail with the help of deep dive into the human brain. Its application in the field of consumer research and marketing at large, is set to grow with advancements in neuroimaging tools.

Limitations and Future Scope: This paper looks at the emergence of neuromarketing as an evolving area of research for marketers. While it discusses in detail the application of neuromarketing in analyzing consumer behavior, the focus has been restricted only to

on-demand app-based service. Also, the case in point discussed in the paper are limited to app-based services in the limited number of domains like personal transportation, food delivery, content streaming, online education and online dating. While these areas are disparate in terms of business models, platform functionality, pricing structure and servicescape, there is no way to establish that these are representative of all on-demand app-based service.

As for the direction of future research, there could be two branches of research based on this paper. In the neuroscience domain, neuroimaging experiments to ascertain the difference between the neural activity in the brain in response to marketing stimuli for traditional products and services versus on-demand app-based services can be undertaken.

Further, external factors while measuring various brain activities could be isolated and accounted for with a measure or an 'interference coefficient' that could be used in all future insights to get rid of the unwanted interference of external uncontrollable factors upon the neural activity. It would be worthwhile to also study differences, if any, within various app-based services. This would help in understanding if different nature of service lead to neural activities of different intensity in the brain.

In purely marketing domain, a comparison between the motivation and expressed preference for services between different app-based services could be measured. The researchers could also look at comparing the existing research concerning neural activity in the brain for traditional services and ascertaining if the outcome recorded after prediction in those cases would compare with the outcome as expressed by the customers for app-based services.

References

1. Adolphs R, Tranel D, Koenigs M and Damasio A (2005), "Preferring One Taste Over Another Without Recognizing Either", *Nature Reviews Neuroscience*, Vol. 8, No. 7, pp. 860-861.
2. Agarwal S and Dutta T (2015), "Neuromarketing and Consumer Neuroscience: Current Understanding and the Way Forward", *Decision*, Vol. 42, No. 4, pp. 457-462.
3. Akter S and Wamba S (2016), "Big Data Analytics in E-Commerce: A Systematic Review and Agenda for Future Research", *Electronic Markets,* Vol. 26, No. 2, pp. 173-194.
4. Alwitt L (1985), "EEG Activity Reflects the Content of Commercials Hillsdale", in L Alwitt (Ed.), *Psychological Processes and Advertising Effects: Theory, Research and Applications*, pp. 209-219, Lawrence Erlbaum, Hillsdale, NJ.
5. Ambler T, Ioannides A and Rose S (2000), "Brands on the Brain: Neuro-Images of Advertising", *Business Strategic Review*, Vol. 11, No. 3, pp. 17-30.
6. Ariely D and Berns G S (2010), "Neuromarketing: The Hope and Hype of Neuroimaging in Business", *Neuroscience*, Vol. 11, No. 4, pp. 284-292.

7. Bagozzi R, Gopinath M and Nyer P (1999), "The Role of Emotions in Marketing", *Journal of the Academy of Marketing Science*, Vol. 27, No. 2, pp. 184-206.

8. Barbu C, Florea D, Ogarcă R and Barbu M (2018), "From Ownership to Access: How the Sharing Economy is Changing the Consumer Behavior", *Amfiteatru Economic Journal*, No. 20, pp. 373-387.

9. Bechara A and Damasio A (2005), "The Somatic Marker Hypothesis: A Neural Theory of Economic Decision", *Games and Economic Behavior*, Vol. 52,September, pp. 336-372.

10. Belk R W (1975), "Situational Variables and Consumer Behavior", *Journal of Consumer Research*, Vol. 2, No. 3, pp. 157-164.

11. Ben-Akiva M, McFadden D and Train K (2019), "Foundations of Stated Preference Elicitation: Consumer Behavior and Choice-Based Conjoint Analysis", in M Ben-Akiva, D McFadden and K Train (Eds.), *Foundation: Consumer Behavior and Choice-Based Conjoint Analysis*, pp. 1-144, Now Publishers Inc., Hanover.

12. Berns G and Moore S (2011), "A Neural Predictor of Cultural Popularity", *Journal of Consumer Psychology*, Vol. 22, No.1, pp. 154-160.

