Analyzing the Strategic Role of Neuromarketing and Consumer Neuroscience

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Analyzing the Strategic Role of Neuromarketing and Consumer Neuroscience

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Advances in Marketing, Customer Relationship Management, and E-Services (AMCRMES) Book Series

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Mission

Business processes, services, and communications are important factors in the management of good customer relationship, which is the foundation of any well organized business. Technology continues to play a vital role in the organization and automation of business processes for marketing, sales, and customer service. These features aid in the attraction of new clients and maintaining existing relationships.

The Advances in Marketing, Customer Relationship Management, and E-Services (AMCRMES) Book Series addresses success factors for customer relationship management, marketing, and electronic services and its performance outcomes. This collection of reference source covers aspects of consumer behavior and marketing business strategies aiming towards researchers, scholars, and practitioners in the fields of marketing management.

Coverage

- Mobile Services
- Online Community Management and Behavior
- B2B marketing
- Data mining and marketing
- Cases on Electronic Services
- Web Mining and Marketing
- Cases on CRM Implementation
- Legal Considerations in E-Marketing
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Dedicated to my Mom and Dad: Cemile, Nazmi Atlı

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Neuromarketing is a relatively new concept. It is simply focused on the relationship between consumer behavior and the brain. For this purpose, it analyzes various customer behaviors towards the product and purchase by using various brain imaging techniques and behavioral methodology. Some limbic structures of brain such as ventral tegmental area (VTA), nucleus acumbens (NAc), and amygdala have a link to prefrontal cortex (PFC) by dopaminergic mesocorticolimbic pathway. This functional link is called brain reward system (BRS). BRS has a crucial role in the decision-making process of humans during shopping as well as addiction processes of brain. Studies investigating BRS in neuromarketing are very limited. In the chapter, working principles of BRS in neuromarketing and association with human shopping behaviors and shopping addiction/dependence has been investigated and discussed.

This chapter elucidates the origins and changes in understanding of neuroethics. An accent is then put on the role neuroethics should play. As a consequence, limitations in research are identified, especially in connection with ethical questions that had been proposed by philosophers in previous centuries. The urgency of their remarks has intensified due to the expansion of neuroscience. This theoretical part is subsequently enriched by practical aspects and ethical codes of which prescripts are key and neuromarketing practitioners are expected to obey them. Despite a growth of interest in neuroethics, the author presumes that the field still represents a ceaseless combat from within, and he claims that it may even remain invincible as a vicious circle. In conclusion, new trajectories are brought and considered together with recommendations and suggestions of new research possibilities as in case of political neuromarketing. This branch, however, perfectly illustrates the complexities associated with neuroethics.

Neuroscientific tools have increasingly been used by marketing practitioners and researchers to understand and explain several different questions that have been issued for a specific company or a general understanding. In this respect, the neuroscientific approach has been evaluated as a potential tool for understanding the neural mechanisms directly related to marketing with its contribution to providing novel perspectives. The chapter addresses one of the most relevant subjects, brands, for issuing the strategic role of applied neuroscience in marketing and consumer behavior. The first section of this chapter focuses on a novel definition of brand, and the next section covers the brand image, brand perception, and brand loyalty. The second section summarizes the main findings regarding the neuroscience of brands. In the final section, the findings from a related experiment have been provided for the potential roles of neuromarketing for developing marketing strategies for brands.

The purpose of this chapter, which is designed to measure where and how the consumer focuses in an advertising brochure, which visual is more striking, and how much eye strain (twitch) it takes, is to measure the density and visual attention of the eyes through the eye-tracking device during the individual examination. For this study, an experimental laboratory for neuromarketing research was used. After watching the videos and images of the participants in the eye-tracking module, the general evaluations were taken to determine what they remembered, and a comparison opportunity was born. According to the findings, logos, and photographs are more effective than texts. Viewers read large text and skip small text. Suggestions for future research are presented in the chapter.

The main purpose of this chapter is to concisely describe the origin of neuromarketing, its applications in the organization, and to explore consumer behavior with the help of different neuromarketing technologies like fMRI, EEG, and MEG. This chapter gives a guideline on how neuromarketing would be used in different areas of organization functions, like, brand management, advertisement, communication, product design, decision making, etc. with the help of data mining, artificial intelligence, social media, machine learning, remote sensing, AR, and VR. The chapter identifies the opportunities of neuromarketing with the latest technological development to understand the customer mindset so that it would be easy to formulate neurostrategy for an organization. This chapter gives a future research direction with strategic management, so that it will be helpful for a professional to create a more accurate strategy in a VUCA (volatility, uncertainty, complexity, ambiguity) environment, predict, and fulfill the "institution void" situation with more accuracy in an emerging developing market.

With the change and development of technology, the techniques used in marketing research have also changed. Quantitative and qualitative research techniques have been applied to traditional marketing research. Although these techniques are applied, the purchasing decision process of the consumer is not fully understood. The decision-making processes of consumers are more clearly understood thanks to the neuromarketing approach that arises as a result of the collaboration of marketing with neuroscience and the research methods applied as a requirement of this understanding. In this chapter, research methods used in the field of neuromarketing will be examined, examples of applications will be given, and suggestions will be made to academicians and practitioners.

Consumers experience retail environments through the encounters they have. Out of these, the oft-repeated ones become part of the way they experience the world, which lay down and solidify neural connections and firing patterns leading to sight, hearing, feeling, and doing. This 'doing' shapes consumer experiences. The foundation for such experiences is the fact that human brains are geared towards recognizing patterns and interruptions in patterns. To their benefit, retailers use information about the brain identifying patterns of experience and anomalies in those patterns. This knowledge makes sales promotions so fundamental for engaging buyers. Their visit to their favorite store is interrupted by a sudden discount or an alluring offer, which retailers are forever carrying out to seduce buyers. This chapter explores the neuroscience theories that equip the retailers to send out signals to entice buyers and covers applications of such theories in real retail encounters, including the role of dopamine and the brain, impulse buying, and the thrill of hunting deals.

Marketing research, dedicated to comprehending consumer behavior and purchasing practice, comprises methodical gathering, analysis, and interpretation of related data. Since the understanding of consumer behavior is a comprehensive and complicated task, the contemporary marketing studies argue that traditional marketing research should be supported by neuromarketing methods to explore consumers' psychology, motivation, and behavior. In this chapter, the advantages and disadvantages of traditional marketing and neuromarketing research methodologies and the differences between them are discussed. The traditional market research methods are explained through their qualitative and quantitative dimensions. The most commonly used grouping scheme of techniques in neuromarketing research is presented,

namely, neurometric, biometric, and psychometric techniques. The marketing research supported by neuromarketing approaches enables us to look at the consumers' mind as closely as we have never experienced before and opens up new horizons in understanding consumer and marketing relationship.

As the academic interest about start-ups grows, researchers explore reasons behind start-up failures or success stories, and they aim to develop guides for entrepreneurs to succeed. Literature suggests that marketing is one of the crucial fields for successful start-up companies, among many others. Meanwhile, marketing researchers have recently been paying growing attention to applying neuroscience techniques into the marketing field. Even with the rising popularity of neuromarketing research, start-up companies still fall short of using new era marketing tools due to high costs, although they compete with established firms that massively employ neuromarketing techniques in their marketing mix. In this chapter, it is discussed how helpful neuromarketing techniques could be for entrepreneurs as the success of start-up companies depend on efficient allocation of their severely scarce economic resources, and it is argued that publicly supported start-up hubs, in coordination with universities, shall help develop collective neuromarketing researches for the sake of cost cutting.

Consumer neuroscience is a quickly growing discipline that harnesses both theoretical principles and applied measures from the decision and affective neurosciences, along with psychophysiology and vision research, in order to explain and predict consumption behaviors. This discipline links several subfields, including neuroeconomics, social and affective neuroscience, and neuromarketing. This emerging field comprises both direct and peripheral measures of neural processing related to consumption behaviors. Consumer neuroscience complements traditional commercial research measures such as self-report, which can often be inaccurate and biased by anticipated or recalled, but not actual, consumption behaviors. All told, consumer neuroscience represents a unique field focusing on the consumer and the innumerable factors that affect individual preferences and consumption behavior. This chapter will provide a comprehensive overview of the field's history, key measures used, case examples of academic and commercial work, and a discussion of the field's continued bright trajectory.

Given increasing knowledge about how consumers communicate with texts, our understanding of how brain processes information remains relatively limited. Besides that, in today's world, advancing neuroscience-related technology and developments have changed the understanding of consumer behavior. In this regard, in the 1990s, consumer neuroscience and neuromarketing concepts were revealed. This new concept has brought a multi-disciplinary approach and new perceptions of human cognition and

behavior. For measuring consumer behaviors through a new alternative method, research has started combining traditional marketing researches with these new methods. This chapter explores how typeface knowledge from the brain functions using neuroscience technology and the importance neurosciences methodologies have for readability research. Moreover, this chapter will evaluate how typefaces affect the purchase decision of the consumers and offer an integrative literature review.

Chapter 12

This chapter discusses the opportunities and challenges involved in combining the two fields of neuroscience and talent management (often abbreviated as TM), starting from the assumption that the need to merge them is justified by their complementarities, rather than by the level of analysis they focus on. The authors discuss potential benefits and drawbacks for management research using methods obtained from cognitive neuroscience. Firstly, they discuss distinct advantages in applying techniques allowing researchers to track processes that are essential to the talent management field, warning that neuroscientific approaches and technologies are not commonly used. Secondly, they define main problems, which describe the limits within which management scientists can usefully apply these approaches. Thirdly, they suggest a new perspective that incorporates the complementary capacities of managers and neuroscientists to generate useful information and perspective for both disciplines.

Preface

Neuroscience has influenced marketing science in important respects over the past decade, and the connection between these two disciplines has created greater insights and understandings into customer behavior. In this regard, these recent developments contributed to the rise of a new research area called neuromarketing or customer neuroscience. In this book, chapter authors present an overview of the neuromarketing and consumer behavior applications, as well as practice and literature. It also introduces major trends expected to shape neuromarketing over the next years. Besides that, a chapter in this book, also coined the Neuro Talent Management term as very first in academic literature.

Analyzing the Strategic Role of Neuromarketing and Consumer Neuroscience is organized into 12 distinct chapters that provide comprehensive coverage of important topics. The chapters are:

1. Importance of Brain Reward System in Neuromarketing: Brain Reward System and Neuromarketing
2. From Philosophical Queries to Greater Dilemmas of Neuroethics
3. Consumer Neuroscience Perspective for Brands: How Do Brands Influence Our Brains?
4. Understanding Consumer Behavior Through Eye-Tracking
5. Neuromarketing Trends and Opportunities for Companies
6. The Science Behind Neuromarketing
7. Pattern Thinking: Understanding the Mind of the Consumer
8. Traditional Market Research and Neuromarketing Research: A Comparative Overview
9. Neuromarketing Insights for Start-Up Companies
10. Consumer Neuroscience: Evolution and Commercial Applications
11. A Neuromarketing Perspective for Assessing the Role and Impact of Typefaces on Consumer Purchase Decision
12. Applying Neuroscience to Talent Management: The Neuro Talent Management

The following paragraphs provide a summary of what to expect from this book. A brief description of each of the chapters follows:

Chapter 1, "Importance of Brain Reward System in Neuromarketing: Brain Reward System and Neuromarketing," by Tayfun Uzbay, investigates working principles of Brain Reward System in neuromarketing and association with human's shopping behaviors and shopping addiction/dependence.

Chapter 2, "From Philosophical Queries to Greater Dilemmas of Neuroethics," by Martin Petlach elucidates the origins and changes in the understanding of neuroethics.

Chapter 3, "Consumer Neuroscience Perspective for Brands: How Do Brands Influence Our Brains?" by Tuna Çakar and Yener Girişken, focuses on the main findings regarding the neuroscience of brands and the potential roles of neuromarketing for developing marketing strategies for brands.

In Chapter 4, "Understanding Consumer Behavior Through Eye-Tracking," by H. Serhat Çerci and Selcuk Köylüoğlu, the authors made an experimental laboratory for neuromarketing research, and they present findings and suggestions for future researches.

Chapter 5, "Neuromarketing Trends and Opportunities for Companies," by Arabinda Bhandari, gives a guideline on how neuromarketing would be used in different areas of organization functions with the help of data mining, artificial intelligence, social media, machine learning, remote sensing, AR and VR. Also, the author identifies the opportunities of neuromarketing with the latest technological development to understand the customer mindset so that it would be easy to formulate neurostrategy for an organization.

Chapter 6, "The Science Behind Neuromarketing," by Yetkin Bulut and Burak Arslan, examines research methods used in the field of neuromarketing and gives examples of applications to academicians and practitioners.

Chapter 7, "Pattern Thinking: Understanding the Mind of the Consumer," which was written by Tanusree Dutta and Soumya Sarkar. explores the neuroscience theories that equip the retailers to send out signals to entice buyers and covers applications of such theories in real retail encounters, including the role of dopamine and the brain, impulse buying, and the thrill of hunting deals.

Chapter 8, "Traditional Market Research and Neuromarketing Research: A Comparative Overview," by Sertaç Eroglu, Nihan Tomris Küçün, discusses the advantages and disadvantages of traditional marketing and neuromarketing research methodologies and the differences.

Chapter 9, "Neuromarketing Insights for Start-Up Companies," which was written by Arzu Çakar Girişken, discusses how helpful neuromarketing techniques could be for entrepreneurs as the success of start-up companies dramatically depend on efficient allocation of their severely scarce economic resources.

Chapter 10, "Consumer Neuroscience: Evolution and Commercial Applications," by Kimberly Rose Clark, provides a comprehensive overview of the field's history, key measures used, case examples of academic and commercial work, and a discussion of the field's continued bright trajectory.

Chapter 11, "A Neuromarketing Perspective for Assessing the Role and Impact of Typefaces on Consumer Purchase Decision," by Nihal Toros Ntapiapis and Çağla Özkardeşler, explores how typeface knowledge from the brain functions using neuroscience technology and the importance neurosciences methodologies have for readability research. Moreover, this chapter will evaluate how typefaces affect the purchase decision of the consumers and offer an integrative literature review.

Chapter 12, "Applying Neuroscience to Talent Management: The Neuro Talent Management," which was written by Dinçer Atlı, discusses the opportunities and challenges involved in combining the two fields of neuroscience and talent management (often abbreviated as TM), starting from the assumption that the need to merge them is justified by their complementarities, rather than by the level of analysis they focus on.

As you can see above, this book is based on qualified contributions of experts in the field of neuromarketing. I believe that *Analyzing the Strategic Role of Neuromarketing and Consumer Neuroscience* will provide readers from the academic community and business sphere (university students, scholars, professionals) with theoretical knowledge necessary for an in-depth understanding of neuromarketing issues at the level of theory and practical implications for all the sectors.

As an editor, I am pleased to offer this book that will empower students, researchers, and academicians with a strong understanding of important issues within neuromarketing by providing both broad and detailed perspectives on theories and developments.

Acknowledgment

Chapter 1
Importance of Brain Reward System in Neuromarketing

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ABSTRACT

Neuromarketing is a relatively new concept. It is simply focused on the relationship between consumer behavior and the brain. For this purpose, it analyzes various customer behaviors towards the product and purchase by using various brain imaging techniques and behavioral methodology. Some limbic structures of brain such as ventral tegmental area (VTA), nucleus acumbens (NAc), and amygdala have a link to prefrontal cortex (PFC) by dopaminergic mesocorticolimbic pathway. This functional link is called brain reward system (BRS). BRS has a crucial role in the decision-making process of humans during shopping as well as addiction processes of brain. Studies investigating BRS in neuromarketing are very limited. In the chapter, working principles of BRS in neuromarketing and association with human shopping behaviors and shopping addiction/dependence has been investigated and discussed.

INTRODUCTION AND BACKGROUND

The declaration of the new millennium as the brain century has further increased the popularity of the brain and the brain researches. In the past, brain research was carried out exclusively in the fields of medicine such as neurology, psychiatry, brain and neurosurgery, the biology of basic science and the psychology of social sciences. In this century, law, history, philosophy, various engineering fields, politics, economics, communication and ethics are joined to the neuroscience area and the period of interdisciplinary (multidisciplinary) brain studies started. Although some are challenging, new fields such as neurolaw, neurohistory, neurophilosophy, neuroengineering, neuropolitics, neuroethics and neuroeconomics have emerged and the number of interdisciplinary researches is increasing.

Recently, a new tool of marketing research called "neuromarketing" has evolved from brain researches that investigate an association with customer behaviors (i.e., decision-making processes during shopping) and brain activity. It is an adaptation of neuroscience to marketing. Neuromarketing has gained growing popularity in the academia as well as the commercial world and includes the direct use of brain

imaging, scanning, or other brain activity measurement technics such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), electroencephalography (EEG), eye tracking, pupil dilatation reflex (PDR) and magnetoencephalography (MEG) to record an individual's response to marketing products (Javor et al., 2013; Kumar and Singh, 2015). Thus, neuromarketing is a new exciting field with great potential for application in the practical zones of marketing, brand management and advertising. Human behavior and psychology, psychiatry, neurology and some other disciplines of social sciences such as sociology, ethics, economy, management and even law have a robust connection with neuromarketing (Breiter et al., 2015).

The human brain is approximately 1.5 kg in weight and places into our skull which a safe place. It is composed of %75-80 water, more than %10 lipid and %8 protein. It is divided into two part named hemisphere, left and right hemispheres connected by the corpus callosum. In Figure 1, a sagittal section of the right hemispheres of the brain including some important structures and formations are seen. Simply, we can evaluate the brain in two essential parts in aspect to emotion, drive, decision and behavior. These parts are the limbic system seeing in the red circle and frontal cortex.

Figure 1. Brain and some important structures and formations (NAc: Nucleus Accumbens; VTA: Ventral tegmental area)
Source: Modified from Morley, 2009; with the approval of the author.
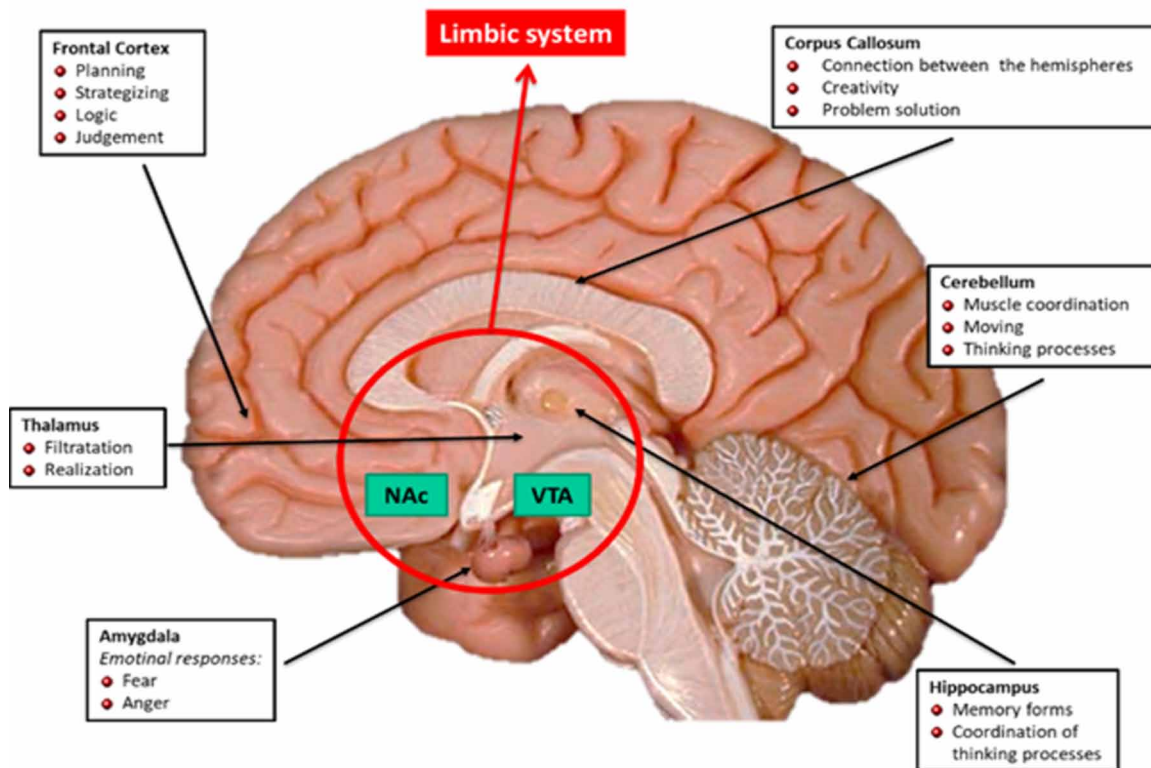
The limbic system includes some important anatomical and functional formations of the brain such as thalamus, amygdala, hippocampus and nucleus accumbens (NAc).

Thalamus is responsible for the functions of the brain involved infiltration and realization. Hippocampus is a center of memory. It is also associated with coordination of thinking processes. Amygdala is related to some excited feelings such as fear and anger. NAc and ventral tegmental area (VTA) located in the center of the limbic system generates the basis of the brain reward system (BRS). Two brain hemispheres are consolidated or connected to each other by dense fibers called corpus callosum. It is also associated with creativity and problem solution. The cerebellum is responsible for muscle coordination, moving and thinking processes. The frontal cortex of the brain is associated with planning, strategizing, logic and judgment. While the limbic part of our brain represents motivational and impulsive behaviors, the frontal cortex, especially in, prefrontal part of cortex (PFK) represents voluntary and decision-making processes and behavioral control against to impulsivity.

Sometimes, neuromarketing has also been associated to several exaggerated claims, such as control of consumer behavior by external interventions or the presence of a "purchase button" in the brain (Ariely and Berns, 2010). The ethical aspect of neuromarketing and whether it really can be a sub-discipline of neuroscience is already debated among scientists.

Figure 2. Major dopaminergic pathways in brain
Mesocortical and mesolimbic pathways or mesocorticolimbic pathway is directly related to reward and pleasure. Dopamine is a key neurotransmitter in this pathway (VTA: Ventral tegmental area; NAc: Nucleus accumbens, Am: Amygdale; Sep: Septum; Str: Striatum; SN: Substantia nigra; Th: Thalamus; Hyp: Hipotalamus; P: pituitary/Hypophisis; Hip: Hippocampus; C: Cerebellum)
Source: Uzbay, 2004.
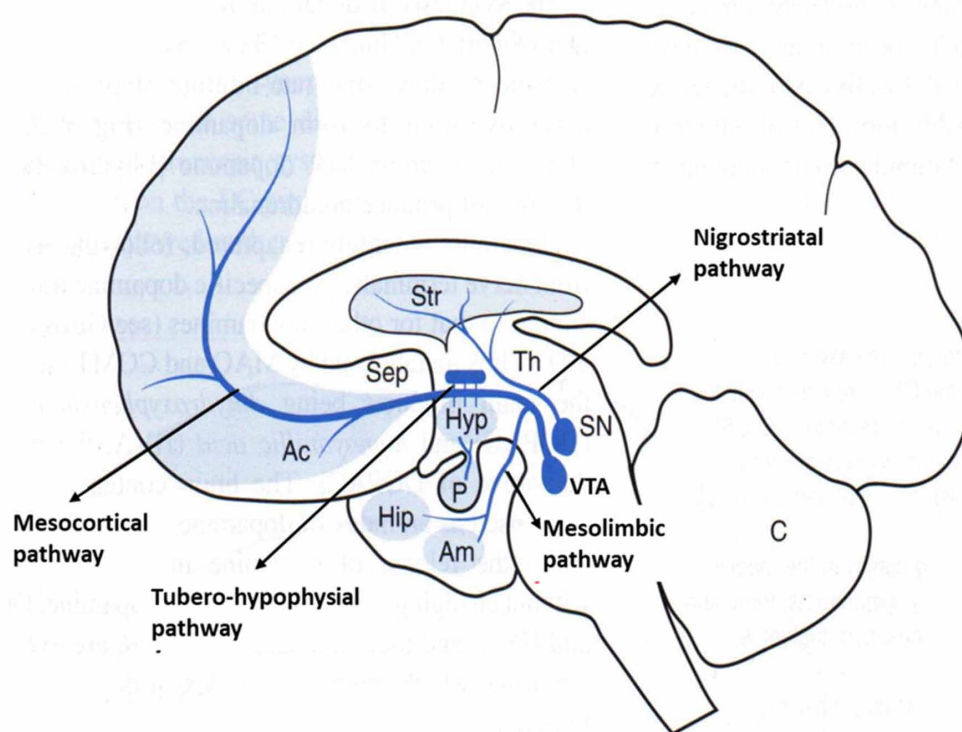
Organization of all motivational behaviors depends on the mesolimbic and mesocortical dopamine systems of the brain. A neuronal network beginning from VTA provides a neuronal communication link between VTA, NAc, amygdala, hippocampus and cerebral cortex. This network consists of two main neuronal pathways called mesocortical and mesolimbic pathways (Figure 2). Both pathways can also be named as the mesocorticolimbic pathway. The mesolimbic dopaminergic system plays an essential role in all motivated behaviors concerning various types of reward and pleasure (Wise, 2004; Salamone et al., 2007; Ballard et al., 2011; Berridge and Robinson, 1998; Watanabe and Narita, 2018). A mono-amine, dopamine, is a key neurotransmitter and mediates neuronal transmission in the network (Ballard et al., 2011; Baik, 2013). These structural elements and neuronal network can also be described as a human's pleasure center or BRS. BRS is one of the two major brain systems that consider fundamental to almost all human behaviors including pleasure-seeking and loss/pain avoidance systems (Peterson, 2005; Javor et al., 2013).

PFC, NAc and VTA are each directly occupied in motivation to obtain the reward: VTA neurons respond to reward cues and increase their activity before goal-directed behavior (Schultz, 1998; Fiorillo et al., 2003). The NAc is critical for interpreting motivational initiative into motor behavior (Goto and Grace, 2005). The PFC, exactly the dorsolateral part (DLPFC), is associated with the image and integration of goals and reward information (Miller and Cohen, 2001; Wagner et al., 2001; Watanabe and Sakagami, 2007). Physiological relationships between the VTA, NAc, and PFC are also important for performing reward-motivated behavior. These include dopamine release in the NAc following VTA activation (Fields et al., 2007; Roitman et al., 2008) and modulation of VTA responsivity by both the NAc (Grace et al., 2007) and PFC (Gariano and Groves, 1988; Svensson and Tung, 1989; Gao et al., 2007).

The decision of whether to purchase a product is the essential component of economic breakdown in marketing. Purchase decision has a biological baseline including some BRS components such as NAc (Glimcher and Rustichini, 2004; Knutson et al., 2007). A motivational input or stimuli inducing pleasure or reward is essential for purchase behavior and BRS modulates reward-based decision-making processes as well as other reinforcing events leading addiction i.e., using addictive chemicals, gambling, sportive or academical success and sugar. When considered from this point of view, purchase behavior may lead to shopping addiction that interest closely ethical and legal dimensions of neuromarketing.

The main goal of this chapter is to investigate and discuss the relationship between BRS and purchase behavior in frame of neuromarketing. In addition to this, the addictive dimension of purchase behavior via BRS will also be discussed.

BRAIN PARTS AND BRAIN FUNCTIONS

A neuron is a basic unit of the brain and neurons link up and communication with each other without have any contacting. Approximately 100 billion neurons exist in the brain. There is constant communication between the neurons. The communication is carried out by neurotransmitters such as dopamine, serotonin and noradrenaline releasing to space called synapse between pre and post synaptic neurons. Space is 0,1 nanometer or 100 Pico meters (one-100 million cm). Only one neuron can get ten thousand different communications with other neurons. So, there could be a billion synapses in the part so as a grid of brain or in a tissue of cubic centimeter contains communications as a number of stars in milky way galaxy (Uzbay, 2011).

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Adaptive capacity and the ability to sustain long-term changes as neural activity patterns are considered as the most critical and intriguing properties of the brain. This concept, called neuroplasticity or brain plasticity, refers to the ability of the brain to adapt and change over time (Uzbay, 2008; Dulac, 2010). Donald Hebb, a Canadian psychologist and behavioral neuroscientist, suggested that we can change our brain by learning something new, and these changes in the brain occur at the neuronal level. The brain can continuously remodel itself via changes in connections at the synaptic level (Hebb, 2009), and the Hebbian Theory forms the essential basis of synaptic plasticity, neuroplasticity, or brain plasticity. Terje Lomo from Oslo University and Timothy Bliss, a British Neuroscientist, described long-term potentiation (LTP) in 1973. LTP is a process required to adapt the amplitude of the neural response after repeated stimulation (Lomo, 2018). The potentiation of the response is sustained for a long time, and it is the molecular basis of learning.

Neuroplasticity represents the adaptation of the brain. It underlies all memory processes and is principally based on altered gene expression on the neuronal level (McClung and Nestler, 2008). Knowledge based on accurate information and adaptation is crucial for survival. Learning and memory, which are two of the most important activities on the neuronal level, are of key importance to accurate information processing (Figure 3).

Figure 3. The mechanism of learning and memory
Knowledge and adaptation according to accurate information are everything for survival. This process is carried out by neuronal plasticity modulated by several factors, such as second messengers, various neurotransmitters, and proteins, on the molecular level. ACC and FC are important brain areas for continuing and interpreting of attention to any internal or external stimuli that enter the brain. The dense neuronal circuit called the cingulum, which reaches out from the septum to the hippocampus, makes a significant contribution to producing several memories. These memories are converted to available behaviors that support decision-making and purchase or providing. BRS also directly influences to decision-making before purchasing or providing of a marketing product or other requirements (ACC: anterior cingulate cortex; FC: frontal cortex; Hp: hippocampus; VTA: Ventral tegmental area; BRS: Brain reward system; LTP: long-term potentiation; CREB: cAMP response element binding protein). Source: Modified from Uzbay et al., 2019.
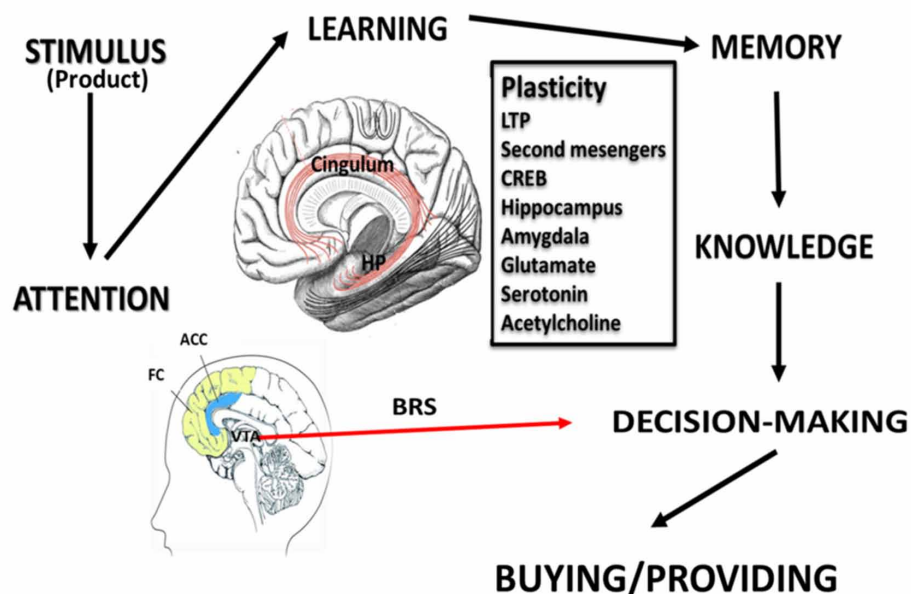
As seen in Figure 3, sustainable attention is also critical for learning and memory, and any problem in this area of the brain might lead to disorders such as attention deficit and hyperactivity disorder (ADHD) (Tian et al., 2006; Wang et al., 2018). The cingulum is a group of white matter fibers that arise from the cingulate gyrus to innervate the neurons in the entorhinal cortex, creating a path for communication between the prefrontal cortex and hippocampus, both of which are parts of the limbic system (Bruni & Montemurro, 2009). Thus, besides attention, the cingulum has a crucial role in visual and spatial skills and memory.

Capable and sustainable attention is the first important component of purchase behavior in neuro-marketing. If any marketing product does not attract your attention, you do not take care of it and do not buy it. Advertising and other strategies of marketing primarily based on attention. Following sustainable attention, learning, memory and other information processing processes in the brain results in having knowledge. Some crucial brain neurotransmitters i.e., serotonin, acetylcholine, glutamate and dopamine serve to the processes. Truth knowledge is a critical importance to provide our vital or other comfort increasing and pleasurable requirements. Having truth knowledge frequently results in a beneficial decision-making that supports a logical satisfy a need. However, this system does not work properly and logical every time, especially, you need some comfortable or pleasurable products. BRS can directly affect the decision-making process and may cause some inaccurate preferences (Figure 3, red arrow).

BRAIN REWARD SYSTEM (BRS)

Background

Paul Bloom, a psychologist and cognitive scientist from Yale University, suggested that many significant human pleasures are universal, and humans enjoy stimulation. Also, over time, new delighters may emerge. Louis Menand, a historian, writer and lawyer from Harvard University also said "Every aspect of life has a biological foundation in exactly the same sense, which is that unless it was biologically possible it wouldn't exist" in The New Yorker at November 2002 (Marcus, 2009). Indeed, human pleasure is the result of biological processes taking place in the brain and BRS is responsible for all biological processes involved in pleasure.

Is there a center of pleasure and reward in the brain? The beginning of the studies seeking answers to this question goes back to the beginning of the 1930s. Burrhus Frederic Skinner, an American psychiatrist and writer from Harvard University, invented Skinner Box in 1931. He measured operant conditioning by this equipment and described positive and negative reinforcement. Many addictive drugs and pleasure objects produce positive reinforcement in mammals. A reinforcing stimulus increases the probability of that class of responses that immediately precedes it; the presentation of a reinforcing stimulus is a reinforcement. Skinner noted that "Some reinforcements consist of presenting stimuli of adding a something for example, food, water, or sexual contact to the situation. These we call positive reinforcers" (Kelleher and Gollup, 1962). Pleasurable and rewarding objects or events were also positive reinforcers. Positive reinforcement has a key role in the development of pathological drug seeking behavior.

Is there a center of positive reinforcement in the brain? Answer to this question came in 1953. James Olds and Peter Milner from Mc Gill University showed that electrical self-stimulation of the septal area of the brain produced positive reinforcement in rats. In repeated experiments, the intracranial cannula was placed in different parts of the brain and the frequency of electrical stimulation of the rats

was monitored. When stimulation was received in some areas, such as the septal area and immediately below the NAc, the number of pedal presses increased abnormally. Thus, they suggested that this area may be a reward center of the brain (Olds and Millner, 1954). Since NAc is important for DA release, it was discovered that DA is a reward neurotransmitter. The drugs that induce hedonic and reinforcing effects also elicited a similar effect.

The mesolimbic dopamine pathway seen in Figure 2 regulates the psychophysiology of the reward. Positive reinforcement and motivational behaviors are modulated by the mesolimbic dopaminergic system. Dopaminergic nerves starting from VTA give widespread projections to prefrontal cortex via NAc and amygdala. In addition to various drugs and substances, all pleasant events trigger dopamine in this pathway, causing it to be sensed. Dopamine is considered as basic enjoy or reward neurotransmitter and NAc and/or VTA in the center of limbic area is accepted as the reward center of the brain (Wise & Bozarth, 1985; Koob, 2006; Yuan et al., 2019). An urban legend says that serotonin is a happiness hormone, but it is not true. While dopamine is responsible for motivational behaviors reward, pleasure and euphoria via mesolimbic pathway (Koob, 2006), serotonin is due to functions such as mood, memory processing, sleep, cognition and nociception via serotonergic pathways (Giordano and Schultea, 2004; King et al., 2008; Mendelshon et al., 2009; Silber and Schmidt, 2010; Švob Štrac et al., 2016).

BRS is activated by all addictive substances, gambling, shopping, internet and social media activities, sportive or academical success, some enjoyable hobbies and some foods such as chocolate and ice-cream.

Importance of PFC

The PFC is located just behind the forehead where the skull is the thickest and hardest. Since the skull is a structure that protects the brain from physical interference, this forehead is the best protected part of the brain. This region of the brain is very prominent in mammals, and the species that occupy the most space in the brain is human. It accounts for approximately 30% of all brain shells in humans, 17% in chimpanzees, 7% in dogs, and 3.5% in cats (Andreasen, 2001). There is a point in human being taking up more space than the species close to him. Man is a voluntary entity. It decides whether to perform an action imposed by desire and impulses first and after a certain reasoning process. The analysis also includes the benefit/ loss ratio that will result in you turning the incoming warning into behavior, that is, action. Social rules, traditions, moral and cultural values that must be followed play a decisive role in the decision taken in the context of logic (Krawczyk, 2002; Funayama and Mimura, 2012).

For example, to better understand, you use this part of your brain to decide if you need money to buy an expensive garment that you like to see on the showcase. Your decision may be to buy or not to buy. You decide on the answers to questions such as the burden of shopping on your next month's payments, whether the product suits you, and whether it will meet your significant lack of clothing. Or when you decide to not eat the delicious desserts in your meals at a time when your weight starts to increase by taking more calories than necessary, you decide by evaluating the damages that continue to eat in this way. It is also a very tempting desire to have a relationship with the opposite sex that you don't know yet. Before you experience this pleasure, it is still the job of the PFC to analyze your risks such as serious sexual illnesses (i.e. AIDS, hepatitis C).

This region of the brain in the less developed animals needs to be met immediately in the foreground. Therefore, animals with small frontal cortex also behave more impulsively. Of course, needs are also important for humans, but the human advanced frontal cortex is based on the decision of its behavior as a result of its analysis. Animals exhibit analysis-based behavior in proportion to the size or develop-

Figure 4. Sections of prefrontal cortex (PFC) (OF: Orbitofrontal, VM: Ventromedial; DL: Dorsolateral)
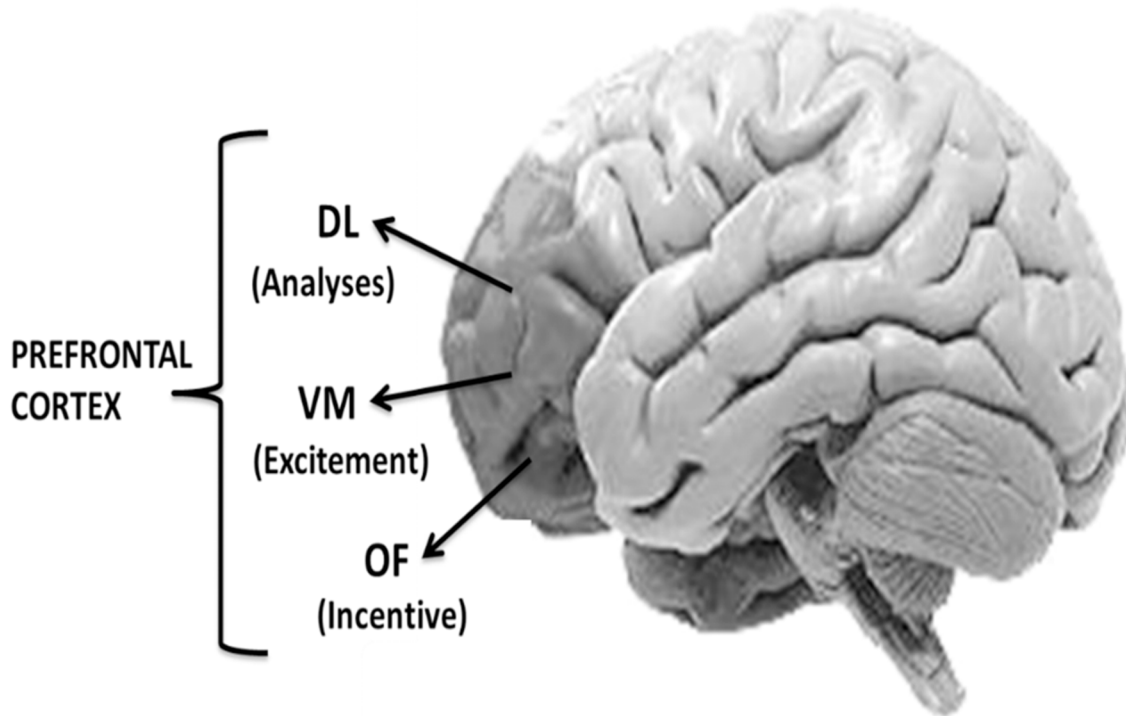
ment of the frontal cortex; however, the most comprehensive analysis and the analysis based on moral values are specific to human.

The orbitofrontal (OF) part (or primitive part) of the PFC, which is located just above the eye holes, cause exuberant, over-moving, socially ignorant behaviors, especially sexual assets. It has been shown that people with damaged orbitofrontal cortex lack of the ability to direct their behavior. These people exhibit impulsive and risky behaviors. The central part of the PFC, called the ventromedial (VM), works like emotional mental police. It receives and analyzes information related to impulse, stimulation and reactions from below. Makes plans to correctly orient or turn this information into action. In the dorsolateral (DL) parts, the analysis from the middle part is evaluated for the last time and the decision is transformed. Insensitivity, indifference and thinking skills occur in people with damage (Angrilli et al., 1999; Shamay-Tsoory et al., 2003; Berlin et al., 2004; Rosenbloom et al., 2012; Schneider and Koenigs, 2017; Barrash et al., 2018) (Figure 4). In a recent study, Çakir et al. (2018) showed that positive purchasing decisions significantly increase the neuronal activity through fronto-polar areas, which are strongly related to OFC and VM parts of PFC that regulate the computation of subjective values for the perceived options.

The development of the forehead lobe of the brain is normally completed by the transition from puberty to adulthood, that is, in the early twenties. The frontal lobes develop rapidly until the age of 10 and 11. However, this development continues during adolescence. In some individuals, this process continues until the late twenties, while in others it cannot be completed for life or develop healthily. Therefore, children and adolescents who have not yet developed frontal cortex are able to decide and act

more impulsively than experienced and mature adults. Especially adolescents are closer to experiencing exciting new things and taking risks than adults. For this reason, the first contact with the substance is the most common adolescent drug addiction, which is a significant public health problem, while addictive substances constitute a risk for adolescents mostly during adolescence. Because the frontal cortex, which will transfer the risks and harms of trying a harmful thing to the decision-making process with detailed analysis, has not yet completed its development.

Humans being have the ability to learn quickly and use what they have learned to adapt to the environment. It further develops this skill through education. Education also improves the ability of the frontal cortex to better analyze by organizing lessons from mistakes. Development of the frontal cortex has been a major contributor to the brain's evolution, learning, application and discoveries. The development of the human brain, which develops and makes discoveries that both learn and improve both the quality of life and the sovereignty of its environment, is still in progress.

Damage or underdevelopment of the forehead of the brain has important consequences that are reflected in behavior and entered into scientific records. For example, there is a clear relationship between the loss of calm and the failure of the frontal cortex, or its unhealthy functioning or damage. People with frontal cortex injury have difficulty in anger controlling (Goldstein et al., 1993). Anger controlling is difficult because the development of frontal cortex is not completed during adolescence. Brain scans (Soloff et al., 2017; Herpertz et al., 2017) and behavioral tests (Berlin et al., 2005) of antisocial individuals identified as an aggressive and damaging pattern of behavior indicated that their activity in the frontal lobe region of their brains was abnormal.

Some physical traumas of PFC may also cause impulsive behavior, personality disorder, even suicide. Bennet Omalu, a neuropatologist, described a traumatic neurologic problem called "chronic traumatic encephalopathy" in some American footballers caused by head-to-head collision (Omalu, 2014; Omalu et al., 2018). These players displayed personality disorders. They were impulsive, aggressive, could not make sensible decisions, and had attention deficits. Some of them were drug addicted, and the cause of death in some cases, according to autopsies, was suicide. In postmortem autopsies, Omalu detected some transformations and deformations in the frontal cortex neurons of these players.

How Does BRS Work?

Figure 5 is representing and summarizing the principle of work the BRS. The BRS obtained from two functional parts. They are called "reactive" and "reflective" reward systems. First, all motivational or reinforcing stimulus by addictive drugs, chocolate, sexual objects etc. are perceived to VTA and immediately stimulated dopamine release from NAc. There are dopaminergic connections between amygdala, VTA and NAc. Thus, amygdala learns this stimulus and record it to remember when it was met the stimulus again. If you met the desired stimulus second or third times, amygdale says: "Wow; it is a good thing. It worth trying". Also, it encourages and supports to VTA and NAc for testing it. Then, the desired stimulus comes to PFC. OF and VM parts of PFC identify the stimuli as incentive and excitement, respectively. Then it is passed to the dorsolateral component of PFK (DLPFC) for analyzing. By that, the decision-making process is completed. Thus, DLPC analyses the statement and it is decided whether or not (Figure 4).