13. Bhave K, Jaun V and Roy S (2013), "Understanding the Orientation of Gen Y Toward Mobile Applications and In-App Advertising in India", *International Journal of Mobile Marketing*, Vol. 8, No. 1.

14. Bond A T (2014), "An App for That: Local Governments and the Rise of the Sharing Economy", *Notre Dam L Review*, Vol. 90, No. 77, pp. 77-96.

15. Braeutigam S, Rose S, Swithenby S and Ambler T (2004), "The Distributed Neuronal Systems Supporting Choice-Making in Real-Life Situations: Differences Between Men and Women When Choosing Groceries Detected Using Magnetoencephalography", *European Journal of Neurosciences*, Vol. 20, No. 1, pp. 203-302.

16. Burne J (2003), "Inside the Mind of the Shopper: Neuromarketing: Brain Scans Now Offer the Slightly Alarming Prospect of Marketers Being Able to Track the Deepest Desires of Consumers and Target Their Advertising Accordingly", *Financial Times*, November 28, p. 13.

17. Cacioppo J and Petty R (1985), "Physiological Responses and Advertising Effects: Is the Cup Half Full or Half Empty?", *Psychological Marketing*, Vol. 2, No. 2, pp.115-127.

18. Calvert G and Thensen T (2004), "Multisensory Integration: Methodological Approaches and Emerging Principles in the Human Brain", *Journal of Psychology*, Vol. 98, Nos. 1-3, pp. 191-205.

19. Campbell M and Keller K L (2003), "Brand Familiarity and Ad Repetition Effects", *Journal of Consumer Research*, Vol. 30, No. 2, pp. 292-304.

20. Chib V S, Rangel A, Shimojo S and O'Doherty J P (2009), "Evidence for a Common Representation of Decision Values for Dissimilar Goods in Human Ventromedial Prefrontal Cortex", *Journal of Neuroscience*, Vol. 29, No. 39, pp. 12315-12320.

21. Deppe M, Schwindt W, Kramer J *et al*. (2005), "Evidence for a Neural Correlate of a Framing Effect: Bias-Specific Activity in the Ventromedial Prefrontal Cortex During Credibility Judgments", *Brain Research Bulletin*, Vol. 67, No. 5, pp. 413-421.

22. Eberhart B (2018), "How Companies are Using Neuromarketing to Influence What Brands You Buy", April 10. Retrieved from *Business Standard*.

23. Esch F, Moll T, Schmitt B *et al*. (2012), "Brands on the Brain: Do Consumers Use Declarative Information or Experienced Emotions to Evaluate Brands?", *Journal of Consumer Psychology*, Vol. 22, No. 1, pp. 75-85.

24. Eser Z, Isin F and Tolon M (2011), "Perceptions of Marketing Academics, Neurologists and Marketing Professionals About Neuromarketing", *Journal of Marketing Management*, Vol. 27, Nos. 7&8, pp. 854-868.

25. Evans D and Schmalensee R (2016), "Matchmakers", in D Evans and R Schmalensee (Eds.), *Matchmakers - Introduction*, pp. 1-2, HBS Publishing, Boston.

26. Falk E B, Berkman E T and Lieberman M D (2012), "Effects from Neural Responses to Population Behavior: Neural Focus Group Predicts Population-Level Media", *Psychological Science*, Vol. 23, No. 5, pp. 439-445.

27. Fortunato V, Giraldi J and Oliveira J (2014), "A Review of Studies on Neuromarketing: Practical Results, Techniques, Contributions and Limitations", *Journal of Management Research*, Vol. 6, No. 2, pp. 201-220.

28. Fugate D L (2007), "Neuromarketing: A Layman's Look at Neuroscience and its Potential Application to Marketing Practice", *Journal of Consumer Marketing*, Vol. 24, No. 7, pp. 385-394.

29. Fung So K K and Hudson S (2017), "Understanding Consumer Motivations Behind the Adoption of Mobile Applications", *International Journal of Contemporary Hospitality Management*, Vol. 29, No. 9, pp. 2218-2239.

30. Garcia J R and Saad G (2008), "Evolutionary Neuromarketing: Darwinizing the Neuroimaging Paradigm for Consumer Behavior", *Journal of Consumer Behaviour*, Vol. 7, Nos. 4&5, pp. 397-414.