The reactive reward system provides motivation and behavioral drive from the "bottom-up", including the mesolimbic pathway and the amygdala. Projections of this system to both ends of this pathway. Connections the amygdala makes both with dopaminergic nerves in the VTA and with spiny neurons in

Figure 5. The reactive and reflective reward systems
Reactive reward system works from limbic to cortical (from bottom up). It is impulsive. Reflective reward system works from cortex to limbic (from top to bottom). It is volitional and decisive (NAc: Nukleus accumbens; VTA: Ventral tegmental area; DA: Dopamine; OFC: Orbitofrontal cortex; VMPF: Ventromedial cortex; DLPFC: Dorsolateral prefrontal cortex; CSTC: Cortico-striatal-thalamic-cortical loops).
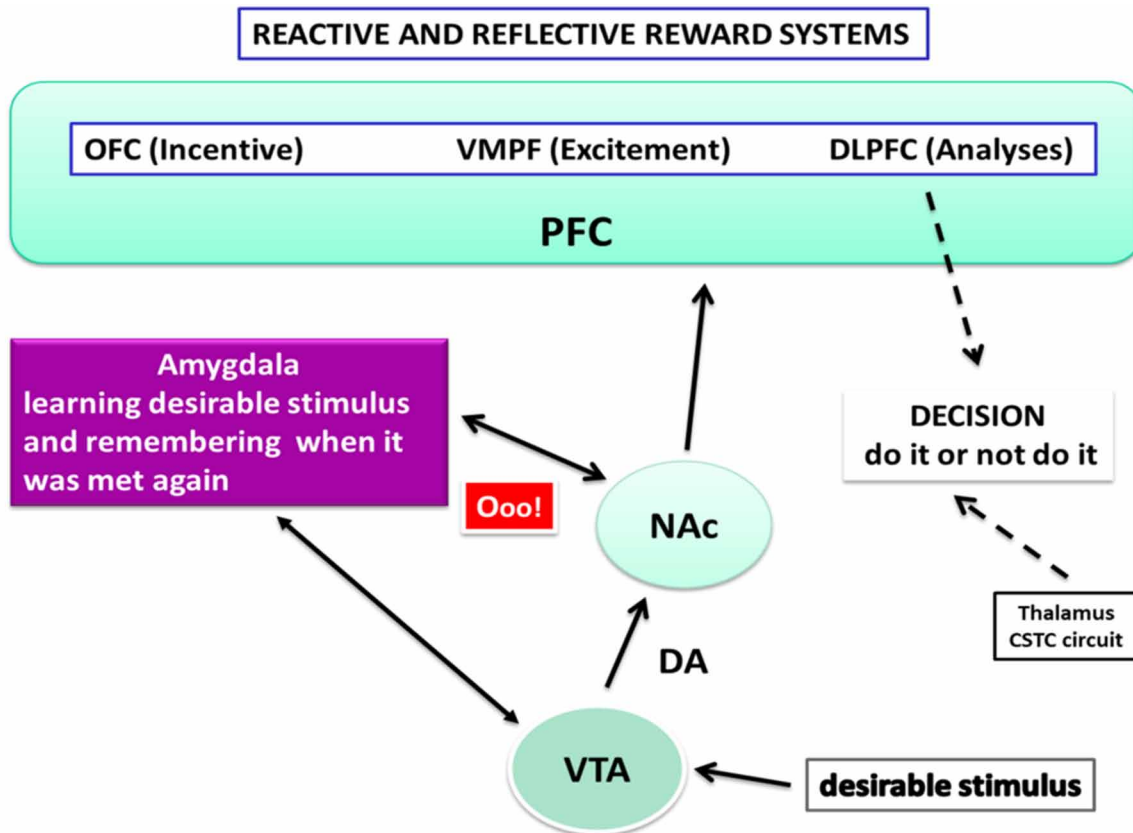
the NAc. Spiny neurons in the NAc also receive input from the mesolimbic pathway. Upon repeated exposure to pleasurable events or objects, this reactive reward system "learns" to trigger a seeking behavior and "remembers" how to do this when confronted with internal cues such as craving and withdrawal and external cues from the environment such as people, places, and things associated with past use.

The processes modify brain circuits by neuroplastic changes. Substance abuse is a good example of how the normal mechanisms of learning are hijacked and built into a brain disorder. Connections of the mesolimbic dopamine system within the NAc create bursts of dopamine release from phasic dopamine firing, pleasure, reward, and "fun" potentiating the effects of conditioned reward from previous experiences. Connections of DA neurons with the amygdala are involved with reward learning.

The amygdala is an important site of emotional learning. For example, the amygdala is involved both in learning about fear (i.e., fear conditioning) and in learning to no longer fear (i.e., fear extinction). The amygdala is also involved in learning about reward. Connections received from dopamine neurons projecting from the VTA cause the amygdala to develop adaptive changes that condition it to remember the rewards, including not just memory of pleasure but also memory of the environmental cues associated with the pleasurable experience (Stahl, 2008; McDonald and Hong, 2013). Once reward learning

has been conditioned in the amygdala, connections of the amygdala back to the VTA dopamine neuron later communicate whether anything relevant to the previously rewarding experience is being detected. Connections of the amygdala with the NAc tell the spiny neurons there that emotional memories have been triggered by internal or external cues, and instruct these spiny neurons to act impulsively, right away, automatically, obligatorily, and without thought, almost as a reflex action, to find and take more drugs. The net result of these changes is that the reactive reward system hijacks the entire reward circuitry when addiction has developed. Individuals in this state are no longer able to base their decisions upon the long-term consequences of their behavior (Stahl, 2008).

A complementary and in some ways, a competitive component of the reactive reward system is the reflective reward system, or the "top-down" component of reward circuitry. This includes important connections from the prefrontal cortex down to the NAc. These connections are connected to cortico-striatal-thalamic-cortical (CSTC) loops (Figure 5). CSTC loops are related to many different psychiatric disorders such as impulsive drug abuse and attention deficit hyperactivity disorder (ADHD) and the related CSTC loops regulating symptoms in ADHD. Prefrontal projections from the orbitofrontal cortex may also be involved in regulating impulses, whereas prefrontal projections from the dorsolateral prefrontal cortex (DLPFC) maybe involved in analyzing the situation, keeping some flexibility of choice in play, and regulating whether it is rational to take action. Finally, the ventromedial prefrontal cortex (VMPFC) may try to integrate impulsiveness from OFC with analysis and cognitive flexibility from DLPFC with its own regulation of emotions and come up with a final decision of what to do. Additional input for such a final decision also comes from two areas: the insula and sensory cortex, contributing feelings about prior experiences of reward and punishment, and the hippocampus, providing contextual information about the decision to be made. When all the inputs are integrated, the final output is either to stop the action that the reactive reward system is triggering (generally drug seeking), or to let it happen (Stahl, 2008).

The reflective reward system is built and maintained over time based upon various influences including neurodevelopment, genetics, experience, peer pressure, learning social rules, and learning the benefits of suppressing current pleasure for more valuable future gain. The reflective reward system has the power to shape the final output of the reward system into long-term beneficial goal-directed behaviors, such as the will power to resist addictive pleasurable actions. When fully developed and functioning properly, the reflective reward system can also provide the motivation for pursuing more naturally rewarding experiences such as education, accomplishments, recognition, financial benefits, career development, enriching social and family connections, etc.

Determining whether the output of the reward system will be converted into short- or long-term rewards are the result of the balance between bottom up reactive reward drives and top down reflective reward decisions. For example, the first time you take a drug, there is immediate pharmacological action upon the mesolimbic pleasure center, the exact site of action dependent upon the exact substance ingested. Dopamine is released, pleasure is experienced, and the amygdala "learns" that this is a rewarding experience. The reward has now been conditioned in the amygdala (McDonald and Hong, 2013). After repetitive rewarding experiences with the drug, the reward circuits become "addicted", so the next time there is an opportunity to use the drug, it is not just the ingesting of the drug that causes dopamine release and pleasure; the cues that predict hedonic pleasure already cause dopamine release. The reward system has learned to anticipate the reward, and that anticipation itself becomes pleasurable. The amygdala signals the dopamine neuron in the VTA that something good is about to happen because it remembers the past drug reward; it may also signal that relief from craving is insight. Getting the anticipated reward is a very compelling option, so there is a powerful impulse sent to the VTA triggering DA in the NAc to transform

this impulse into the action of finding some drugs and making this reward really happen. Substantial reward and relief are already experienced just by anticipating the reward, but the real kick comes when the drugs are actually ingested again. During addiction, the reward is overestimated and hyperactive by virtue of the "diabolical learning" that has occurred in reward circuits. This process of synaptic plasticity changes the efficiency of information flow in the reactive reward circuitry to allow its neuronal activity to preempt all contradictory input coming from the reflective reward circuit in the prefrontal cortex (Cooper et al., 2017; Zhang et al., 2019). However, can impulses from the reactive reward system ever be resisted? What is the role of will power over temptation? If temptation is bottom-up demanding from the reactive reward system, will power can be seen as top-down decision making by the reflective reward system. Specifically, drug seeking is not always an involuntary response to internal and external cues urging that behavior, especially before addiction sets in and when the prefrontal decision-making circuits are well developed and frequently utilized. If addiction is diabolic learning, will power may be virtuous learning within the same reward system. Thus, when temptation occurs with the opportunity to ingest drugs arising at a party, in a bar, or when seeing or feeling drugs or their paraphernalia, the amygdala anticipates the pleasure that the drugs would bring by signaling an impulsive choice to the VTA to release dopamine that urges output from the NAc to engage in behavior that leads to ingesting the drugs again (Stahl, 2008; Meyer et al., 2016).

The OFC is signaling craving and voting for more pleasure action as well. However, this is just a temptation. For a split second there may be the opportunity for the DLPFC to think about whether it wants to take this action and to cast an opposing vote, showing cognitive flexibility, keeping the system from taking an immediate obligatory action just because the reactive reward system is demanding it. Reflective reward system allows the time to assess risky situations and potential for harm. On the one hand, "diabolical learning" and changes in dominance of the reactive reward system from repeated addictive drug ingestion that overvalues short-term rewards can result in compulsive drug-seeking behavior; on the other hand, "virtuous learning" and plastic changes that lead to dominance of the reflective reward system can produce the ability to suppress short-term rewards for long-term gains (Stahl, 2008; Meyer et al., 2016).

COMPULSIVE SHOPPING BEHAVIOR (CBB)/SHOPPING ADDICTION

Shopping is the most common method used by modern people to meet their needs. Shopping in the modern world is directly based on the economy. The volume of shopping in the world and the money contained in the system are guided and controlled by global powers. The capitalist system promotes purchasing and consumption. A continuous consumption is necessary for the economy wheel to spin. Therefore, today, shopping has gone beyond the supply of needs. The advertising industry encourages people to shop whether they need it or not. Shopping makes people feel good. The fact that today's people are conformist and focused on pleasure is a good target for advertising and marketing strategies.

Today's shopping considers both a functional or practical activity as well as a social activity or relaxation with hedonistic elements (Hirschman & Holbrook, 1982). The pleasure component has been enhanced by the presentation of huge shopping malls offering a variety of activities including shopping, ingestion and several entertainments. A change in beneficial experience for the shopper from the purchased item itself to the experience of the shopping process has been identified (Langrehr,1991). The highly practical and sensory nature of shopping provides rewards in to the individual, separate from the rewards of the purchase act (Rose & Dhandayudham, 2014).

Psychologically enjoyment has been recognized as a hedonic emotion which motivates some behavioral and physical activity such as website experience (Lin et al., 2008). Davenport et al. (2012) also suggested "reward sensitivity" as an influence upon compulsive buying proposing that a person who is very sensitive to rewards will respond to enjoyable stimuli such as shopping. Hedonic motivations have been identified in relation to shopping (Arnold & Reynolds, 2003). Pleasure has been found to be a factor of an individual's probability to endure to shop (Hart et al., 2007) and is identified as a rewarding part of compulsive buying behavior (Davenport et al., 2012). Similarly, enjoyment has also been identified as a promoter of online shopping (Wolfinbarger & Gilly, 2001). Lejoyeux and Weinstein (2010) report that positive feelings of pleasure or excitement are also associated with a compulsive buying behavior (CBB). Even some authors accepted that shopping could be an important source of self-definition or therapy (Lo and Harvey, 2012). However, if it becomes excessive and uncontrolled, it converts a problematic behavior.

As mentioned in the introduction of this article, neuromarketing has developed considerably since the early 2000s as a new field of neuroscience that measures how the brain works and how it decides, which is the main objective of marketing. The techniques used have also expanded. Accurately identifying which brand, color, smell, music and food you prefer or not by analyzing the brain and emotions of consumers is extremely important in terms of introducing new products to consumption in the globalizing world or ensuring the consumption of existing ones. For this reason, the interest of important brands with ambitious products to market is increasing.

Indeed, the number of people who tend to shop constantly, who cannot control their budget, and therefore become seriously depressed by borrowing to a considerable extent, is gradually increasing. Although Shopping addiction was not included in the Diagnostic and Statistical Manual of Mental Disorders V (DSM V) and World Health Organization, International Classification of Mental and Behavioral Disorders (ICD-10), recently, CBB has been described in the literature (Lojeyeux and Weinstein, 2010; Granero et al., 2016; 2017) and there is a strong consensus on this definition among the scientist. A range of terminology has also established to describe excessive and uncontrolled shopping in the field containing "compulsive buying" (O'Guinn & Faber, 1989; Workman & Paper, 2010), "impulsive purchasing" (Baumeister, 2002); "compulsive consumption" (Hirschman, 1992); "impulsive spending patterns" (Vohs & Faber, 2003) and "shopping addiction" (Sussman et al., 2010). CBB can also be described as pathological buying, compulsive buying disorder or shopping addiction. It is a mental health problem characterized by the impulsive, excessive, persistent and uncontrollable buying of products despite negative job-related, social, psychological, psychiatric and financial consequences (Müller et al., 2015; Granero et al., 2016).

Prevalence of CBB has increased meaningfully worldwide and is gradually getting more attention from scientists. When the current literature is examined, it is seen that the incidence of CBB within total population varies between roughly 3.5-8% (Lojeyeux and Weinstein, 2010; Granero et al., 2016; 2017; Maraz et al., 2016). The incidence is higher among young people, university students and women than in adult men (Otero-López and Villardefrancos, 2014; Maraz et al., 2016). Some researchers have suggested that women are more prone to CBB than men (Black, 2007; Davenport et al., 2012). Compared to normal, individuals with CBB are more materialistic in their choice of products. Materialistic attitudes encourage CBB in young students and other individuals (Lo and Harvey, 2012; Spinella et al., 2015; Islam et al., 2017).

No single factor explains the etiology of CBB. Several factors such as level of arousal, existence of anxiety and stress or comorbidity of other psychiatric disorders (depression, drug addiction, attention

deficit disorders, impulsive character etc.), external environmental stimuli (media, advertisements etc.), sensation seeking and other cultural, sociodemographic or psychosocial factors are related to CBB etiopathogenesis (Davenport et al., 2012; Rose & Dhandayudham, 2012).

Assessment and diagnostic criteria that distinguish CBB from other behavioral disorders have been published (Yüncü and Kesebir, 2014). Somebody can easily reply following statements as "yes" or "no."

- When I have money, I cannot help but spend part or all of it.
- I am often impulsive in my buying behavior.
- As soon as I enter a shopping center or mall, I have an irresistible urge to go into a shop and buy something.
- I am one of those people who often respond to direct mail offers.
- I have often bought a product that I did not need, while knowing that I have very little money left.
- For me, shopping is a way of facing the stress of my daily life and relaxing.
- I sometimes feel that something inside pushed me to go shopping.
- There are times when I have a strong urge to buy.
- I often have an unexplainable urge, a sudden and spontaneous desire, to go and buy something.
- At times, I have felt somewhat guilty after buying a product, because it seemed unreasonable.
- There are some things I buy that I do not show to anybody for fear of being perceived as irrational in my buying behavior.
- I have sometimes thought "If I had to do it over again, I would..." and felt sorry for something I have done or said

An individual who answers "yes" to one or more of these statements may have CBB problem and needs psychiatric help.

Although CBB is not yet officially defined as an addiction in psychiatric guidelines, it has many criteria suggesting that it should be considered an addiction. First, Compulsive behavior is one of the most important parts of the addictive process (Rose and Dhandayudham, 2014). If the desire to shop has turned into a compulsive form and is continued with excessive repetition, it can have devastating consequences like other addictions and should be evaluated within addictions. Secondly, CBB exhibits prominent comorbidity and similarity with other types of behavioral addictions (Robbins and Clark, 2015; Granero et al., 2016) and other impulse control problems and eating disorders (Fernandez-Aranda et al., 2006; 2008; Potenza, 2014). Furthermore, as in chemical or drug use addictions, abnormalities in PFC, reward processing system and limbic system (parts of BRS) have been detected by brain imaging studies in individuals with CBB and in other behavioral addictions (Raab et al., 2011; Leeman and Potenza, 2013; Probst and van Eimeren, 2013).

Advertisements may also have BRS activating feature. The effects of advertisements on abusing potential of addictive substances has been subjected in some studies. For example, in a recent study, Courtney et al. (2017) suggested that alcohol adds activated BRS in college student population by fMRI measurement. Left OFC activation was also detected after watching images of appetizing foods (Beaver et al., 2006; Van der Laan et al., 2011) and alcohol advertisements (Courtney et al., 2017). These studies indicated that advertisements may be a stimulating factor for overeating or drug abuse.

The reflective reward system cannot function properly for people with PFK problems. The decision-making processes associated with these individuals are limbic and the reactive system is dominant in the process. On the other hand, various neuromarketing strategies, such as product advertising, are

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limbic-oriented and aim to suppress the reflective reward system (Figure 5). As a result, it is no surprise that shopping addiction has emerged in some vulnerable people nowadays, as advertisements and other marketing strategies that promote purchase are highly developed. Increasing incidence of CBB in the community indicates that it should be considered as a public health problem. Detection of individuals prone to addiction by neuromarketing methods (i.e., brain imaging techniques and behavioral tests) and taking protective measures may increase the reputation of neuromarketing as a science. Otherwise, the use of neuromarketing techniques to promote unnecessary purchasing will make it difficult to accept as a science. It will also raise serious ethical issues. Increasing the attractiveness of products with marketing strategies, and stimulation of BRS via dopamine when people buy new products may make them more obsessed and persistent in vulnerable people. Over time, a pleasant shopping activity can turn to CBB that avoids people from seeing other basic needs and disrupts the quality of life depend on excessive debt.

FUTURE RESEARCH DIRECTIONS

Neuromarketing is a new and developing scientific field. Studies on the relationship between neuromarketing and BRS are very limited. People's shopping motivation may turn into addiction in some sensitive individuals, and BRS is an important brain system associated with addiction. Therefore, there is a need to increase the number of studies examining the relationship between BRS and shopping behavior in the future. The results of these studies will also contribute to the discussions related to the ethical dimensions of neuromarketing.

CONCLUSION

In our globalizing world, neuromarketing techniques are increasingly used to enable people to buy products. Enjoying or rewarding properties of any good or services are critical in buying. At this point, the BRS and neurotransmitter dopamine plays a key role. Everything that stimulates BRS by its charm produces the desire and demand to buy. BRS, like many other dependencies, has a close relationship with the mechanisms that cause CBB. On the other hand, some methods of neuromarketing encouraging purchase increase CBB risk in susceptible individuals.

BRS works with limbic oriented in adolescents and young people whose PFK development is not yet completed. For this reason, young people behave more impulsively, make decisions more quickly and make a good target audience for sales. In particular, adolescents tend to the first address or object that impulsively promises fun and pleasure. One of the easiest ways to satisfy these impulses is to shop, to have new and interesting products. At this point, it seems that using various neuromarketing techniques to create a youth-oriented market for some products directly targeting young people may cause serious social problems, especially addiction. On the other hand, the close relationship between BRS and addiction necessitates that the neuromarketing techniques to be performed through this system must be based on the right rules and be placed on an ethical basis. Although the ethical dimensions of neuromarketing have been discussed in various aspects in the relevant science from 2010 (Fisher et al., 2010; Javor et al., 2013; Sarrazin et al., 2015; Ulman et al., 2015; Banja, 2019), the relationship between purchasing behavior and BRS and risk of CBB has not been adequately evaluated. It would be appropriate to evaluate the ethical dimensions of neuromarketing in detail through the relationship between BRS and CBB.

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KEY TERMS AND DEFINITIONS

Addictive Behavior: An addictive behavior is a behavior, or a stimulus related to a behavior (e.g., shopping, food, gambling, some drugs), that is both rewarding and reinforcing, and is linked with the development of an addiction.

Attention: The power to concentrate thought on something. Attention is the focus of consciousness. Objectively, it requires selecting a portion of all sensory or memory-embedded information for later use.

Brain Reward System (BRS): Some limbic structures of the brain such as ventral tegmental area (VTA), nucleus accumbens (NAc) and amygdala have a link to the prefrontal cortex (PFC) by dopaminergic mesocorticolimbic pathway. This functional link is called brain reward system (BRS). BRS has a crucial role in the decision-making process of humans during shopping as well as addiction processes of the brain.

Decision Making: Decision making is the process of making choices by identifying a decision, gathering information, and evaluating other resolutions.

Neuromarketing: Neuromarketing is a multidisciplinary field of commercial marketing communication that applies neuroscience to marketing research and examines the perceptual functions of consumers, their emotional responses to cognitive and marketing stimuli.

Reactive Reward System: The reactive reward system provides motivation and behavioral drive from the "bottom-up", including the mesolimbic pathway and the amygdala. Projections of this system to both ends of this pathway. Connections the amygdala makes both with dopaminergic nerves in the VTA and with spiny neurons in the NAc.

Reflective Reward System: A complementary and in some ways, a competitive component of the reactive reward system is the reflective reward system, or the "top-down" component of reward circuitry. This includes important connections from the prefrontal cortex down to the NAc. This system is related to decision making process during shopping.

Reinforcement: Reinforcement is a consequence applied that will strengthen an organism's future behavior whenever that behavior is preceded by a specific antecedent stimulus. Positive reinforcement and motivational behaviors are modulated by the mesolimbic dopaminergic system.

Chapter 2
From Philosophical Queries to Greater Dilemmas of Neuroethics

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ABSTRACT

This chapter elucidates the origins and changes in understanding of neuroethics. An accent is then put on the role neuroethics should play. As a consequence, limitations in research are identified, especially in connection with ethical questions that had been proposed by philosophers in previous centuries. The urgency of their remarks has intensified due to the expansion of neuroscience. This theoretical part is subsequently enriched by practical aspects and ethical codes of which prescripts are key and neuromarketing practitioners are expected to obey them. Despite a growth of interest in neuroethics, the author presumes that the field still represents a ceaseless combat from within, and he claims that it may even remain invincible as a vicious circle. In conclusion, new trajectories are brought and considered together with recommendations and suggestions of new research possibilities as in case of political neuromarketing. This branch, however, perfectly illustrates the complexities associated with neuroethics.

INTRODUCTION

A fascination with human beings and their behavior has been persistent among philosophers and theorists for centuries. Pioneering concepts classifying human behavior and its aspects gradually appeared in ancient times (e.g., Aristotle, 1998). Anon, initial findings and considerations were proposed with regard to the role of physiological attributes in behavioral traits. These attempts could not succeed, however, due to the intensifying and the rising power of the Church across Europe in the Middle Ages. Despite accurate motions on humanity, which can be summarized by Aristotle's "zoon politikon" (Kullmann, 1991), following deliberations, on the other hand, highlighted dissimilar facets being responsible for human behavior. And they were other than the biological ones (e.g., René Descartes and his work).

Although natural sciences have been considerably appealing since the 18th century (Farah, 2010), significant discoveries of human behavior and biological formulas emerged in the 20th century. However, many crucial studies were burdened by its connection to the Nazi regime in Germany, of which any ethical components had been vacuous and regarded as irrelevant (Schreiber, 2017). And thus, in the name of the science, experiments on humans as subjects were frequent back then. By today's perception, it would be ethically and socially unacceptable.[1] Properly, it is necessary to take into account that even other forms of research, including diverse experiments, have been conducted with bias, howbeit in a more human manner. Biased attitudes had been in use especially against disabled and mentally ill persons, in particular, since phrenology as a scientific discipline had been influential in studying human behavior and its connection to physiological traits until the beginnings of the 20th century (Illes & Bird, 2006). If the 20th century may be understood as the period of genetics, then the contemporary century, as a "neurocentury" (Farah, 2011), is most definitely the century of neuroscience (Moreno, 2003; Conrad & De Vries, 2011). And inasmuch as modern technologies have been significantly on the upgrade in the first decade of this century, scholars of ethics and bioethics were given new materials, data and eventualities to examine (Leefmann, Levallois, & Hildt, 2016). Bioethicists, however, still do find neuroethics a priori superfluous and worthless (Conrad & De Vries, 2011).

Therefore, this chapter summarizes the most striking approaches and attitudes regarding neuromarketing and its corresponding cardinal neuroethical queries that are frequently discussed. Bearing in mind the complexity of neuroethics as a field of research, the text deals with marketing and neuromarketing as two analogous stances and then ethics and neuroethics is analyzed accordingly while using particular instances in order to ask corresponding (neuro)ethical questions. Whereas the introductory sections examine necessary components specifically indispensable for neuroscientific practice, the following part focuses on respective philosophical reasoning on ethical matters in marketing, medical environment, and neuromarketing as such. Afterward, there are neuroethical issues to be addressed. The chapter encapsulates sundry approaches to neuroethics, and in the aftermath, possibilities of further research will be stated. However, marketing, in its elemental theoretical concepts, as formed by economists, is to be excluded from this chapter to avoid repetitive inferences without any satisfactory foci on neuroethical aspects. Since neuromarketing, having certainly problematic relations with (neuro)ethical questions by definition, has been comprehended as ambiguous, the text addresses both the stances, be it affirmative or negative with respect to the applicability, functionality, and the raison d'être of neuromarketing and neuroethics.

Overall, as concluded, there are key issues to be studied at first, and only further improvements in neuroscience may affect the future directions of neuroethics. Owing to the instant questioning of elemental definitions (Roskies, 2006), practice procedures, and the mission itself, it is understandable that neuroethics struggles with clarifying in which trajectory it should lead; meaning that it has not been entrenched in the system of academic disciplines. Given the critical appraisals and observations scholars have offered, this chapter's objective is to advert to the route neuroethics shall set out for. Furthermore, the aim is to identify the roles neuroethics should play in order to be finally acknowledged after years of being lost in the fog of void and empty definitions. Finally, the code of ethics, as issued especially but not only by the Neuromarketing Science & Business Association (NMSBA), will be recalled and complemented by additional recommendations and suggestions for neuromarketing practitioners so that their future research projects will be suitable and correct on the ethical level, and thus, widely acceptable by all the involved parties.

However, before further debates, there are terms that need to be at least briefly explicated in respect of its meanings in order to avoid any disarray. First and foremost, ethics per se functions as a theory of morals. It defines and arbitrates what is or is not moral or immoral, right or wrong, good or bad, true or false and so forth. In the course of time, there have been many changes in the understanding of the content of morals and principles which should have been universal. Originally, Cicero had translated the term morals from the Greek word *ēthikós* to Latin. Secondly, bioethics is a hypernym for ethics because its aim is to interpret ethical problems and situations not merely in medical surroundings, but within respective research areas covering all the living creatures and nature. It means that the outputs of bioethics apply to pharmacy, chemistry, biophysics, and ecology, for instance (Haskovcova, 2015). Regardless of this terminology, moral principles and codes must always be in line with the legislation and legal code of each country.

NEUROMARKETING AND ETHICS

Neuroscience endeavors to investigate brain processes leading to diverse brain activities, which result in particular behavior patterns, be it good or evil (cf., Sapolsky, 2017; Zimbardo, 2008). Progressively, neuroscience has exhibited a certain level of positive opportunities (Morein-Zamir & Sahakian, 2010), and then many thrilled scholars and marketing experts have embraced this discipline across the world in order to enhance their campaign strategies and the ultimate impact on consumers. For this reason, there are currently brand-new and voguish neuro-x fields, as for instance, neurolaw, neurotheology, neuro-economics, neuroeducation, neuropolitics, and neuromarketing (Racine & Dubljević, 2016). Nowadays, however, the use of neuroscience has led to many queries "(…) challenging our understanding of human behavior" (Farah, 2004). And neuromarketing declares to know the answers to many questions previously posed and asked by marketing experts (Illes & Bird, 2006). Consequently, a gradual increase of neuromarketing can be observed among many traditional and well-known companies such as Disney, Ebay, Google, Hyundai, PayPal, and Microsoft because even marketing and PR specialists took the opportunity to link marketing research and economics to neuroscience to make sure that their products succeed easily and dominantly (cf., e.g., Farah, 2011; Hensel, Wolter & Znanewitz, 2017). The problem is, though, as stated by Zhixing (2019), that neuromarketing usually stands on the verge of the ethical and unethical course of action. In defiance of difficulties caused by interpretations of results in neuroscience, neuroethics cannot be simply embodied into a metronome principle which would be stating that something is or is not ethically appropriate. From a philosophical perspective, there are many questions that cannot be answered in one word either.

Different Practices, Different Ethical Issues

Marketing and neuromarketing, as seen in this book, appear in many diverse forms and therefore, ethical challenges vary accordingly in a mere juxtaposition. It was just a matter of time so that a new type of science could have been developed to study and analyze the human brain properly, since there has been a significant excitement because the human brain still remains entangled with mystery (Moreno, 2003). Neuroscience has complemented and partly substituted the interest and role of genetics in research inasmuch as neuroscience's purport is to analyze human biological backgrounds (Farah, 2012).

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The tools of neuroscience are based on the level of technical employment; and so, one may differentiate between instruments of technological versus social science and psychological character. Additionally, statistical processing complements the other two. All of these phases as they are utilized may be overlapping and supplementing one another. Overall, out of the tools, it is necessary to emphasize that in neuromarketing, mostly three instruments are used: electroencephalography (EEG), functional magnetic resonance imaging (fMRI), and eye-tracking. And hence, even these three most frequent instruments may be biased and represent a problematic aspect.

Whilst social science and marketing strategy research are based on questionnaires, focus groups and interviews, and experiments during which subjects are given an opportunity to lie in accordance with his or her preference of free will, in neuroscience, there is only very limited, if any, room for lies from the subjects. Moreover, there are even other obstacles. These tools are not designed to be moved, especially in the case of fMRI. And it means that everyday reality cannot be sufficiently modelled and reached. Even in the case of portable devices, such as the EEG and partly eye-tracking, there are concurrent effects to be placed, albeit in a slight form (Farah, 2005). Moreover, taking part in any fMRI research does not leave the examined subject in a comfortable situation because his or her position must remain still, for instance. Nevertheless, an increase of articles and studies employing the fMRI scanning was unquestionable in the period from 1991 to 2005, specifically from 0 to approximately 1,600 papers (Illes, 2007). As it was demonstrated, the vast range of tools also signifies a myriad of ethical queries, and each tool may vary in its consequences and for that reason, before every research project commences, researchers and marketers are expected to consider the ethical side as outlined in this chapter.

ORIGINS OF ETHICAL RECONSIDERATIONS

Modern roots of bioethics possessed its origins in 1927 when Fritz Jahr published his text, *Bioethik: Eine Umschau über die ethischen Beziehungen des Menschen zu Tier und Pflanze,* presupposing mutual relations among animals, humans, and the vegetative kingdom (Conrad & De Vries, 2011). In brief, there are many requisites delineating ethics as such to investigate the morals, but overall, three types of ethics are to be recognized. The first-order moral questions are summed by the criteria delivered by normative ethics. Second-order issues are addressed by metaethics, these are, for instance, the moral objectivity or moral epistemology. Finally, very particular themes, as of environmental or neuroscience character, are analyzed by applied ethics. By contrast, there are two most frequent motifs in neuroethics: free will and Immanuel Kant's categorical imperative. Free will as part of determinism may be dated back to the Greeks in antiquity (Moreno, 2003). And since there are two orientations of responsibility in ethics, moral and legal (Glannon, 2006), only the former, as the categorical imperative, may affect the incentive to act *(Bestimmungsgrund)* afterward (Falduto, 2014).[2]

Leung (2013) identified three principles of ethics that are to be used regardless of the research theme. It is the "primum non nocere" that highlights the possibility of incidental findings and how to handle this situation. According to this rule, people should be informed about potential incidental findings during conducted experiments. In that text, however, the author did not consider free will adequately. What if a subject were against this rule and did not wish to know and thus be informed about the incidence under no circumstances? Secondly, there is the principle to "help and rescue" demonstrated, among others, in the Hippocratic oath. And finally, "mutual benefit" shall be minimal, meaning that the researcher is expected to protect the examined subject only during the course of the experiment. These

three principles may become contradictory after all, especially if neuroscience is employed. Even the concept of free will tends to be eclipsed as in the case of Everts (2007), when claiming that [free will] is only "illusory" in neuroscience.

If ethics were meant to reside in two aspects of research, empirical, meaning descriptive, and consequentially deontological so that new defining criteria may state universal morals (Petru, 2005), the role of neuroethics, in its minimalist form, must be conditioned by two features too: normativity and the a posteriori analysis. As a result of the medical scandals in the 1960s, modern ethics has experienced approximately forty years of existence, even though some basic forms of ethics have always been assumed, since medicine's transformation and development from the 5th century BCE (Conrad & De Vries, 2011). Regarding the legal aspect, there is an increase of legal measures in order to take into consideration specific local conventions (Kulynych, 2002; Leung, 2013).

The striking point as an initial problem, however, may be found at the universities and colleges where social neuroscience or neuro-x field are currently emerging. The problematic facet resides in the level of inexperienced practice. Many of social science-based institutions are not fully prepared, nor used to having independent Institutional Review Boards (IRB) specifically for their research projects. Although there are usually commissions for ethical affairs within these institutions, the problem is that they may be found only on the top, meaning university, level and it implies that these commissions are responsible for the university as a whole, but this is not sufficient, since IRB should have been formed even on the lower levels. On the other hand, the situation differs in the case of private research centers and neuromarketing companies. This group of organizations is expected to follow and adhere to a widely accepted set of rules, known as codes of ethics, especially in order to draw attention to its own quality and harmlessness.

DEFINING THE ROLE AND PROBLEMS OF NEUROETHICS

What does neuroethics as a term stand for? To parse, *neuro-* as a prefix signifies that this area is linked to the central nervous system (CNS), and *psyche* which signifies that it should be analyzed via the tools of neuroscience. The second part of the word originates in the Greek word *ethos,* meaning a sort of character in possession of oneself while defining community values and morals (Petru, 2005). Initial reasons for this interconnection rooted in the juncture between psychology and neuroscience (Farah, 2005), whereas from the 1980s and the early PET utilization, first attempts of cognitive neuroimaging appeared. The interest escalated in the 20th century thanks to the possibility to apply individual imagining in order to deeply investigate the mental state. Before this era, similar types of research were met predominantly with hostility (Evers, 2005; Farah, 2012). A universally accepted definition specifies that neuroscience is supposed to examine ethical, legal, and social (ELS) ramifications. These three areas have been, however, addressed mostly separately (Illes, Kirschen & Gabrieli, 2003). There are two more issues to bear in mind. First and despite a very own inner importance, the general public is usually excluded and not instructed in this area (Farah, 2011; Sahakian & Morein-Zamir, 2009). Furthermore, even in the academic milieu, university courses are lacking in attention dedicated to neuroethical themes as previously mentioned,[3] notwithstanding the specialization of university courses in neuroscience (Morein-Zamir & Sahakian, 2010). Nevertheless, the overall definition purely claims that neuroethics examines "consequences for the individual and society" (Farah, 2004).

Two prominent scientists are known for taking part in the inception of neuroethics. It is Martha J. Farah who has been associated with the beginnings of neuroethics thanks to her innovative standpoints (Conrad & De Vries, 2011). Another scholar to be highlighted is Judy Illes who has focused on this sphere of research from a clinical perspective. The professional roots of neuroethics may be dated to 2002 when a conference of the same name took place in San Francisco, USA. Its aim was to merge scholars out of dissimilar research disciplines (e.g., philosophy, law, biology and medicine, and psychology) to eventually delineate fundamental issues and aspects which should have been taken into account for this highly needed sphere of interdisciplinary research (Leefmann, Levallois, & Hildt, 2016).[4] Four crucial output domains of neuroethics were identified at this conference as summarized by Illes and Bird (2006):

a. Consequences for understating of the self and responsibility
b. Social policy in respect of socially relevant topics
c. Clinical practice specializing in therapeutic activities
d. Public engagement and education

Source: (Illes & Bird, 2006, p. 514)

Having said that, traditional ethical queries, as studied and appraised by bioethics, have been modified and, in some cases, rigorously intensified in urgency (Farah, 2010). Previously, a total of three rudimentary roles of neuroethics could have been found. These had been formed in accordance with the topics it used to characterize. The first one had studied children and their rearing in a general sense, the following one was dedicated to technological advances, and finally, the third one was based on ethical considerations of human behavior traits (Illes & Bird, 2006). Among the most common and relevant instances of neuroethics, it is neuroenhancement, responsibility, and brain imaging that are predominant topics (cf., e.g., Chatterjee & Farah, 2013; Farah, 2012). Geographically, Canada and the USA both play first fiddle as the local scholars have been studying corresponding aspects in a varied incidence from the early 1970s (Müller & Jox, 2017). As exemplified by Olteanu (2015) in Table 1, it was particularly the second half of the 2010s, with the peaks in 2009 and in 2013 respectively, that has drawn attention to neuroethics significantly, slowly being accompanied by neuromarketing studies as well.

Originally though, preliminary attempts to conduct experiments in ethics appeared in the late 1960s. It was Philippa Foot and her proverbial "trolley problem" which has been subsequently elaborated on (cf., Thomson, 1986) into two analogous examples when the "footbridge" situation was added. The purport is to test participants' reactions in accordance with ethical and moral principles. In the first experiment, there is an unstoppable trolley which is on the way to kill five people walking in the track. The only chance to stop the trolley is if using a lever so that the trolley is redeployed to a different track in which direction; however, one person would be killed anyway. What is to be done? What is the *right* thing to do? Responders as subjects may decide whether to act, and thus use the lever, and kill one person knowingly instead of having five dead people. Contrariwise, subjects may not act and therefore, they would not kill that one person intentionally, but five other people would be hit and killed consequentially. The second example uses an unstoppable vehicle too. In this situation, subjects are expected to decide whether to push a fat man off the footbridge in order to stop the vehicle and save five people in the track. Nevertheless, this deed would mean a caused killing of the fat man.

The second option is not to intervene but to have five other people killed. Again, could a subject select any better variant? There are no correct or wrong answers in these two tests. Yet subjects neither act, nor perceive these two situations as if under the same circumstances, but quite the opposite. In 2001,

Table 1. Increasing number of articles dedicated to neuromarketing and neuroethics
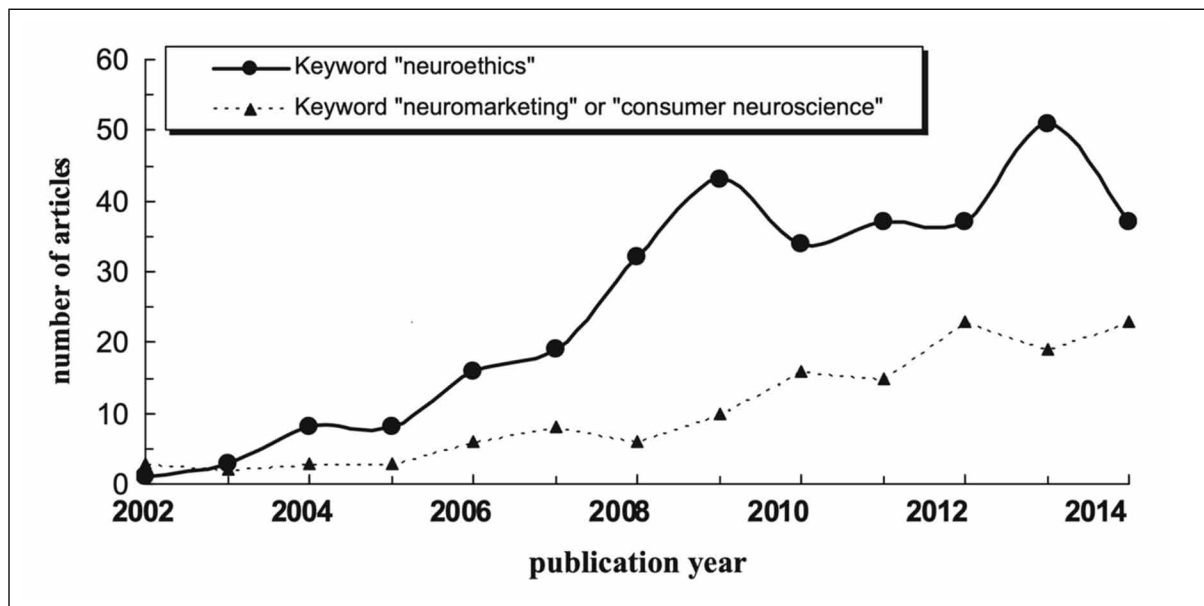
Source: (Olteanu, 2015)

these dilemmas were worked up into an fMRI study (Greene et al., 2001), and it concluded that in the footbridge situation, brain activity took place in the medial frontal gyrus, posterior cingulate gyrus, and bilateral superior temporal sulcus. These areas are connected to emotional responses, and it signifies "personal" dilemmas. By contrast, in the "trolley" experiment, dorsolateral prefrontal and parietal areas were activated, and thus implying rather "impersonal" dilemmas (Gold & Roskies, 2008). Discovered and verified dissimilarities resulted in the furtherance of deliberations between the Humean and Kantian devotees who dwell on the presence of emotion and reason in moral judgments (Ibid.). Accordingly, three neuroethicist approaches and corresponding scholars may be classified. The technology-driven approach that has been represented by Martha J. Farah, the healthcare-oriented approach is symbolized by Judy Illes and Eric Racine, and finally the knowledge-driven approach is linked to Adina Roskies. On top of that, the paper even elaborated on the original fields these scholars are coming from, and it was concluded that a vast majority of experts has been based in psychiatry and neuroimaging, whereas social and economic studies were underrepresented as figured out from their academic outputs (Leefmann, Levallois, & Hildt, 2016).

Negative attitudes have been observed from the very beginning with three significant arguments opposing neuroethics as a whole. At first, neuroethics would have reduplicated the findings of traditional bioethics. Second, the promises of neuroscience lack in feasibility as in case of neuroethics, and finally, new sets of rules would come in vain (Parens & Johnston, 2007). Therefore, neuroethics has been appraised as a field, rather than a "developing scientific discipline" (Leefmann, Levallois, & Hildt, 2016). The causes are straightforward, since the methods, approaches, and the role within neuroscience and toward other scientific disciplines lack of coherent definition or rigorous delineation (Northoff, 2010). For this reason, neuroethics may be perceived merely as an "innovative approach" instead (Levy, 2011). Another form of criticism denying any innovativeness claims that neuroethics only mirrors scholars'

personal stances (Knoppers, 2005). Moreno (2003), on the other hand, perceived changes only in updated analytical procedures. Similarly, as in the case of social sciences and humanities, there are terms with no transparent and agreed definitions. Furthermore, neuroethics does not seem to be limited in boundaries of what to target on (Knoppers, 2005). On that account, debates on neuroethics are not able to concentrate on deeper aspects and they remain superficial in many cases. Notwithstanding obvious exceptions, scholars mostly summarize and quote aberrant definitions in order to contrast the dissimilarity in technicalities. However, there is not sufficient enough room to develop the field and demarcate the borders so that the field might become internationally recognized.