31. Glancy D (2012), "Privacy in Autonomous Vehicles", *Santa Clara Law Review*, Vol. 12, No. 4, pp. 1171-1239.

32. Hannaford A (2013), "Neuromarketing': Can Science Predict What We'll Buy?", April 13, available at www.telegraph.co.uk/science/science-news/9984498/Neuromarketing-can-science-predict-what-well-buy.html

33. Harmon-Jones E (2003), "Clarifying the Emotive Functions of Asymmetrical Frontal Cortical Activity", *Psychophysiology*, Vol. 40, No. 6, pp. 838-848.

34. Hawlitschek F, Teubner T, Adam M *et al*. (2016), "Trust in the Sharing Economy: An Experimental Framework", Thirty Seventh International Conference on Information Systems, pp. 11-14, IE, Dublin.

35. HBS Working Knowledge (2013), "Neuromarketing: Tapping into the Pleasure Center of the Customers", February 1, available at www.forbes.com/sites/hbsworkingknowledge/2013/02/01/neuromarketing-tapping-into-the-pleasure-center-of-consumers/print

36. Jeon H M, Kim M J and Jeong H C (2016), "Influence of Smartphone Food Delivery Apps Service Quality on Emotional Response and App Reuse Intention – Focused on PAD Theory", *Culinary Science and Hospital Research*, Vol. 22, No. 2, pp. 206-221.

37. Kable J W and Glimcher P W (2007), "The Neural Correlates of Subjective Value During Intertemporal Choice", *Nature Neuroscience*, Vol. 10, No. 12, pp. 1625-1633.

38. Kenning P and Plassmann H (2005), "Neuro Economics: An Overview from an Economic Perspective", *Brain Res. Bull*, Vol. 67, No. 5, pp. 343-354.

39. Kenning P, Plassmann H and Ahlert D (2007), "Applications of Functional Magnetic Resonance Imaging for Market Research", *Qualitative Market Research: An International Journal*, Vol. 10, No. 2, pp. 135-152.

40. Klucharev V, Smidts A and Fernandez G (2008), "Brain Mechanisms of Persuasion: How 'Expert Power' Modulates Memory and Attitudes", *Social Cognitive and Affective Neuroscience*, Vol. 3, No. 4, pp. 353-366.

41. Knutson B, Fong G W, Bennett S M *et al*. (2003), "A Region of Mesial Prefrontal Cortex Tracks Monetarily Rewarding Outcomes: Characterization with Rapid Event-Related fMRI", *Neuroimage*, Vol. 18. No. 2, pp. 263-272.

42. Knutson B, Rick S, Wimmer G E *et al*. (2007), "Neural Predictors of Purchases", *Neuron*, Vol. 53, No. 1, pp. 147-157.

43. Koch C (2004), *Quest for Consciousness: A Neurobiological Approach*, Roberts & Company Publishers, Englewood.

44. Koenigs M and Tranel D (2008), "Prefrontal Cortex Damage Abolishes Brand-Cued Hanges in Cola Preference Social Cognitive and Affective", *Neuroscience*, Vol. 3, No. 1, pp. 1-6.

45. Kosslyn S (1999), "If Neuroimaging is the Answer, What is the Question?", *Philosophical Transactions of the Royal Society B (Biology)*, Vol. 354, pp. 1283-1294.

46. Koufie G and Kesa H (2020), "Millennials Motivation for Sharing Restaurant Dining Experiences on Social Media", *African Journal of Hospitality, Tourism and Leisure*, Vol. 9, No. 1, pp. 1-25.

47. Lee N, Broderick A and Chamberlain L (2007), "What is 'Neuromarketing'? A Discussion and Agenda for Future Research", *International Journal of Psychophysiology,* Vol. 63, No. 2, pp. 199-204.

48. Liao C H, Tsou C W and Shu Y C (2008), "The Roles of Perceived Enjoyment and Price Perception in Determining Acceptance of Multimedia-on-Demand", *International Journal of Business and Information*, Vol. 3, No. 1, pp. 27-52.

49. Litt A and Shiv B (2012), "Manipulating Basic Taste Perception to Explore How Product Information Affects Experience", *Journal of Consumer Psychology*, Vol. 22, No. 1, pp. 55-66.