As a consequence of these disputes, neuroethics was divided by Roskies (2002) into two categories. Firstly, as *ethics of neuroscience*. This area dissects the steps of neuroscientific research design and the ELS consequences and therefore, a certain similarity with bioethics may be observed. The second category, *neuroscience of ethics*, examines aspects of free will, identity, mental privacy and so forth. And so reversely, the latter expands on the perspective of neuroscience when studying the brain activities and functioning. On a similar basis, Northoff (2010) delineated empirical and theoretical neuroethics to deal with distinct parts of the research so that he could decline the dual terminology as proposed by Roskies. By contrast, Macdonald exemplified two categories in which neuroethics is to be analyzed. First, there are objects that can be literally executed (i.e. modern tools of neuroscience and its discoveries) versus the things that are known and comprehended (i.e. neuroanatomy and corresponding ethical matters) as summarized by Olteanu (2015). Furthermore, bearing in mind only two groups of challenges, when researching neuroethics, would not be sufficient because scientific and socio-cultural aspects are not of complete and adequate qualities. And it foregrounds that philosophy should be included as well (Evers, 2005), be it in its traditional sense or as so-called "neurophilosophy".

The parallel problem is, however, that the results obtained by neuroscience are being accepted uncritically and people tend to believe the given information a bit more (Illes & Bird, 2006), and it is disputable for several reasons. First and foremost, using EEG and fMRI may be challenging even for trained experts and moreover, the interpretation itself is very knotty. It is not astonishing that even statistical processing may become an obstacle if variables are mistaken or even reversed. The outcome may work otherwise than previously predicted (Lieberman & Long, 2018). Furthermore, for the human brain, as it reacts and acts in accordance with the stimuli, enhancement, drugs, surgeries and/or injuries, there are only two fundamental phases in its activity that are being distinguished: "alive or dead" (Farah, 2005). It means that apart from all the attempts to investigate the brain thoroughly, it will still remain unpredictable for decades. It is questionable, though, whether it may ever be decoded as a structure. As Farah (2012) then wittily emphasized, neuroethical issues are of this twofold character: "damned if you do and damned if you do not" (Farah, 2012).

Resources are the aspect to supplement and bound the aforementioned. As noted by Kulynych (2002), the financial side impacts on the ethical conclusions. Neuroscience with its tools represents a costly sphere of science many universities are not able to afford, and, on that account, research projects are frequently supported with finances from private companies. Therefore, in many cases, the final observations may or may not be biased or at least questionable and thus burdened with conflicts of interest. In order to save money, analyzed samples of participants are usually university attendees who may also be disputable after all. Brain-reading may be applied in two forms, lie-detectors and neuromarketing. Whereas the former may be seen as a chance for new accuracy improvements in neurolaw, the latter wishes to forecast what consumers' behavior is to look like, thus products can be designed accordingly (Haynes, 2011). There are two classes of the greatest concern in neuroethics of neuromarketing: vulnerable parties and

unprotected consumers (Murphy, Illes & Reiner, 2008). Moreover, neuromarketing, neuroenhancement, and mental privacy represent the trinity that has been all the rage for neuroethical research in the past years (International Neuroethics Society, 2017). By all means, neuromarketing possesses its own critical renditions for neuroethics. There are certain advantages and disadvantages to be taken into account. Whilst regular marketing research inclines to be biased by lies from examined subjects, neuromarketing as such is not fully implemented and in addition, there has not been much discovered yet (Farah, 2011). And so, there are issues of neuroethics that should have been pondered upon when using neuromarketing.

Right at the beginning, customers are driven to lose anyway in the whole process, be it from the financial or even health side, especially if only greater companies are able to afford neuromarketing. Subsequently, in comparison to sociological surveys, it is not possible for subjects to lie and therefore, to express and employ their free will. In addition, in the meantime of the neuromarketing experiment, it is questionable how to deal with incidental findings. If there are unusual or clear instances of tumor or other perilous components observed, should there be the same logic as in the medical or university research to inform the subject or relatives? How far is it allowed to proceed then if no code of ethics or Internal Review Board (IRB) had previously been installed? Who is responsible for the process of research and what about the final findings and data storage? Are they to be private for good if paid by the company itself or should it be put under the scrutiny of peer-reviewed journals so that the universal knowledge may be spread easily and become transparent after all? Would the sense of common good be put in practice if a groundbreaking discovery were made? Is the responsibility only upon each human being and thus mental privacy is to be decided by everyone separately if willing to take part in a neuromarketing research project? And finally, when considering mental privacy, there are small-sized samples in neuroscience in comparison with sociological surveys, but are these small samples considerable for mental privacy? In other words, is it acceptable for society if mental privacy is disrupted in the case of three people in order to know more about the human brain or its treatment? Who is to decide and state the red lines? How applicable is Kant's categorical imperative on using people as a means while applying neuromarketing for the UNICEF charity advertisement versus mostly unhealthy food producing companies or internet tycoons? Does it mean that consumers are to be influenced and manipulated significantly with their free will in the name of consequentialism? Is the apparent consumerism in line with human rights and free will to possess a new product for oneself or no justice is to be exercised? And therefore, there is a spiral of reciprocally adjacent queries neuromarketing and neuroethics will have to face.

More importantly, regardless of positive or negative attitudes toward neuromarketing, scholars of neuroethics shall abandon facile visions that neuromarketing is to be conducted only ethically if researchers follow basic principles. It is vital to bear in mind the existing difference between the university and business research procedures (cf., e.g., Sebastian, 2014). While universities are usually but not necessarily supposed to adhere to ethical commissions and IRB, non-academic institutions dedicated to neuromarketing are expected to follow the NMSBA's code of ethics. The fact is, however, that private organizations may decline these widely accepted rules even though this decision could jeopardize the company's credibility.

As aptly summarized by Haynes (2011) in this matter, neuroethics must be able to deal with three elemental aspects: accuracy, validity, and reliability of which all, in simple terms, signify substantial impediments. Children as a specific group represent a separate aspect of this story of ethics as well, since using them as a research sample is precarious twice more than in case of adults. Affirmative stances, however, were claimed by Matthews (2015), for instance, who has theorized that neuromarketing did not represent any ethical danger and proved to be successful. His hypotheses were supported by his sug-

gestion to differentiate between *neuromarketers* and *neuroadvertisers*. Matthews admitted a possibility that only the latter is on the verge of ethical problems because their goal is not to design a product, but rather to disseminate manipulation and influence the public.

Nevertheless, this draft is dubious and naïve at the same time. Apart from the fact that deciding where the red line could be set in order to distinguish between these two sorts of practitioners remains unfeasible, it is also inescapable to realize that marketing, be it neuroscience-based or not, will always be aiming at having the final say and thus influencing the consumers over and over. And so, proposals on making customers thrilled and satisfied, as expected by utilitarianism, are untenable. For neuromarketing, Ruanguttamanun (2014) even predicted that deeper exposures of brain activities may be fatal and result in the state of "overconsumption" invading mental privacy of a great majority of people. Despite the media coverage exhibiting a higher rate of interest which is on the average of 39%, neuroscience tends to keep itself isolated, and regardless of an increase in studies on neuroethics, this whole process still lags behind (Garnett, Whitele, Piwowar, Rasmussen & Illes, 2011). The myths about the power of neuromarketing have endured. Not only it will be demanding to disprove them, the public will need to be educated specifically in this area as previously stated by Illes & Bird (2006) because neuroscience and brain studies have been omnipresent in the last decade, and its leverage could even be increased and intensified.

CODES OF NEUROETHICS

There are three periods to which every neuromarketing research project should adhere to. Firstly, there are necessary steps and rules to be observed before the experimental investigation can be actually conducted. Secondly, it is in the course of an experiment when subjects are temporarily involved, and thirdly, when analyzing, interpreting, and preserving the data and research findings. Concluding deliberations should take place then. Afterward, the circle can be completed and repeated. At the same time, there are four key parties engaged in neuromarketing research, be it directly or indirectly. They all shall be thoroughly considered when preparing a project, and these are as follows: the ordering party, research institutions that conduct the experimental study, examined research samples (i.e. subjects who undergo the investigation), and society that is about to face the imposed product, advertisement or commercial (Hensel, Iorga, Wolter, Znanewitz, 2017; Clark, 2017). And neuromarketing practitioners then bear full responsibility for given groups of people.

Overall, the author identifies three fundamental types of neuromarketing projects regarding ethical consequences. *Positive neuromarketing* research is based on public service advertising. In this case, the aim is to help the public when vital steps must be taken in health issues or for charity donations. *Negative neuromarketing* of which employment should, sooner or later, be reconsidered. There are two spheres in which negative neuromarketing poses a significant threat and within these, meticulous steps are indispensable from the side of practitioners. First, in case of health and its possible harm. There are studies showing how obese customers react differently to many products and consequently, they may be influenced easily to spend more money or even keep their unhealthy lifestyle. Similarly, convincing and influencing consumers to buy and consume tobacco products or alcoholic beverages cannot be in accord with neuroethical principles.

Even the pharmaceutical industry represents a questionable area. Secondly, and equally crucial, it is the sphere of political neuromarketing campaigning. In this sense, politicians and political parties are

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treated as products which are to be offered and sold accordingly. Political neuromarketing does not use only the tools of neuroscience. Even shallow methods inquiring the color preference, face angle or skin tones have already been successfully used. In case of neuroscience, the eventuality of violating free will is even more persistent and hazardous. Moreover, one political figure or party could seizure control if the societal voting or behavior pattern were predictable. This political issue is inherently connected to the gun industry, and it is ethically doubtful, too (cf., Clark, 2017; Odekerken, 2018; Wieckowski, 2019). In this case, neuromarketing would be transformed into "stealth neuromarketing" of which aim is to manipulate consumers only (Clark, 2017, p. 151) in order to be in line with the preferred attitudes or needs as assigned by the ordering political party. Finally, there is an approach of *regular neuromarketing*. Among the three types of neuromarketing, however, classifying and differentiating may become knotty, especially in case of political neuromarketing. For this reason, legal and ethical codes should be in harmony.

Recommendations and guidelines for dealing with neuroethics in neuromarketing may be found in many forms and are based on the type of research (cf., e.g., Hensel, Iorga, Wolter & Znanewitz, 2017; Thomas, Pop, Iorga & Ducu, 2017; Coutinho, 2018). The most detailed proposal for neuromarketing code of ethics was introduced by Murphy, Illes & Reiner (2008). In accordance with the given article, there are three crucial realms to take into account: the rights of research subjects, providing evidence, and rigorous data interpretation for the media. The code proposal may be summarized into following points:

1.   Research participants and their rights

All research studies that work with human beings must adhere to the scientific code of which approval from the Institutional Review Board (IRB) is necessary. Among all the participating parties, there are two omitted groups, though, and it is the research staff and company's (as the ordering party) employees. Even researchers, members of laboratories or employees may abuse the data or resell the findings. And for this reason, codes and regulations shall be applicable and enforceable for them, indeed (Isa, Mansor & Razali, 2019).

1.1 Protection of research subjects

Basic provisions include informed consent of participants, confidentiality, and particular regulations for incidental findings because any possible discovery of diseases or medical problems may come under the scrutiny of ethical boards. Dignity is, among others, another relevant aspect that has been addressed because it "links human rights to bioethical values" (Ulman, Cakar, Yildiz, 2014).

1.2 Protection of niche populations

The niche groups consist of young adults and students, children, pregnant women, disabled people or even left-handed persons and so forth because they may be harmed easily.

1.3 Full disclosure of goals, risks, and benefits

The ordering party, be it a smaller or greater company, shall always issue a document on ethical standards and principles.

2.   Representation in the media

Research analyses should not be announced in an overexaggerated manner as an overstatement in order to draw attention to the company if provided data cannot sufficiently support given hypotheses (e.g., Stanton, Sinnott-Armstrong, & Huettel, 2016) Otherwise, even a backlash could follow, and the company might lose consumers' trust forthwith. In many instances, journalists and paper publishers craving for a sensation have caused a turmoil among scholars (cf., e.g., Iacoboni, Freedman, & Kaplan, 2007; The New York Times, 2007; Randall, 2015)

3.   Validity

Developing the aforementioned, Murphy, Illes & Reiner (2008) suggest that a database of findings and data shall be at customers' disposal in order to allow the public and scholars make use of it and examine whether the research studies had not been delivered incorrectly. Contrary to research papers in academic journals, research papers for the industry do not need to undergo a peer-review procedure. Therefore, its validity may be very limited, and on top of that, the findings may actually be completely meaningless for the company.

An initiative called NeuroStandards 1.0 and 2.0 has been established by the Advertising Research Foundation (ARF). Its objective is to offer the members good-quality peer-reviewed analyses concerning with proposed methods in research projects (Stanton, Sinnott-Armstrong & Huettel, 2016). However, the most respected and exploited (e.g. Olteanu, 2015) code of ethics in neuromarketing has been introduced by the Neuromarketing Science & Business Association (NMSBA, 2019).[5] Among its members, this strictly unbiased and independent organization aims to insist on conducting merely "honorable and ethical neuromarketing" (Coutinho, 2018, pp. 155-156). In the 12 articles of NMSBA,[6] of which members must claim allegiance to, all the essential issues are mentioned and clarified. Apart from definitions, and principles of neuromarketing and its credibility, the code deals with participants in the section of integrity of which aim is to protect anyone from being harmed or stressed. Moreover, as it is emphasized in this article, neuromarketers should never deceive participants when using them for an experiment, and no further sales may be offered to participants in the aftermath, either. Article 4 stresses transparency. According to this article, taking part must always be voluntary, and subsequently, the data and process of its collection should be made available to the clients. All aspects must then be archived with all the relevant details.

In Article 5, the NMSBA discusses the consent which is based on participants' complete understanding after having everything explained in "layman terms". Article 6 on privacy declares that participants are expected to be aware of the project background and furthermore, a true identity of selected subjects will never be exposed, if not previously agreed by both parties. A neuromarketing research company is fully responsible for all the data, and every brain scan image or document will belong to the research institution. Article 7 on participant rights then specifies that there was no obligation to participate and a withdrawal was possible as well as the data could be deleted if requested by a subject. The data protection possesses significant importance and follows the principles of the country in which the research is about to take place. Extending the previous one, Article 8 remarks that anyone under the age of 18 will

be allowed to participate only if informed consent is signed by parents. In the case of subcontracting, the research institution's duty is to announce it. The closing articles on publication, commitment, and implementation are dedicated to respecting the code, its acceptance and its fulfillment.

SOLUTIONS AND RECOMMENDATIONS

As in the case of neuroscience and its contemporary fashionableness (Conrad & De Vries, 2011), neuromarketing has gradually become an indispensable ingredient of marketing. And indeed, it is a natural part of science to analyze human behavior and thus contribute to the blooming field of neuromarketing thanks to the valuable knowledge neuroscience has gained in the past periods of time. However, this relation may be found only fractionally reciprocal, since neuromarketing practitioners are not necessarily scientists publishing their research findings in peer-reviewed journals (Hensel, Wolter & Znanewitz, 2017). And it demonstrates that another strikingly problematic aspect may lie in the non-academic neuromarketing approach per se. Nevertheless, neuroethics should endeavor to develop itself into a regular discipline not only in the academic environment (Roskies, 2002; Illes, 2007), but moreover, is should set borders and determine neuroethical concerns for the near future (Murphy, Illes & Reiner, 2008). On this account, the identified role of neuroethics should be of a ternary character. First, neuroethics should keep on being empirical and thereby investigating the results of neuroscience for further considerations. Second, in accordance with the former, it shall be descriptively interpretative, and therefore neuroethics should be able to: i, verify or falsify hypotheses on neuroethical issues; and then ii, put them into context from a historical perspective and medical experience. Third, neuroethics would not meet the criteria without being deliberatively normative while using the knowledge of bioethics and philosophy so that, in line with the other two roles, pioneering, and universally applied prescripts and borders might be defined or modified respectively.

Only if these sines qua non roles are consistently fulfilled, the relevance and significance of neuroethics may be finally proven. The problem, however, lingers on the assumed labor shortage rising in this "mariage de raison" of neuroscience to social sciences and vice versa. And since neuro-x disciplines operationalize on the highest level of interdisciplinarity and enter other areas of social sciences, there is a very limited number of people educated and sufficiently trained in neuroscience and physiology and, at the same time, knowledgeable in corresponding social or political phenomena in order to be sufficiently able to analyze and interpret the findings (Petlach, 2019). On the whole, the future of neuroethics inheres in itself and its ability to combat prejudice not only from within (cf., e.g. Illes, 2007), but also with respect to the outside world (Farah, 2005). Legrenzi and Umiltà (2011, p. 85) contrasted that neuroethics and corresponding fields and disciplines "demonstrate that not all theoretically possible judgments are psychologically plausible and performable in cognitive terms".

Ultimately, Ulman, Cakar and Yildiz (2014) identified three possible neuromarketing trajectories that could be expected. First, neuromarketing may be subject to no restrictions and thus it would enjoy full independence. However, a higher level of abuse and ethical damage could emerge as a consequence. Secondly, a new, detailed and elaborated set of rules and prescript should be imposed particularly for neuromarketing. Research institutions, academia, and the industry would have to comply with them. Finally, neuromarketing could be banned, be it a partial or complete prohibition by national governments. In this option, France represents a pioneering example of banning neuromarketing as a whole. According to Article 16.14 of the French Code Civil from 2011: "brain imaging techniques may only be

used for medical or scientific purposes, or as part of forensic expertise…" (Code Civil, 2011). This ban, however, cannot be as mighty as desired because for the purposes of research, neuromarketing practitioners only need to conduct their research in any other neighboring country or if possible, experiments may be conducted while employing other tools, such as eye-tracking, which are not included in the legal provision. This type of circumventing the law only leads to a squandered chance to keep a good track of neuromarketing. An exaggerated argument has been then put by Zuidgeest (2019) stating that any disapproval of neuromarketing is the same as opposing marketing as such. On the other hand, as concluded by Wieckowski (2019): "fueling consumerism as consumer debt rises is an ethical concern" which as a statement vigorously endorses other previously mentioned studies (e.g., Ruanguttamanun, 2014).

Specifically, political neuromarketing has had its moment of glory in Latin America or India, for instance (e.g., Braidot, 2011; Dutta & Mandal, 2018). The fact is, that these countries are not necessarily burdened with wars or other atrocities as genocides for example, and thus ethical matters are on a lower level of emphasis. Paradoxically and out of spite then, a great amount of literature on neuromarketing currently originates in the German-written literature, in which both theorists and students in their diploma theses (cf., e.g., Bittner & Schwarz, 2014; Dolezal, 2017; Häusel, 2019; Pispers, Rode & Fischer, 2018; Scheier & Held, 2018; Stockinger, 2011) focus not only on neuromarketing and its practical use, but they also stress ethical questions when following and elaborating, among others, on Mill and Kant's interpretations in order to examine the practical dimension of neuromarketing. As it turned out, the previously mentioned deontological approach, which has been associated especially with Immanuel Kant, focuses on the act itself, and thus it is not able to consider the relevance of context. By contrast, utilitarianism then excessively studies merely the consequences arising from the act (O'Shaughnessy, 2002).

FUTURE RESEARCH DIRECTIONS

This chapter endeavored to summarize the principal features of ethical codes, origins, and trajectories (bio)ethics has exhibited up to its latest form, known as neuroethics. And although neuroethics is not in possession of strong academic background, and therefore it seems to be either neglected or criticized by definition, the objective of this chapter was to advert to the crucial role this field will have to play because of the spread and availability of modern technologies. The ethical problem, however, arises even more significantly if neuroscience is employed as a means of neuromarketing. And the situation then intensifies its ethical knottiness when neuromarketing meets other disciplines, especially politics. Regardless of previously delivered remarks on ethical problems in political marketing, which may be perceived as an example par excellence (Banker, 1992), the interconnection with political neuromarketing has not been thoroughly analyzed yet.

First and foremost, neuromarketing and other neuroscience practitioners, together with social scientists, must recognize the indispensability of neuroethics for further research, forasmuch as they have failed to do so (Wardlaw et al., 2011). Furthermore, before conducting a vast range of studies, it will be necessary to get in touch with and reassure the public in order to elucidate the use and application possibilities of neuroscience, since the public does find neuromarketing and neuro-x fields rather perilous due to the potential abuse of mental privacy (Ibid.). Without nipping fundamental issues in the bud, many questions will remain unresolved, and problems could escalate.

Two directions of research in neuroethics should be observed and adequately improved. The first one lies in the philosophical component. In defiance of some initial research based on traditional philoso-

phers, which are reflected in sundry approaches as, for instance, Kantian's deontology, consequentialism and J. S. Mill's utilitarianism, contracting views, and objective relativism in relation to marketing, they highlight and focus on only some selected aspects of ethics (e.g., O'Shaughnessy, 2002). And for that reason, they tend to be insufficient in regard to other contemporary facets of neuromarketing, neuropolitics and other fields. Hence, further philosophical queries are vital as they address ethical issues, and these may be put into context afterwards. The second branch should be based on the side of the practice as researchers need to better understand the processes of consumers' decision-making, be it in a political or business perspective (Palmer, 2015). In the end, it will be crucial to challenge and unify (sic) the medical, business and neuromarketing codes of (bio)ethics into a comprehensive code that could be widely used and followed in research studies of social neuroscience and neuro-x fields. This final step, nonetheless, symbolizes another inner obstacle of biased tendencies in the research of neuroethics, and it is the impact of cultural heritage as exemplified by scholars of communitarianism. Without providing enough evidence justifying the position of neuroethics, future research studies might be characterized as substantially disputable.

CONCLUSION

In defiance of adverse criticism, neuroethics will continue to overlap other neuro-x fields and disciplines. Stanton, Sinnott-Armstrong and Huettel (2016), when studying similarities between marketing and neuromarketing, concluded that four spheres mingle and are to endure. Initially, the expensiveness of (neuro) marketing will be reflected in the final price consumers will have to pay for given products. Another shared aspect is the absence of Institutional Review Boards (IRB) which would supervise the projects. This remark brings back the other initial problems as the lack of experience in the field, and even making a great mistake when neglecting neuroethics as a whole. Thirdly, (neuro)marketing companies do not need to worry about whether consumers' decisions harm their health as in the cases of tobacco products, drugs, and unhealthy food. Last but not least, a high level of predictability may endanger societies in every country of the world. Most interestingly, neuromarketing is anticipated to blossom especially in political public relations (PR) and marketing. Regardless of financial benefits as the principal demand, the problem is, however, that whereas in neuromarketing and its economic sense, there are products to be sold and bought, in neuropolitics and neuromarketing, free will and free future of the state might be affected unfavorably. In this situation, if neuromarketing were misused, political regimes would probably be transformed into a different form of political regime. Ad absurdum, it would not be most definitely a democratic one. Although concerns of this chapter may sound sci-fi burdened, the future maintains the contrary. In the end, it might be possible to question Orwell's known phrase from *1984* that "nothing was your own except the few cubic centimeters inside your skull" (Orwell, 2014).

After all, neuroethics is supposed to draw a clear distinction between human beings and mere items (Farah, 2004). And owing to many vital aspects and research measures neuroethics has been expected to untangle (e.g., Gordijn & Buyx, 2010), it could become more than an arbiter for deciding whether a research project might either potentially pose a threat or be plausible. However, it will not be technically feasible to deal with more specific case studies and meta analyses without gradual debilitations of constant dwell on contra factual studies as obvious in neuroethical literature (Farah, 2012). Regarding the skepticism surrounding neuromarketing and corresponding neuroethics (Murphy, Illes & Reiner, 2008), it is essential to appraise the possibilities and prospects into deep (cf., Lim, 2018) once again before

jumping to conclusions that neuroethics may be of no great significance. After all, there is a reciprocal relation between neuroscience and ethics (Farah, 2010), stressing that neuroscience needs neuroethics and vice versa. With the rise of neuroscience and neuromarketing with more than 200 companies making use of it, an obvious growth of neuroethics is to follow as a "pressing" issue (Gold & Roskies, 2008). Similarly, it may be expected in case of criticism casting doubt upon the justifiability of ethics as a whole (Racine, 2010). And for this reason, it is crucial to observe which directions of neuroethics scholars might eventually determine. It is inevitable that revolutions always devour their own children.

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KEY TERMS AND DEFINITIONS

Brain Imaging: Tools of neuroscience, such as electroencephalography or functional magnetic resonance imaging, are employed to obtain scan images capturing brain function activities.

Categorical Imperative: Immanuel Kant's crucial prescript in ethics on the forms of behavior one is expected to apply from within in order to make them universal.

Ethics: A complex philosophical inquiry on morals, values and rules and the way in which they are to be applied in everyday situations.

Free Will: A philosophical concept studying one's ability to act in accordance with own intentions without being limited by the others or fate.

Manipulation: A form of act of which aim is to influence someone else's behavior.

Morals: Subjectively personal principles of act, whereas ethics is specifically spread as a condition in concrete realms in which corresponding doctrines are universally recognized.

Neuroethics: Akin to ethics but differentiating by its concentration on morals and rules while the tools of neuroscience are utilized in the process of research investigation.

Neuromarketing: A developing strategy of marketing which makes use of neuroscience so that more accurate results are obtained when studying consumer behavior and product designing.

ENDNOTES

[1]   Experiments with questioned qualities appeared even after the Second World War, in the 1960s and 1970s, with the infamous Stanford experiment as one of the main instances (cf., Zimbardo, 2008).

[2]   Kant's contribution has been analyzed for centuries and his notes on autonomy of human beings are highly regarded even nowadays (Tesluk, Illes & Matthews, 2017).

[3]   The authors claimed that less than 8 out of 20 university and research institutions have delivered neuroethical classes in the United Kingdom (Morein-Zamir & Sahakian, 2010).

[4]   William Safire is associated with the opening explanation that neuroethics should define the good and the bad at the same time (Farah, 2012; Müller & Jox, 2017).

[5]   Another code of ethics applicable to neuromarketing has been delivered by the ESOMAR (2011), while further comments on legal provisions and experience were executed by Voorhees, Spiegel & Cooper (2011).

[6]   The Code of Ethics in its complete listing is available on the NMSBA's official website: https://www.nmsba.com/buying-neuromarketing/code-of-ethics.

Chapter 3
Consumer Neuroscience Perspective for Brands:
How Do Brands Influence Our Brains?

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ABSTRACT

Neuroscientific tools have increasingly been used by marketing practitioners and researchers to understand and explain several different questions that have been issued for a specific company or a general understanding. In this respect, the neuroscientific approach has been evaluated as a potential tool for understanding the neural mechanisms directly related to marketing with its contribution to providing novel perspectives. The chapter addresses one of the most relevant subjects, brands, for issuing the strategic role of applied neuroscience in marketing and consumer behavior. The first section of this chapter focuses on a novel definition of brand, and the next section covers the brand image, brand perception, and brand loyalty. The second section summarizes the main findings regarding the neuroscience of brands. In the final section, the findings from a related experiment have been provided for the potential roles of neuromarketing for developing marketing strategies for brands.

INTRODUCTION

Neuromarketing focuses in particular on the body's neurophysiological and biometric reactions as a supplementary method for marketing studies. Work on neuromarketing primarily aims at integrating behaviors inside the nervous network (brain and entire body) with customer behavior (Hubert, 2008). While data collection through neuroimaging appears similar to quantitative strategies, work on neuromarketing, including biometric analysis, indicates that it still has some characteristics in common with qualitative methods. In terms of advertisement analysis and evaluation, this application-based type of

neuroscience is a fairly recent technique, which has slowly become popular, despite bearing a resemblance to quantitative and qualitative approaches of conventional methodology (Kessler *et al.*, 2012). While such methods are often used for sector-specific purposes, there has been a shift towards utilizing more analytical methods, especially over the last decade (Ariely & Berns, 2010). The key explanation for this was the desire to reach secret knowledge that could be represented as implicit details that cannot even be accessed by the user (McClure et al., 2004; Dijksterhuis 2004). The second motive was linked to the prospect of supplying the tests with cheaper and quicker settings so that they could be streamlined and serviced at a pace that would satisfy the sector-specific requirement (Ariely & Berns, 2010). Such initial motives culminated in more than 300 firms being formed under which various technologies were created for sector-specific usage within the product domain known as neuromarketing. This interdisciplinary area is at the nexus of diverse disciplines including communications, finance, psychology, and neuroscience.

The commonly used neuroscientific methods could be evaluated under two groups: (1) the ones that directly get data from the brain like EEG/ERP or fNIRS, and (2) the ones that indirectly obtain data from the brain like skin conductance resistance or eye tracking systems. These methods are adopted from clinical applications and research thus many of these have a long history in medicine. Here, some of the common methods will be explained in sufficient details. EEG/ERP, neuroelectrophysiological method, focuses on acquiring the brain potentials via the electrodes placed on the scalp. On the other hand, eye-tracking method measures the eye gaze in terms of understanding the direction of eye movements, attention level and fixation points. Meanwhile, the neuroimaging methods such as fMRI and fNIRS are based on the neurophysiological changes among the blood, especially oxygenation level (Alivisatos, *et al.,* 2013).

ACCESSIBILITY OF THE METHODS

The growing use of neuroscientific approaches has caused a long-lasting impact on various fields including economics, ethics and marketing. The implementation of these neuroscientific methods has been adapted directly from the literature of neuroscience, thus providing scientific legitimacy and reliability as research context (Hammou *et al.,* 2013; Badoc *et al.,* 2014). The costs of the equipment used to use these methods differ widely, depending on their technological requirements and limitations. For example, in terms of its sampling frequency, channel number and software package for data acquisition and data analysis, an EEG / ERP system can be found at a price of 100 USD up to more than 100.000 USD.

Prices have typically continued to decline over the last decade, as the use of open source (free software) is favored because future convergence of inexpensive apps has become feasible. There are eye-tracking tools, for example, with prices down to $100 and no software package built for high level data analysis. Prices have typically continued to decline over the last decade, as the use of open access (free software) is favored because future convergence of inexpensive apps is feasible. Of starters, there are eye-tracking systems with costs down to $100 and no software kit built of high data analysis standards. Deleting the artifact components from the raw data to include a collection of accurate and appropriate data analyzes is an extremely crucial reality. Otherwise, it may result in deceptive results that may contain unacceptable internal and external noise levels.

INCREASING DEMAND TO USE OF OBJECTIVE TOOLS

Particularly over the last decade the use of analytical approaches over marketing and consumer analysis has become highly important. The measurement of TV advertising as a supplementary resource to conventional media analysis approaches has become one of the implementation areas of such quantitative techniques including fMRI, EEG and Eye-tracking (Ariely & Berns, 2010). The usage of TV ads has been one of the key public contact practices for companies and have long been believed to have an effect on their brand identities as well as directly on their revenues (Cummings & Nickerson, 2017). However, the assessment of such ads remains a subject of debate, since there is still no unbiased and accurate process generally acknowledged for assessment. Nonetheless, there is an increasing empirical literature, known as consumer neuroscience, that seeks to understand consumers 'neural underpinnings, and primarily the field of study has been the assessment of TV advertising. There are many reasons to back up the need for an unbiased consumer analysis process.

Applied neuroscience approaches are candidates for having less disruptive (more sterile) results, according to Ariely & Berns (2010), which will enable researchers and clinicians to provide better models compared with conventional testing methods. In comparison, as opposed to traditional communication strategies, the usage of neuroscientific approaches has been reported to be cheaper and faster. Such modern approaches are claimed to be cheaper and quicker since smaller measurements are enough to make more reliable forecasts in neuroimaging experiments-even if the model is correctly shaped (Ariely & Berns, 2010). Ariely & Berns (2010), however, further suggested that this assumption could not be a reliable forecast since developments in technology might raise the technological and operating costs.

For marketing experts and clinicians their second point regarding exposing the secret knowledge in the brain is even more compelling. They claim that traditional approaches will only hit a certain degree of market preferences. The neuroscientific approaches may help one to enter consumers 'underlying (or true) desires that are not feasible by their introspection or some other form of behaviour (Dooley R., 2012). There are a few experiments with results that suggest that certain of the neuronal mechanisms may be conducted at a stage that cannot be actively regulated and deliberated as Pepsi Challenge specifically notes. (Dijksterhuis 2004; McClure *et al.*, 2004). In other words, participants 'articulation processes that run the risk of misguiding the researchers, since the articulation is more likely to be affected by public perceptions and social standards, especially for contexts like products and advertisements (Fischer, Chin & Klitzman, 2010).

REWARDING EFFECT OF BRANDS

The obtained findings from one of the neuroscientific studies conducted by fMRI in the relevant literature indicate that when a person makes a choice between a favorite brand and non-favorite brand, there are significant differences with respect to brain activations (Deppe *et al.*, 2005). Most importantly, there is an increased level of neural activation within the *ventromedial prefrontal cortex* while choosing the favorite brand. Since *vmPFC* is known to be a part of the human brain reward system, this increased activation leads to a conclusion that the brain reward system takes role during the preference of the favorite brand due to a rewarding effect caused by this brand. Moreover, there is reduced activity for a favorite-brand among dorsolateral prefrontal cortex (dlPFC) as well as visual cortex. Dorsolateral prefrontal cortex has been known due to its role in critical thinking, strategic decision-making, and conflict resolution,

thus, this reduced activation in favor of favorite-brands might be due to the need for less level of conflict during the choice of the favorite-brands.

Another fMRI study by Schaefer and Rotte (2007) focuses on the possible influence of a favorite car brand's impact on one's experience. The obtained results demonstrate that the ventral striatum, also a central component of the human brain reward system, is activated more when one imagines that she is driving a car with her favorite brand as opposed to a non-favorite brand. Thus, a possible take-home note might be that even such an imaginary scenario might trigger the brain reward system because of a rewarding impact while driving a favorite-branded car more than non-favorite branded car. In addition to this, another fMRI study by Schaefer and Rotte (2007b) worked on the research question related to the effect of social status caused by car brands. The results showed that the car brands with high social status perception (as opposed to the low status) caused more neural activation in the medial prefrontal cortex. Again, it is highly likely that the car brands perceived as promoting social status possibly trigger the brain reward system more than the others with lower levels of promoting effect.

However, this influence might not be totally caused by luxury of the presented items, instead, it might be related to various different associations that we have. For instance, the fMRI study by Erk et al. (2002) have demonstrated that several brain regions that are accepted as the part of brain reward systems including striatum, vmPFC/mOFC, and ACC have been activated more when the participants saw sports cars (vs. limousines). Thus, the issue might not be so simple that more luxurious items occasionally activate the brain reward system more. In other words, one should be careful about driving conclusions over a single experiment but one should be aware of the other empirical findings in the literature as well as their limitations to drive the possible conclusions.

RECALLING THE BRANDS AND THE RELATED MEMORIES

Another crucial point has been related to the neural correlates of brand familiarity. As the fMRI study performed by Schaefer et al. (2006) indicated MFG has been found to be activated more when the person sees familiar brands as opposed to the unfamiliar brands. In addition to this finding, an fMRI study performed by Esch et al. (2012) demonstrates that *strong* brands as opposed to *weak* brands induce neural activity among dorsolateral prefrontal cortex (dlPFC). This finding might be indicating that the strength of a brand might be explored in relation to the activity it causes within this specific brain region. Another study by Klucharev et al. (2008) illustrates that expert endorsement is also associated with the level of neural activity among several brain regions including the left dlPFC, left medial temporal lobe structures including hippocampus.

INFORMATION BIAS AND CONFLICT RESOLUTION
RELATED TO BRAND NAMES

Brand information has long been known to be a form of cognitive and affective bias for the customers since they are likely to have formed various different associations in memory. The results from the fMRI study by Deppe *et al.* (2007) show that people could be biased by the information provided such as the brand name of a newspaper when they are said to evaluate the given advertisements in terms of their attractiveness. This bias caused by brand name is similar to the famous empirical finding found

in the Pepsi Challenge. As expected, people tend to evaluate the print advertisements of more favorite brands more positively than the non-favorite ones. Another similar study by Deppe, Schwindt, Kramer, et al. (2005) has indicated that the perceived credibility of a headline is influenced by the brand name of a newspaper and this influence could be predicted by the higher levels of neural activity in anterior cingulate cortex (ACC) that is known to be related to conflict resolution.

PROSPECTING BRAND LOYALTY

The neuroimaging studies related to brand loyalty have attempted to understand the specific brain regions that are influential during the behavior of loyal customers as opposed to disloyal customers. The fMRI study by Plassman, Kenning, and Ahlert (2007) illustrated that there is a significant level of correlation among *striatum* during the brand choice for loyal customers as opposed to disloyal ones. Striatum has been found out to be a crucial component of the human brain reward system. Thus, this correlation might be indicating that the positive and rewarding effects could be linked to the brand memory.

DARK (UNCONSCIOUS) SIDES OF BRANDS

One of the most stunning studies in the neuromarketing literature has been known as the Pepsi Challenge not only because of its counterintuitive findings indicating that people might behave differently in blind tastings and tastings with brand-information. Their neuroimaging results have shown that vmPFC/mOFC has been activated due to their revealed preferences. In other words, this neural region induces higher activation while a person consumes the beverage that she prefers. Thus, this brain region might be evaluated as a pleasure-meter that is activated more or less with respect to the pleasure level of the experiencer/person. However, the more interesting point is related to the presence of brands. When people are presented with brand-information about the beverage they consume, there might be a pattern of neural activation differences for Coke (but not for Pepsi). The obtained findings have illustrated that memory-related brain areas including hippocampus and dorsolateral prefrontal cortex (dlPFC) are activated higher when they know it is Coke they are drinking vs. they do not know what they are drinking. Interestingly enough, these participants who selected Pepsi (vs Coke) in the blind taste tended to select Coke when they are aware of the brand. It seems that successful memory associations have been formed which deviate from the revealed preferences by the users/customers. When these people are asked about the reason about their preference, specifically why they chose Coke over Pepsi, they tend to respond because of the taste. However, the findings from this neuroimaging study demonstrate that these participants were not likely to have higher levels of pleasure due to the indifferent level of neural activation among the pleasure-related brain regions such as vmPFC. In other words, it could be argued that people tend to lie in such occasions in which they are dictated by social norms such that relating this preference to experience pleasantness makes more sense. Moreover, it might also be the case that these participants are not aware of this distinction about their experience (Libet *et al.,* 1983). In other words, people might not be able to reach this information which is directly related to the cause of their behavior. Thus, it is related to Ariely & Bern's explanation by accessing the hidden information. This is one of the rare studies (McClure *et al.*, 2004) that have exemplified such a notion in the domain of consumer neuroscience.

BRAND PERCEPTION (ADJECTIVES)

In the last two decades, using human trait attributions for brands has gained a wide range of popularity and usage in the academic as well as sector-specific studies (Hsu, 2017). The neuroimaging study by Yoon *et al.* (2006) has aimed at understanding whether the same neural circuits take role while making judgments about brands and humans. The obtained findings indicated that there are different neural circuits involved in these judgments related to human traits for brands vs humans.

FROM BRAND PERCEPTION TO COMMERCIAL SUCCESS

TV ads have been one of the most widely preferred marketing communication tools of the companies especially for the last 3 decades. It is becoming of higher interest to assess the population-wide commercial success of these TV ads via more objective tools rather than using self-reports and other qualitative methods. A recent EEG study by Boksem & Smidts (2015) has shown that specific EEG signals could be used as indicators of individual preferences for movie-trailers as well as predicting their population-wide success. Boksem & Smidts (2015) have focused on the activation among the ventromedial prefrontal cortex (vmPFC) that is accepted to be a part of the brain's reward system with calculating the average beta and gamma oscillations over the whole interval. The ventromedial prefrontal cortex of the brain (vmPFC) has empirically been found to be responsible for implicit valuation, processing preferences including products and brands in the relevant academic literature. There is an increasing literature that covers the role of vmPFC in implicit preference that is positively correlated with the actual choices of the individuals (Knutson *et al.*, 2007; Tusche *et al.*, 2010; Cakir *et al.* 2015). Moreover, relying on the findings from different neuroimaging studies including Berns & Moore (2012) and Falk *et al.* (2012), the population-wide successes of the products and advertisements could be predicted by the activity level in vmPFC. Thus, it seems possible that the application of a neuroimaging device (EEG, fMRI, PET, fNIR) to monitor vmPFC might possibly be used for the objective assessment of the commercial TV ads possibly on different dimensions.

This study has initially focused on understanding the neural correlates of watching TV ads on the prefrontal cortex with attempting to predict the individual preferences and the possible influence of brand image via an optic neuroimaging device. Three TV ads of three automobile brands that are common in the national market have been selected for this study. All of these commercials have won prizes in national awards due to their recorded market success. This study has aimed at understanding the preferences of individuals via their neural activity among prefrontal cortex (PFC) during the presentation of commercials. Moreover, the possible impacts of brand images have also been investigated in line with the findings in the literature. An optic neuroimaging (functional near infrared spectroscopy) method that is becoming highly popular in applied neuroimaging research has been used for data collection because of its advantages on practicality and mobility (Kopton & Kenning, 2014).

METHOD

Participants

30 participants who were recorded to be the users of these three automobile brands (10 of each brand) were invited to the experiments. Participants have been selected from the SES groups of B and C1. Participants were known to have no history of neurological illness or damage, and were not taking any psychiatric medication at that time. Moreover, it was known that they had normal or corrected vision. One of the participants has been removed from the further data analyses after preprocessing step because of his excessive artifacts in the fNIR records. The final sample consisted of 29 participants (26 males), between 27 and 49 (M=35.38, SD=6.03) years of age.

Stimuli

For this study, three commercial TV ads have been selected that have been awarded prize in national awards. It was our preference that the participants have been familiar with these ads in order to prevent the novelty effect. Thus, all of the participants have already watched these commercials before. These commercials belonged to three different automobile brands that are known and widely used in the country. These brands are named as follows: Brand A, Brand B, and Brand C. The relevant commercials have been labeled in a similar fashion in relation to the associated brand: Ad A, Ad B, and Ad C. All of the commercials have been less than a minute but longer than 30 seconds which is accepted as a considerable duration for an ideal TV ad.

Procedure

The participants have been informed in detail by written and verbal instructions as they arrived at the research lab. Their questions related to the study were answered prior to the study. They signed informed consent forms. The experiments were carried on a 17'' laptop. The participants watched these TV ads at a random order and fixation durations have been set to 20 seconds and presented before each commercial. The experiment was performed via E-Prime 2.0. After the experiment, the participants responded to a short questionnaire involving their preferences for viewed TV ads, brands and lastly the brand of their current automobile that they owned.

Optic Brain Imaging (fNIRS)

This method of optic neuroimaging can track changes in blood oxygenation and blood volume that have been shown to be correlated with brain physiology as an indication of neuronal activity (Obrig *et al.,* 2000). This method of optical neuroimaging has been established over the last decade as a reliable indicator of oxygenation and blood flow in the human brain (Bunce *et al.,* 2006). This technique, fNIR spectroscopy, was developed as a non-invasive, effective, and portable process, which could be more easily used as a tool for research into neuromarketing. The fNIR spectroscopy is capable of transmitting infrared light from the source to the tissues and receiving the light reflected from the tissues through the intact scalp and skull after its diffusion.