50. Madan C R (2010), "Neuromarketing: The Next Step in Marketing Research", *Eureka*, Vol. 1, No. 1, pp. 34-42.

51. Matrix S (2014), "The Netflix Effect: Teens, Binge Watching, and On-Demand Digital Media Trends", *The Centre for Research in Young People's Texts and Cultures*, Vol. 6, No. 1, pp. 119-138.

52. McClure S M, Li J, Tomlin D *et al*. (2004), "Neural Correlates of Behavioral Preference for Culturally Familiar Drinks", *Neuron*, Vol. 44, No. 2, pp. 379-387.

53. Möhlmann M (2015), "Collaborative Consumption: Determinants of Satisfaction and the Likelihood of Using a Sharing Economy Option Again", *Journal of Consumer Behaviour*, Vol. 14, No. 3, pp. 193-207.

54. Morin C (2011), "Neuromarketing: The New Science of Consumer Behavior", *Symposium: Consumer Culture in Global Perspective*, Vol. 48, No. 1, pp. 131-135.

55. Ohme R and Matukin M (2012), "A Small Frog That Makes A Big Difference: Brain Wave Testing of TV Advertisements", *IEEE Pulse*, Vol. 3, No. 3, pp. 28-33.

56. Olteanu M D (2012), "Anatomy of Methodologies for Measuring Consumer Behavior in Neuromarketing Research", Conference: LCBR European Marketing Conference at: Munich Volume: ISSN: 2190-7935.

57. Panse C, Rastogi S, Sharma A and Dorji N (2019), "Understanding Consumer Behaviour Towards Utilization of Online Food Delivery Platforms", *Journal of Theoretical and Applied Information Technology*, Vol. 97, No. 16, pp. 4353-4365.

58. Plassmann H, O'Doherty J and Rangel A (2007), "Orbitofrontal Cortex Encodes Willingness to Pay in Everyday Economic Transactions", *Journal of Neuroscience*, Vol. 27, No. 37, pp. 9984-9988.

59. Plassmann H, Kenning P, Deppe M *et al*. (2008), "How Choice Ambiguity Modulates Activity in Brain Areas Representing Brand Preference: Evidence from Consumer Neuroscience", *Journal of Consumer Behaviour,* Vol. 7, Nos. 4&5, pp. 360-367.

60. Plassmann H, Ramsøy T Z and Milosavljevic M (2012), "Branding the Brain: A Critical Review and Outlook", *Journal of Consumer Psychology,* Vol. 22, No. 1, pp. 18-36.

61. Quinones A and Augustine A (2015), "Technology and Trust: How the Sharing Economy is Changing Consumer Behavior", November 19, available at https://www.bbvaresearch.com/wp-content/uploads/2015/11/151119_US_SharingEconomy.pdf

62. Richie B and Goeldner C (1994), *Travel, Tourism and Hospitality Research*, John Wiley, New York.

63. Rossiter J, Silberstein R, Harris P and Nield G (2001), "Brain-Imaging Detection of Visual Scene Encoding in Long-Term Memory for TV Commercials", *Journal of Advertising*, Vol. 41, No. 2, pp. 13-21.

64. Rubenking B, Bracken C C, Sandoval J and Rister A (2018), "Defining New Viewing Behaviours: What Makes and Motivates TV Binge-Watching?", *International Journal of Digital Television*, Vol. 9, No. 1, pp. 69-85.

65. Saad G (2007), *The Evolutionary Bases of Consumption*, Lawrence Erlbaum Associates, New Jersey.

66. Sanfey A, Rilling J, Aronson J *et al*. (2003), "The Neural Basis of Economic Decision-Making in the Ultimatum Game, *Science*, Vol. 300, No. 5626, pp. 1755-1758.

67. Santos J P, Seixas D, Brandão S and Moutinho L (2011), "Investigating the Role of the Ventromedial Prefrontal Cortex in the Assessment of Brands", *Frontiers in Neuroscience*, Vol. 5, June, pp. 1-8.

68. Schaefer M and Rotte M (2007), "Favorite Brands as Cultural Objects Modulate Reward Circuit", *Neuroreport*, Vol. 18, No. 2, pp. 141-145.