Figure 1. The Diagrams for Optic Neuroimaging Device (Fnir) Used in The Experiments. Fnir Sensor (Top, Left), Projection of Measurement Locations (Optodes) On Brain Surface Image (Top, Right), Optodes Identified On Fnir Sensor (Bottom).
Source: Adapted from Ayaz et al. (2013).
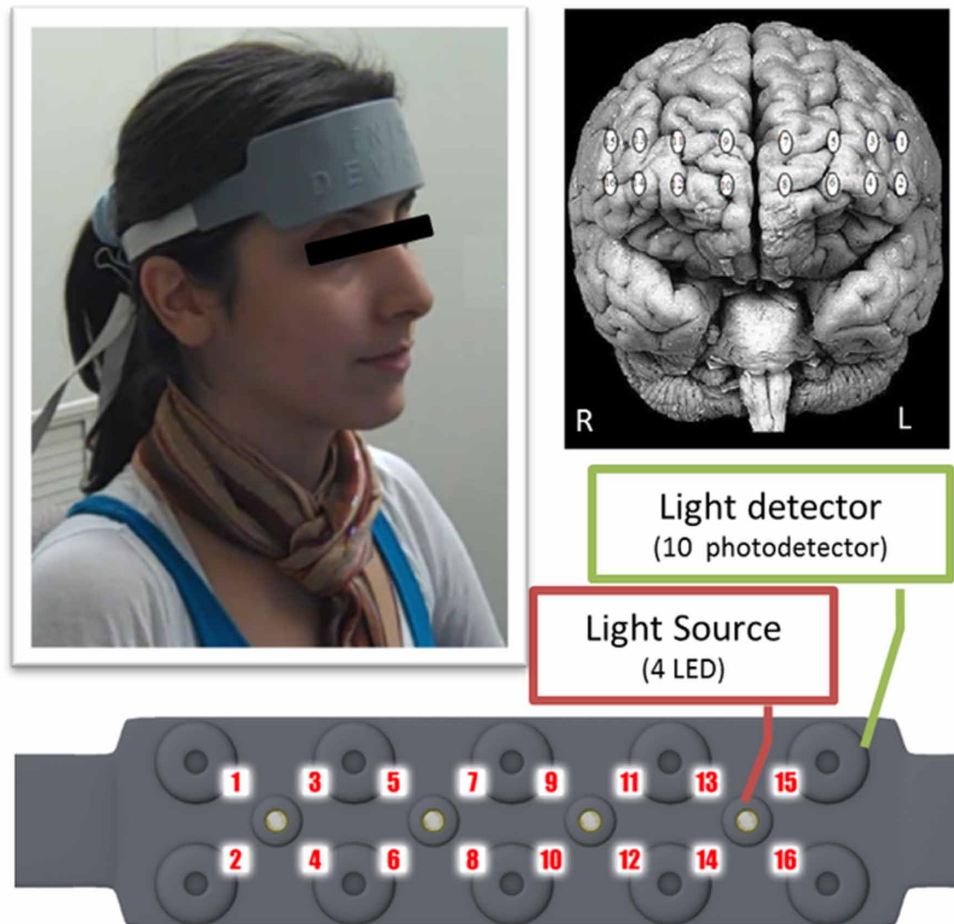
This essentially tests variations in relative ratios and shifts in neural tissue concentration of particular chromium pores such as deoxygenated hemoglobin and oxygenated hemoglobin in capillary beds during brain activity (Jobsis, 1977). Biological tissues are considered to be sensitive to light within the near infrared range (700-900 nm), and within this range, oxyhemoglobin and deoxyhemoglobin are two of the main infrarot light absorbers (Cope *et al.,* 1988). This comparatively higher absorption level of these molecules allows for monitoring of the average relative concentration shifts. This approach (fNIR) has various applications in scientific literature, ranging from mental workload evaluation to human-computer interaction, buying decisions, quality assessments and relationships of choice (Ayaz *et al*., 2012; Shimokawa *et al.,* 2010; Knutson *et al*., 2007; Mitsuda *et al*., 2012).

Behavioral Measures

Figure 2. The Illustration for The Measurement Features of Fnir Device. The banana shaped path that includes the photons scattered back to the photo-detector (right).
Source: Adapted from BIOPAC's website (https://www.biopac.com/application/fnir-functional-near-infrared-optical-brain-imaging/)
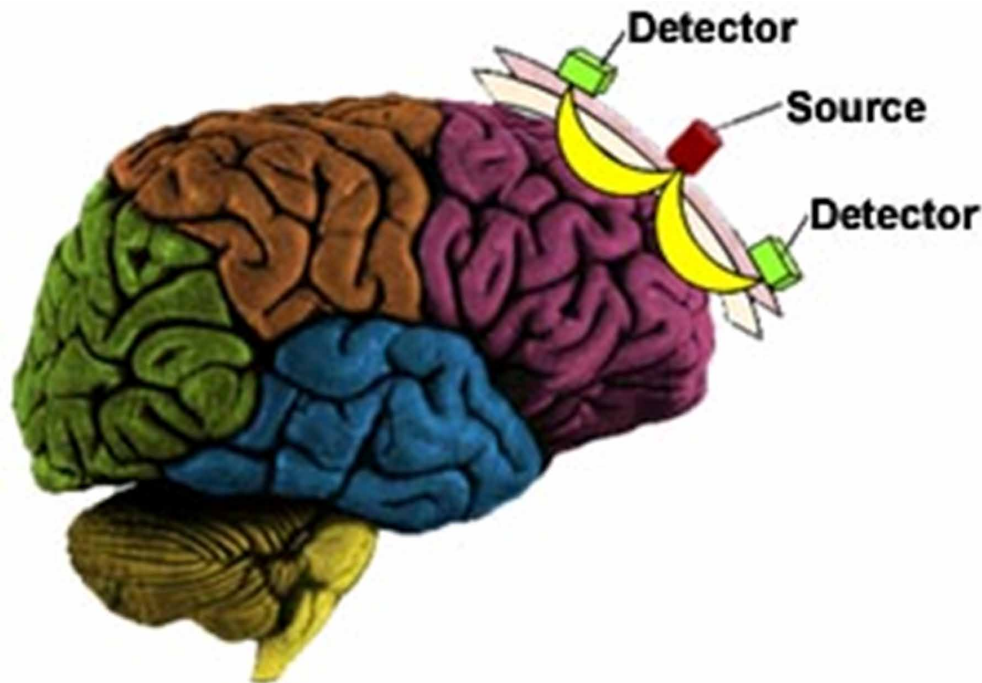
Three different behavioral measures have been used for analyzing the fNIR signals. First, the participants have been asked to declare the preference order of the TV ads among the three they had just watched. The commercials of Brand A and Brand B have been the most preferred ones, since each of them has had the first choice of 12 participants (41.4%). Brand C has been the first preference of only 5 participants (17.2%). Then the participants responded to the question asking the order of their brand preference. 18 of 29 (62.0%) participants selected Brand A as their favorite brand among these, 9 of 29 (31.0%) responded that Brand B is their favorite brand and 2 of 29 responded for Brand C (7.9%). Finally, they were asked the brand of the automobile they owned. Three groups of 10 participants responded that they were owners of Brand A, B, and C respectively. The details of the preference order of commercials, brands and the owned car information have been provided in the Appendix A.

Data Analyses

The obtained fNIR data has been preprocessed before the further analyses. For preprocessing stage, the low-pass filter was set to a finite impulse response and linear phase filter with order 20 and cut-off frequency of 0.1 Hz. Motion artifact filters have been applied for the artifacts due to excessive motion

by the participants (Ayaz *et al.,* 2011). As mentioned above, one of the participants has been removed from the further data analyses because of high level of artifacts. After the filtering phase, the data was recalculated due to the local baseline levels that are the average oxygenated hemoglobin levels of the last 10 seconds just before the onset of the commercial. The average of oxygenated hemoglobin levels is calculated for each commercial then they are analyzed with respect to the responses of the participants that are done just after the experiments.

RESULTS

The averaged oxygenated hemoglobin levels have been analyzed with one-way ANOVA in order to see the possible effect of highest individual preference of commercial TV ads (most preferred one versus others). The results showed that the individual preferences of the participants for commercial TV ads could be predicted via the activation decrease in the optode 16 ($F(1,66)=7.238$, $p<.009$). When the data was analyzed with respect to the order of the commercial preference (from 1 to 3), the Pearson-correlation test results with a significant value for the same optode ($r=.296$, $p<.014$). This could be possibly due to the fact that the involvement of right dorsolateral prefrontal cortex (right dlPFC) has been accepted as an indicator of the deliberative and motivated reasoning (McClure *et al.,* 2004). The second possible explanation might be raised with the studies related to the cognitive workload that have been assigned to the dorsolateral prefrontal cortex (Ayaz *et al.,* 2011). As the cognitive workload demand of a video (commercial TV ad for this case) increases, it is less likely that a participant would tend to like or prefer it. The average neural activation (oxygenated hemoglobin level) has been demonstrated for optode 16 while watching their favorite TV ads versus others. The favorite TV ad has been labeled with "1" and the others as "0". The results showed that the individual preferences of the participants for commercial TV ads could be predicted via the activation decrease in the optode 16 ($F(1,66)=7.238$, $p<.009$).

Moreover, the participants who are the automobile owners of one of these three brands had more activation of the associated TV commercial (than others) in the optode 14 ($F(1,83)=4.567$, $p<.036$). Moreover, there is a marginally significant level of effect in the optode 11 ($F(1,82)=3.402$, $p<.069$). Thus, it seems that owning a car might enhance the affective visual memories on the areas close to orbitofrontal cortex (OFC) while watching its commercials rather than watching the commercials of other brands. Interestingly enough, one of these brands, Brand A, that has been selected as the most preferred one (18 out of 29 participants have declared to prefer this brand among these three) has caused higher level of activation among the central and right ventromedial prefrontal cortex (vmPFC) and orbitofrontal cortex (OFC). 4 of 7 optodes had a significantly higher activation over the following sites: optode 10 ($F(1,84)=4.408$, $p<.039$), optode 11 ($F(1,82)=5.626$, $p<.020$), optode 12 ($F(1,83)=5.025$, $p<.028$), and optode 13 ($F(1,83)=4.347$, $p<.040$). The other sites caused a statistically marginal level of increase: optode 7 ($F(1,84)=3.105$, $p<.082$), optode 8 ($F(1,84)=3.236$, $p<.076$), and optode 9 ($F(1,84)=3.220$, $p<.076$). Since these regions might possibly be associated with the human brain reward system as related to its possible role in implicit preference (especially referring to the ventromedial PFC), these findings seem to be consistent with the academic literature (Plassman *et al.,* 2012). Moreover, Brand C, as the least preferred brand among these (that has been selected as the favorite by just 2 of the 29 participants), had lower level of neural activation among several sites that are around marginally significant level: optode 2 ($F(1,84)=3.652$, $p<.059$), optode 7 ($F(1,84)=3.248$, $p<.075$), and optode 12 ($F(1,83)=3.633$, $p<.060$). Else, there was no effect on the order of presentation of commercials. There was also no ef-

Figure 3. The Average Neural Activation with Respect to The Declared Best Commercial
Source: Created by Authors

Error Bars: 95% CI
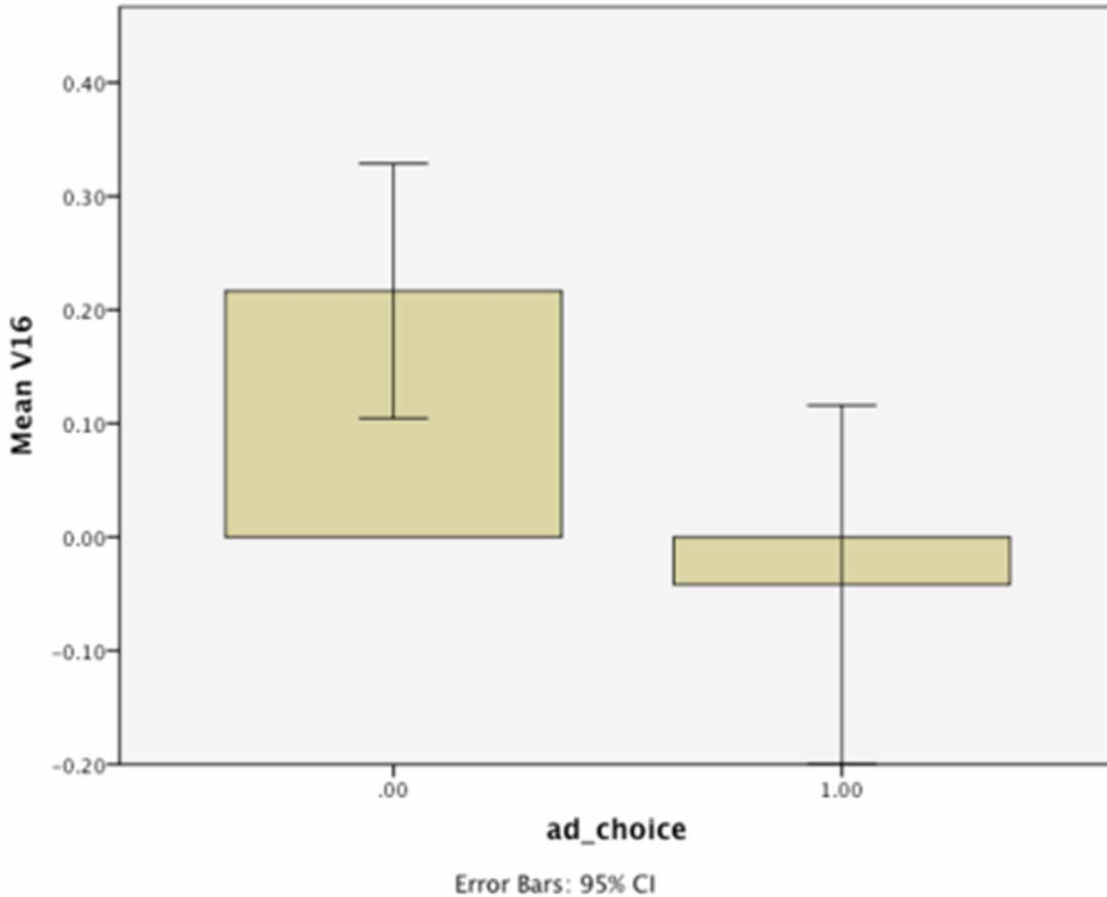
fect of the declared brand preference on the averaged neural activity among any of the optodes from the prefrontal cortex. Thus, it might be the case that the average neural activation measures obtained while watching TV ads provides a more reliable account for the brand image.

DISCUSSION

The current study presents several different important results that have implications for further research both in the fields of consumer neuroscience and neuromarketing. First of all, it seems that more objective tools than self-reports might be used for the preference order as in the case for ordering TV ads. Despite the fact that the results of this study have provided significant findings for the neural patterns of the participants while watching commercials, these results should be handled with great care, since all of the commercials selected for this study have been awarded to be successful by a respected national authority. However, the participants in the experiments have preferred the commercial TV ads of Brand A and Brand B almost equally via the questionnaire just after the experiments. Thus, the activation dif-

ferences of averaged neural signals summarized in the results section are more likely to be caused by the brand preference of the participants, since there is a significant tendency towards Brand A (in contrast to Brand B and Brand C) relying on the responses to the questionnaires. The significant difference among the sites has generally been observed within the optodes 10, 11, 12, and 13 that are close to the ventromedial and orbitofrontal regions of the PFC. These regions have been demonstrated to be active during different modes of effects including the brand image, purchasing decisions, and exposed to logos of the favorite brands all of which are related to the human brain reward system (Plassman *et al.,* 2012).

SOLUTIONS AND RECOMMENDATIONS

Interestingly enough, the analyses for brand preference of the participants (their favorite brands versus other brands) has not provided significant dissociation but Brand A seemed to have a more prominent impact on the participants possibly because of having a stronger brand image and preference. According to the local market reports (prepared in 2014), Brand A has also been ranked higher than the others and Brand B seemed to have the second place among these three brands. The findings of the current study could be accepted as the validation of the market research report. The future studies should include TV ads of the same brand as well as having higher levels of diversity for preference of the TV ads of different brands. Another vital issue has been related to the possible gender bias of this study, since 26 of the 29 participants have been males. We were aware of this gender bias and we have preferred to reduce the possible influence of gender-based differences, since the main research framework has been centered at automobiles for which two genders might react differently. Future studies should also address this gender bias. Moreover, it will scientifically be interesting to figure out and explain some possible differences in neural patterns of different genders. Overall, these results might be implicating a possible neuroscientific application for this optic neuroimaging method for the assessment of the brand image related to the population-wide preference among others. These results might also be promising in order to provide a more objective method for predicting the specific group-level of preferences as a complementary tool to their declared preferences via an easy-to-use and relatively affordable tool (fNIR).

FUTURE RESEARCH DIRECTIONS

As the number of studies in the sector-specific and academic literature increases, there will probably be more consensus directly related to the role of neuroimaging on understand brands and the sub-fields. As presented in this chapter, it is clear that applied neuroscience field mainly including neuromarketing will provide solid basis for developing new strategies on a general framework as well as specifically related to brands. The experimental paradigm demonstrated in this chapter should be replicated in the future studies to provide a reliable and viable framework even may have impact on organizational behavior (Cakar, 2018). The obtained findings seem to indicate that it is possible to provide a potential tool about evaluation of the brand perception with respect to the rival brands. There should be more empirical research carried out specifically on this topic.

CONCLUSION

The present chapter has summarized the main empirical findings related to brands in the related academic literature. The most remarkable take-away note might be evaluating the brands strength with respect to rival brands, in other words, its competitors (Halvorson, & Rock, 2015). Meanwhile, being able to evaluate the perception of a brand is also critical for a business in the sense that this could provide different strategic moves related to change or persist the perception of its customers. Thus, for providing better means of strategy development, the findings from the neuromarketing experiments would potentially be guiding the professionals.

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KEY TERMS AND DEFINITIONS

Brain Imaging Methods: A variety of methods that are used for understanding the neural activations among different parts of the brain generally during a given task such as watching a commercial.

Brand Loyalty: The bond between the customer and the related brand that is considered as providing tendency for the customer preferring the same brand's products.

fNIR Spectroscopy: An optical brain imaging system that relies on the oxygenation level of the blood.

Neuroeconomics: A new approach to economics that retrieves connection among economics, psychology and neuroscience.

Neuromarketing: Understanding emotional reactions of consumers and designing marketing strategy accordingly.

Prefrontal Cortex (PFC): The very frontal part of the brain, behind the forehead, that is known to be responsible for high-order processing including decision-making, problem-solving, and reasoning.

Chapter 4
Understanding Consumer Behavior Through Eye-Tracking

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ABSTRACT

The purpose of this chapter, which is designed to measure where and how the consumer focuses in an advertising brochure, which visual is more striking, and how much eye strain (twitch) it takes, is to measure the density and visual attention of the eyes through the eye-tracking device during the individual examination. For this study, an experimental laboratory for neuromarketing research was used. After watching the videos and images of the participants in the eye-tracking module, the general evaluations were taken to determine what they remembered, and a comparison opportunity was born. According to the findings, logos, and photographs are more effective than texts. Viewers read large text and skip small text. Suggestions for future research are presented in the chapter.

INTRODUCTION

Today's marketing mentality, which focuses on and aims customer satisfaction and consumer wishes, has experienced gradual and radical changes in the process, both in terms of the function of marketing and from the point of view of business and marketers until it reaches this point. Undoubtedly, the three leading actors of marketing, producers/sellers, consumers/buyers, and advertisers have learned lessons from this change. In mentioned period, successful master of persuasion must move ahead of the product range and have a specific action plan that will go beyond changes that vary depending on the situation. Marketers should adopt strategies and policies to increase sales with new methods and techniques. Otherwise, this cumulative effect on the consumer by traditional methods may result in disappointment as a result of excessive market overload. Advertisers, the last important stakeholder, should be able to

analyze the society correctly, foresee market requirements, attract customer demands and needs, and be able to produce results by examining company-related research in the right way.

The most appropriate keyword to use for this explanation is community engineering. It means establishing different structures within the scope of some projects on social life. Today, globalization is emerging as an appearance of social engineering. An example is that television programs target the moral structure of society by affecting the masses (Wikipedia, 02.04.2020). Because a rational and a pragmatist community engineer knows how to turn insecurity into trust, and like a chess player, he can project which moves the other side will make. In this life-and-death battle, only those parties that operate as described will survive, and for those who act otherwise, the result is and will continue to be frustrating. An anecdote of AdAge (Lorna, 2014), shows the situation with all its nakedness. According to the survey, global advertising spending reached the highest limit in history with $ 500 billion in 2013, but half of this money has gone to waste, and it is not known which half has been wasted even though huge budgets are allocated for market research. In order to eliminate these negativities, marketing has put back the unacceptable beliefs in the form of individuals acting completely rationally in order to make more accurate analyzes and determinations and to produce healthy solutions.

Although some authors argue that there are elements such as desire and belief in the concept of rationality, this understanding could not go beyond a commodifying technological approach for humanbeings. This is because the core of this understanding is based on a single plane and it is unable to respond to the complexity created by algorithm between the individual characteristics and behavior (Hazeldine, 2013; Plessis, 2008). In light of these developments, knowing why, how and when people buy this kind of up-to-date and competitive information and considering their behavioral dynamics will undoubtedly have a positive impact on the life expectancy of organizations (Mukherji & Mukherji, 1998). In this new formation, which includes many intersections, the role played by the consumer is clearly felt. This is because the passive consumer who is satisfied with the existing and accepted quickly has been replaced by a well-equipped, active consumer profile capable of dominating the market. As will be discussed in detail in the neuromarketing section, the new consumer profile for which this postmodern consumer term would be a suitable discourse differs more than traditional from multiple predictable variables such as social strata, behavior and demographic characteristics, far from modern consumer characteristics.

The main reason underlying this difference is undoubtedly the role played by consumption. Because production is at the forefront in modern economics, understanding even up to the modern economy, consumption is dominant in today's postmodern economy. With these indisputable changes, the production and consumption become more flexible, and the production of information economies and commodity economies are adapted to this new trend as well as the production of information in accordance with the expectations and needs of the consumer. The new consumer tendency that cares more about its image than the physical and functional characteristics of the product is, of course, an important element of this new economy and socio-culture. What is important in this culture is not to prefer one of the products or services by minimizing the opportunity costs, but to bring more value together by bringing the two together (Burton, 2002).

As a result of the searches in this context, the glances were directed to different disciplines, and some experimental methods of neuroscience, which are in parallel with the developing technology, were combined with marketing researches and the concept of neuromarketing emerged. The data obtained by neuromarketing methods allow enterprises to move to a more effective decision-making stage and to achieve competitive advantage; because the classical research methods such as the questionnaire take into account the verbal responses of the participants, this situation is insufficient against the width of the

senses and cannot direct the enterprises properly. Classical research methods are insufficient to understand the decision-making mechanism that operates within a highly complex process and the brain that hosts this mechanism. Neuromarketing predicts behavior with psychological factors and somatic variables. Neuromarketing explores the relationship between the consumer's nervous system and decision making with an interdisciplinary perspective as a combination of both disciplines (Hubert & Kenning, 2008).

This chapter is prepared to give information about neuromarketing and eye-tracking technique. General information is given in the introduction part of the study. Then, the issue of consumer behavior and neuromarketing was discussed conceptually. Researches using the eye-tracking technique in neuromarketing are presented. An experimental study has been summarized to better understand the subject and the findings were interpreted by comparison with the literature. Following future research directions are presented. In the conclusion part, the results are discussed and limitations of the study are mentioned.