69. Schaefer M, Berens H, Heinze H and Rotte M (2006), "Neural Correlates of Culturally Familiar Brands of Car Manufacturers", *Neuroimage*, Vol. 31, No. 2, pp. 861-865.

70. Senior C and Lee N (2008), "Editorial: A Manifesto for Neuromarketing Science", *Journal of Consumer Behaviour*, Vol. 7, Nos. 4&5, pp. 263-271.

71. Sethu H S and Saini B (2016), "Customer Perception and Satisfaction on Ordering Food Via Internet, a Case on Foodzoned.Com, in Manipal", Seventh Asia-Pacific Conference on Global Business, Economics, pp. 1-13, Finance and Social Sciences, Kuala Lumpur.

72. Smidts Ale, Clement Levallois and Paul Wouters (2019), "The Emergence of Neuromarketing Investigated Through Online Public Communications (2002-2008)", *Business History*, doi: 10.1080/00076791.2019.1579194

73. Sumter S R, Vandenbosch L and Ligtenberg L (2017), "Love Me Tinder: Untangling Emerging Adults' Motivations for Using the Dating Application Tinder", *Telematics and Informatics*, Vol. 34, No. 3, pp. 67-78.

74. Sundararajan A (2016), *The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism*, The MIT Press, Cambridge, Massachusetts.

75. Taher N (2006), *Neuromarketing*, ICFAI University Press, New York.

76. Takada H and Jain D (1991), "Cross-National Analysis of Diffusion of Consumer Durable Goods in Pacific Rim Countries", *Journal of Marketing*, Vol. 55, No. 2, pp. 48-54.

77. Talukdar D, Sudhir K and Ainslie A (2002), "Investigating New Product Diffusion Across Products and Countries", *Marketing Science*, Vol. 21, No. 1, pp. 97-114.

78. Tay B, Jung Y and Park T (2014), "When Stereotypes Meet Robots: The Double-Edge Sword of Robot Gender and Personality in Human–Robot Interaction", *Computers in Human Behavior*, Vol. 38, September, pp. 75-84.

79. Taylor T (2018), "On-Demand Service Platforms", *Manufacturing and Service Operations Management*, Vol. 20, No. 4, pp. 704-720.

80. Thompson C (2011), "How Khan Academy is Changing the Rules of Education", July 15. Retrieved from Wired Digital.

81. Treleaven-Hassard S, Gold J, Ellman S *et al*. (2010), "Using the P3a to Gauge Automatic Attention To Interactive Television Advertising", *Journal of Economic Psychology*, Vol. 31, No. 5, pp. 777-784.

82. Uprety N and Singh B (2013), "Neuromarketing – A Tool of Selling to the Brian", *International Journal of Marketing and Technology*, Vol. 3, No. 8, pp. 98-107.

83. Venkatraman V, Clithero J, Fitzsimons G and Huettel S (2012), "New Scanner Data for Brand Marketers: How Neuroscience Can Help Better Understand Differences in Brand Preferences", *Journal of Consumer Psychology*, Vol. 22, No. 1, pp. 143-153.

84. Vonhaz A (2020), "12 Cognitive Biases E-Commerce Marketers Need to Know", *Neuroscience Marketing*, March 10.

85. Wani T (2013), "From 4Ps to Save: A Theoretical Analysis of Various Marketing Mix Models", *Business Sciences International Research Journals*, Vol. 1, No. 1, pp. 1-9.

86. Yoon C, Gonzalez R, Bechara A *et al*. (2012), "Decision Neuroscience and Consumer Decision Making", *Marketing Letters*, Vol. 23, No. 2, pp. 473-485.

87. Young C (2002), "Brain Waves, Picture Sorts®, and Branding Moments", *Journal of Advertising*, Vol. 42, No. 4, pp. 42-53.

88. Zeithaml V, Bitner M and Gremler D (2012), *Services Marketing*, 6th Edition, McGraw Hill.

89. Zurawicki L (2010), "Neuromarketing, Exploring the Brain of the Consumer", in L Zurawicki (Ed.), *Neuromarketing, Exploring the Brain of the Consumer*, pp. 42-53, Springer-Verlag, Berlin Heidelberg.

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