THE CONCEPT OF CONSUMER BEHAVIOR

Even though societies have experienced painful experiences through chaotic environments in the historical process and lacked a complex economic structure, the basic dynamics of the economy, such as producing and consuming and sharing have always been effective. Although economic activities at the basic level are not in the first place in terms of the importance they have in the social life of the groups of people, the increase in the quality and variety of the economy and the growth in the consumption volume have started to be mentioned together with the concept of welfare paved the way for the mentioned situation to change. Certainly, it is not only those factors that hinder this trend (Kong et al., 2013). The transformation in production approach, the rapid penetration of technological development into all vessels of production, the use of new distribution opportunities, the changes in production organization and changes in human expectations and requirements have also taken place among the factors that make the economy of critical importance. Another critical reflection of the fact that the economy has come in such important ways is that it takes a proactive appearance by being located in the center and affected in many areas and affecting many areas (Lee et al., 2007). In fact, in order to have an economically advantageous position, it was deemed necessary to adapt many factors from the labor force to cost, technology to foreign trade by making better use of the economy. While it is suggested that there should be tripartite relations in the centralization process of the economy, it is accepted that the perspective that is possessed is multidimensional (Babu & Vidyasagar, 2012).

Underlying all this transformation, and perhaps the most mentioned concept in recent years is change. For this reason, the events that have marked and revolutionized each period were born as a result of an individual change. Knowledge economy, technocratic era, post-capitalism, service class society, postindustrial period, information society, neither anticapitalistic nor non-socialist society, third wave society, postmodern period, post-bourgeois society, post-economic society, post-famine society, post-civilization society, disorganized capitalism, the second period of industrial division are the most well-known of these periods (Pop & Iorga, 2012). The phenomenon that draws attention in the ranking here is that one period ends and another period starts by taking the share of change as a result of certain requirements of the ending and beginning periods. Industrial production model, sub-superstructure divided into classes, marginalization, rigid certainty and rules, chaotic relations and defined industrialist/modernist paradigms marked a period, then changed and finally abandoned to new insights (Genco et. al. 2013). These ended movements have been replaced by knowledge, flexibility, the transcendence of standards,

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self-transcendence, classlessness, and post-paradigms in which new social movements are at peace with the environment.

Furthermore, it is argued that this new society design, which is based solely on technological variables, will be characterized by being mixed with information and technological determinism. The reconciliation of these two contexts on the post-industrialist and scientific-technological aspects of the new era remains to be noted. An important economic development that needs to be emphasized in this analysis is that the society which demolishes the social dimensions of the old paradigm is based on today's information elements (Martinez, 2012).

In this way, the new model in which the layers are rapidly integrated with each other, the information is above all for the enterprise. And existing information elements within the enterprise are responsible for the use and dissemination of information. Regulating performance in such undertakings depends on the reaction from customers and employees. The existence of inference in this regard makes itself felt (Kahneman, 2003; Barden, 2013). In other words, the transition from the perspective of sweat and muscle strength to the understanding of the industry and from there to knowledge-based work is a result of a long-standing process. Standing out from some of the past perspectives, perhaps partly in effect, is a euphoric picture of happiness, and the most fundamental point of this analysis is essentially high productivity. What is meant by post-capitalist society is, in fact, information society? From this point of view, knowledge has assigned a decisive role to man and placed him in an absolutely independent position.

Toffler (1980), examines history in three phases and the third wave touches this point. It sees technology as a tool rather than a goal (Zurawicki, 2010; Fisher et al., 2010; Morin, 2011).

These developments have changed the socio-economic conditions of individuals as well as their cultural interactions, their expectations and needs, and the needs have started to diverse in the face of alternatives. This picture obliged the change both in the marketing that subjects humans and its behavior and in other fields, especially in the social sciences. Because the principle of "satisfying the needs", which is one of the two fundamental principles shocking the history of economy and suggested by Sobart too, is vital for a business to survive. Marketing, which has been promoted to modern and post-modern approaches through production, product and sales periods, and humans as the natural result of these evolutions, have been placed in the center. In this period, the customer profile has completely changed compared to the past, and a consumer profile with a high level of education, conscious, fast access to information, researching more, knowing what he wants, more careful and benefiting from the end of technology has emerged (Belden, 2008).

The understanding that the desired goals cannot be achieved by being intertwined with the social sciences has pushed the marketing science to the multidisciplinary research format established on interdisciplinary collective foundations as in other sciences. This teamwork, in the form of integration of information and developing technological methodology at both human and mechanical level, further strengthened that classical methods and theorems were insufficient in explaining the purchasing decision of a human having a complex structure both in general and in narrow terms and the behavior directly affected by it. Thus, with the pluralism in the procedures and methodology, the result of the reality that the individual cannot avoid innovative and continuous external factors around him resulted in the emergence of neuromarketing in marketing science.

Following the transfer of marketing to experimental environments, it has become possible to explain the fundamentals of behavior towards consumer decisions and actions with the triple helix of biology and neurology and with the help of many techniques developed, other senses were associated with the brain and mind maps were drawn. This innovative maneuver in the field of marketing has destroyed all

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taboos and, in contrast to subjective rationality, renamed the individual and his behavior, leading to the acceptance of traditional theorists by claiming that behavior is also patterned with emotions (Sebastian, 2013).

THE CONCEPT OF NEUROMARKETıNG

Neuromarketing is an interdisciplinary field at the border between neuroscience and psychology and marketing. It focuses on measuring the cognitive and emotional responses of consumers to various marketing stimuli (Karmarkar, 2011). From a more detailed point of view, it is possible to say that neuromarketing is an approach consisting of a combination of electrophysiology, neurophysiology, anatomy, molecular biology, embryology, developmental-cellular-behavioral biology, neurology, behavioral neurophysiology and cognitive sciences. However, in the literature, it is especially associated with marketing, psychology and neurology (Zurawicki, 2010).

Contrary to traditional methods such as the focus group or questionnaire, neuromarketing employs a number of specific neuroscience methods including EEG (Electroencephalography), MEG (Magnetoencephalography), fMRI (Functional Magnetic Resonance Imaging), or PET (Positron Emission Tomography), which measures and records the electrical activity and metabolic activity of the brain. Apart from these, neuromarketing also benefits from psychophysiological responses, biometric instruments that measure electrodermal activity, heart rate or respiratory rate, implicit association tests, and eye-tracking methods and techniques.

In this respect, neuromarketing using a variety of measurement techniques within the framework of scientific data and statistical calculations is a field of study that is far from utopia with high reliability and exhibiting a futuristic nature by making predictions in this direction, and tries to solve this riddle by mixing neuroscience in marketing research. Neuromarketing, which began to make its presence felt in the 1980s, began to develop rapidly in the USA and Europe in the early 1990s. In 1990, Professor of Harvard University. Dr. Gerry Zaltman first used the fMRI in marketing research. Professor Dr. Ale Smidts, using the concept of neuromarketing for the first time in 2002, has brought this term to the literature and became the eponym of neuromarketing.

Neuromarketing research, which was carried out exclusively for the development of companies' strategies until the 2000s, gained an institutional character with the establishment of Sales Brain Company in America and gained popularity with Martin Lindstrom's publication of Buy-ology. Therefore, this new research method has emerged over the years as a groundbreaking innovation in the effort to understand "human" for marketing science, which first focused on product, then information, and finally human. This new method realizes Antonio Damasio's determination that "people make irrational decisions when they make decisions by using emotional parts, not rational parts of their brains". It demonstrates the most obvious form of this by adding a separate dimension to the advertisements that are the most effective way to reach customers and that most appeal to people's feelings. While neuromarketing is aware of the fact that traditional methods have some limitations in achieving objective and accurate results, it supports traditional research methods by providing them with neuroscientific bases, in other words, by providing means to act together, not by opposing traditional methods (Mostafa, 2014).

CLASSIFICATION OF NEUROMARKETING TOOLS

Zurawicki (2010), Kenning et al. (2005) and Calvert and Thensen (2004) discuss the research techniques used in neuromarketing in two parts: Techniques measuring central nervous system (CNS) and techniques measuring peripheral nervous system (PNS).

Table 1. Classification of Neuromarketing Tools

Neuromarketing Tools			
Techniques Measuring Central Nervous System (CNS)		Techniques Measuring Peripheral Nervous System (PNS)	
Metabolic Activity Record in Brain	**Recording of Electrical Activity in Brain**	**Without Brain Activity Recording**	
Functional Magnetic Resonance Imaging(fMRI)	Steady State Topography (SST)	Facial Coding	
Positron Emission Tomography(PET)	Transcranial Magnetic Stimulation (TMS)	Galvanic Skin Responce	
	Magnetoencephalography (MEG)	Facial Electromyography	
	Electroencephalography (EEG)	Implicit association test	
		Eye-tracking	
		Measurement of Physiological Responses	

Source: Bercea (2014)

fMRI is the first technique used in the context of neuromarketing, one of the techniques that record metabolic activity in the brain. By means of the fMRI, an increase in the oxygen level in the blood flow of the brain can be measured. As part of an experiment, a subject is screened while lying supine in a narrow, long tube. This tube is surrounded by magnets; once activated, the magnets form electric fields. This instrument is able to very accurately identify increased activity in a particular brain area while presenting a stimulus stimulus state. As a result of this mechanism, fMRI detects active cortical regions. The signal provided by fMRI on the computer screen is shaped like a stain and is called "blood oxygenation dependence level" and analyzed using 3D technology. fMRI is not an easily accessible technology. Its use is very costly as it requires specially trained personnel. The cost of the fMRI is quite high compared to other neuromarketing specific tools (Pradeep, 2010).

PET, which is one of the most advanced nuclear medicine imaging methods that requires, the injection of radio-active elements to subjects so as to perform imaging, is a rather costly method used mostly in clinical studies. PET is a tool that can show various phenomena. These include brain blood flow, blood volume, glucose, and oxygen consumption in cells. One of the substances commonly used in PET is fluorodeoxyglucose (FDG). This substance is absorbed by cells with higher activity as they need more energy to compensate for their consumption. It is also the molecule that emits positrons. In the neuro-marketing study, PET detects the regions that have activity in the brain by following this molecule. But; In addition to its cost, it is also less frequently used in neuromarketing research as it can be a disturbing experience for subjects. From a cost perspective, it is clear that neuromarketing research is limited to

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the financial resources of companies. The cost of renting a laboratory and equipment is quite high. Only financially strong companies can engage in such activities (Köylüoğlu, 2016).

EEG is one of the most popular neuromarketing research techniques nowadays and is a noninvasive technique that measures the electrical activity of the brain at a time when a group of neurons signal. EEG can easily capture the electrical activity of the neurons on the brain surface. The consistent activity of thousands of neurons creates potential electrical differences within the skull. This can be measured using an electrode connected to the signal amplifier. EEG is a silent and harmless device that is directly sensitive to neuron activity. The time resolution only depends on the transmission capacity of the device used. Normally, an EEG device can record data in 1 to 3 milliseconds. Accordingly, the high number of sensors allows this technique to better monitor all brain activity. Given that the different areas of the brain are responsible for completely different functions, certain cortical areas will be activated in the brain, depending on the type of stimulus. Electroencephalography sensors are sensitive to a certain amount of artifacts due to movements such as muscle contraction and blinking when processing the signal given by the brain and may give false positives. The psychological state of the subjects may lead to electrical currents in the brain. To eliminate these artifacts, some signals that could impair the results of the recording of the brain waves are eliminated by an algorithm. Synchronizing electroencephalography with other instruments may give more accurate results on a subject's response to a marketing stimulus (Calvert & Thensen, 2004; Pradeep, 2010).

MEG provides information about brain activity using a magnetic field. Unlike functional measurements such as fMRI, it allows direct measurement of brain activity. It has a high temporal and spatial resolution. In contrast to EEG, MEG can display deeper brain structures. This method, which tracks the magnetic fields generated by the electrical activity of synchronized neurons, is much less used due to its high cost, although it gives more data than EEG. (Kening, Plassman & amp; Ahlert, 2007).

GSR, which is used to measure the skin conductivity, is the technique that measures the electrical properties in the hairless skin depending on moisture to determine response to the stimulus from the nervous system. The psychological effects of stimulants that address sensory organs can be measured by this technique.

FACS developed by Paul Ekman, suggests that a certain number of muscle groups on people's faces reflects human emotions by creating micro-expressions in a universal way, regardless of demographic characteristics, and that people reveal their real reactions through micro expressions even if they want to hide them. Later on, to facilitate and accelerate this system, computer-aided tools have been developed which can read micro expressions on the face.

The eye-tracking method, which also constitutes the methodological backbone of the study, is one of the important techniques used by neuromarketing. Although the intuitive experience tells us that we can see everything at a glance, it is not possible. As you move around somewhere, a very small area is focused and the brain fills the space of other areas. For example, it is believed that the eyes can be moved smoothly against those seen, but this is not the case. If the eye is observed, it actually appears that it makes small, fast jumps, which is called twitching. The image taken by the retina in twitching eyes is blurred, so there is almost a blindness degree in this visual jump, although people cannot realise it. Light enters through cornea and eye lenses, which may be flat or very curved depending on the focus distance of objects. Then it hits the retina around which 120 million rod cells and around 6-7 million conical cells can be found. Depending on the state of light, the pupil's growth or contraction is affected, as well as the emotional interest and cognitive burden of the person. In practice, this measurement, called pupilometry, is usually performed with an eye-tracking camera (Bridger, 2015).

When the historical development of eye-tracking method is examined, it is understood that it is not really a new technique. Because the studies related to the method go back to 1930s. For the first time in 1936, Mowrer developed a system that automatically recorded the eye movement and examined where the eye was looking and what it saw. In this way, rational and original answers could be given to the questions left unanswered by traditional marketing research (Maughan, 2007). The eye-tracking method provides a real-time recording as to where visual attention is directed.

The situation also reveals that the pupil width changes. This measurement is a useful indicator of emotional stimulation. Low, high-resolution video cameras are placed sideways without blocking the consumer's eyes. While other cameras capture relevant information, a small, noninvasive light guides the camera following what is being examined. Generally, studies are carried out with fixed subjects. However, there is a need for additional hardware to follow the view of the subject in motion (Bendle et al., 2015). This is a technique that provides important data in marketing researches to today's modern marketing businesses. Specific areas where consumers look and gaze most in a visual stimulus such as internet pages, posters, product packages, supermarket shelves, magazines and TV commercials are determined.

EYE-TRACKING BASED NEUROMARKETING RESEARCHES

Eye-tracking method is a method used by businesses with today's marketing understanding (Pigeon et al., 1997). In the visual stimuli such as web page, poster, product package, supermarket shelf, magazine, TV advertisement, special areas where the consumer is looking are determined. It is determined where, for how long, and when the stimulus is viewed. Milliseconds and x-y coordinates provide data definitions. These data are interpreted with visual tables and figures (Wedel & Pieters, 2017; Muñoz-Leiva et al., 2019). Findings from this study reveal that, compared to the literature, the logos and photographs placed towards the advertisement perform better than the text in order to attract attention and keep the attention high (Lohse, 1997; Janiszewski, 1998). It is understood that the text information in the advertisement should be presented more concisely in order to increase the effectiveness of the advertisement (Fox et al., 1998; Yang, 2012). Particular emphasis should be placed on the findings, in the multi-text catalogs, viewers first read the large text. Small texts are often skipped (Murphy et al., 2005; Velazquez & Pasch, 2014).

In light of the information given, many studies have been carried out in the literature about eye-tracking technique, which has a significant influence on neuromarketing that draws the attention of the academic community. These studies can be shown below with the help of a table:

In a study about eye-tracking, we obtained similar findings with the literature. If the study will be briefly summarized, the purpose of this experimental study, which is designed to measure where and how long the consumer looks and focuses, which visual is more remarkable, and how much eye stroke (twitch) it receives, is to measure the visual attention and intensity of the points that the subjects look at in an ad brochure with the eye-tracking device.

The heat map highlights the areas of an image on which the eye focuses most with most hits, thus determining what the eye sees initially and intensively. One of the most sensitively interpreted data in terms of reaching the correct result in eye-tracking is the heat map data (Yang, 2012). Visual inspection of the heat map indicates that the primarily concentrated area is in the upper mid of the ad, which hosts the brand name and logo of the company. From this point of view, it can be said that the company

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Table 2. Eye-tracking Based Neuromarketing Researches

Researchers	Research subject	Findings
Treistman & Gregg (1979)	Using the intention to purchase and eye-tracking together	The combination of eye-tracking and purchasing intent yielded better results compared to using them separately.
Smead et al., (1981)	The effect of product promotion and protocols on eye movements	Double comparisons were made between the number of fixings by brand, average fixation number, preference time and percentage of search time.
Anonymous (1984)	Evaluation of outdoor advertising with eye-tracking method	Individuals looked at the brands more than once with the advertisement mentioned.
Russo & France (1994)	Comparison of eye fixing sequences and purchase preference	Harmonization, evaluation and verification stages were observed in purchasing decisions for the market.
Lohse (1997)	Eye movement patterns of consumers on yellow page advertising	This study investigated how consumers view yellow pages.
Pigeon et al.,(1997)	Eye-tracking, Canadian packaging	Attention is drawn to the consumer product in less than seven seconds.
Janiszewski (1998)	The effect of imaging characteristics on visual discovery research behavior	How individuals look at catalogs has been investigated.
Pieters & Warlop (1999)	Visual attention during brand selection: The effect of work motivation and time pressure	Participants under time pressure responded by focusing their attention on picture information with a shorter fixation.
Kroeber & Riel (2001)	The effects of emotionally illustrated elements in advertisements analyzed through eye movement	The elements that are repeated at once and frequently have an important effect on persuasion.
Chandon et al., (2002)	Value measurement of purchasing marketing point with commercial eye-tracking	They used eye-tracking data to differentiate brand evaluations based on memory and visual aid.
Anonymous (2002)	Marketing materials tip	Gallup applied sciences company showed how their written advertisements were kept in mind by eye-tracking method.
Day et al.,(2006)	The effects of flash blockers on decision-making disturbance and arousal source multiple attitude	It has been revealed whether individuals focus on advertisements.
Maughan et al., (2007)	Examination of bus stops ads with eye-tracking technique	A positive relationship has been determined between the fixing time for advertising and evaluation.
Coulter (2007)	Figure effects on eye movement bias and price rounding behavior	The negative effect of price rounding on purchasing has been examined with eye-tracking techniques.
Brown (2012)	The effectiveness of A4 print ads in South Africa	Researchers have identified the existence of a series of browsing movements that begin in the middle of the page and end towards the bottom right corner of the page.
Wedel & Pieters (2017)	A sample study of eye-tracking application is presented to ad pre-tests.	Under normal conditions, eye movements were found to be strong and directly related to high-grade cognitive processes.
Muñoz-Leiva, et al. (2019)	Possible effects of visual marketing stimuli on user (consumer) behaviors were investigated with eye-tracking techniques.	Low interest in advertisements resulted in advertisements not being remembered.

Source: Created by Authors

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Figure 1. Heat Map
Source: Created by Authors
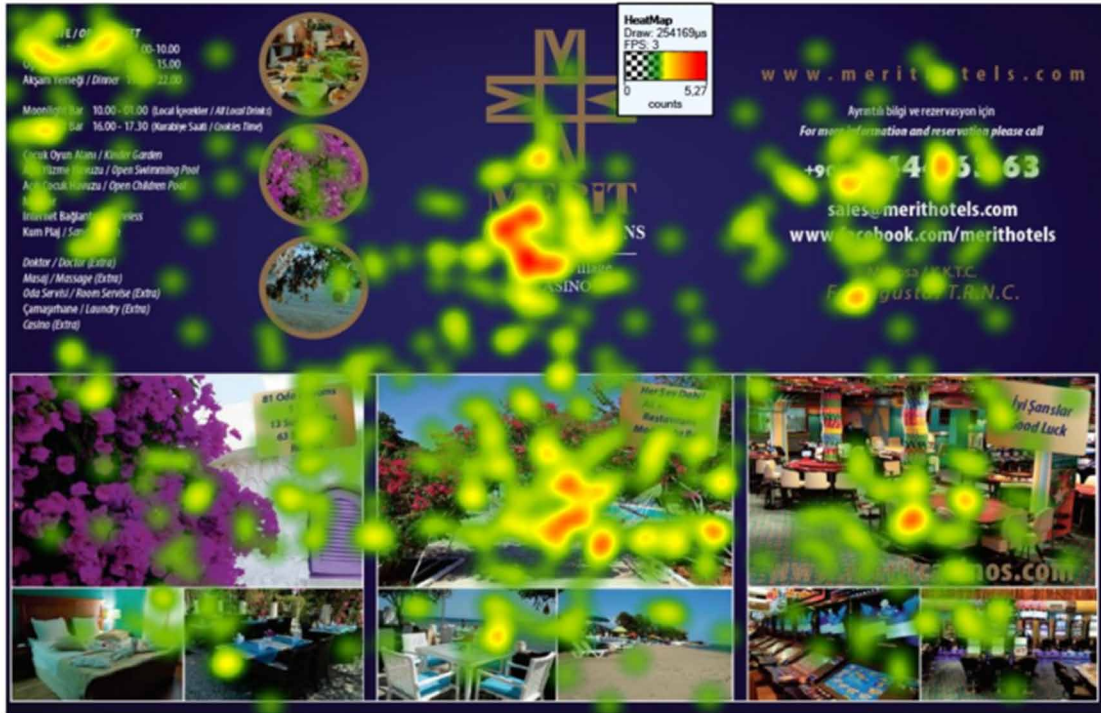
accomplished logo placement (Lohse, 1997; Janiszewski, 1998). Immediately after that, middle-lower and middle-right areas of the photo were determined to be intensified.

The small photographs that remained at the bottom of the image attracted the participants much less. Another remarkable finding concerning the image is that the eyes of the participants generally focussed in the upper right area of the image where the cataloged company's contact information is located right after the photos in the middle area. The areas where the eyes focussed last are the left top and left bottom areas, respectively. The participants focused on the beginning parts of the texts in the upper left of the image, but they shifted their gaze to other places in the lower parts of the articles later (Murphy et al., 2005; Velazquez & Pasch, 2014).

At the end, the length of the articles in the catalogs should be optimized and the part that should be considered the most important part of the article is the beginning of it. It can be concluded for this image that the visual layout is successful, considering the brand logo and name should be placed so as to be the focus of the participants.

The results on the above image represent how many percents of the subjects see marked areas. It is seen that the visuals in the study are clustered in two areas. While the rate of being seen of the area hosting brand logo and the visual is 100%, the rate of the text in the upper left of the image is 56%. The left and right bottom corners of the image have hardly been seen.

The basic function of the gaze map is to reveal the time sequence of the gaze or where, when, and how long gaze was placed. The time spent while looking, which is also referred to as retention time, is

Figure 2. Visual Cluster Map
Source: Created by Authors

Figure 3. Gaze Map
Source: Created by Authors
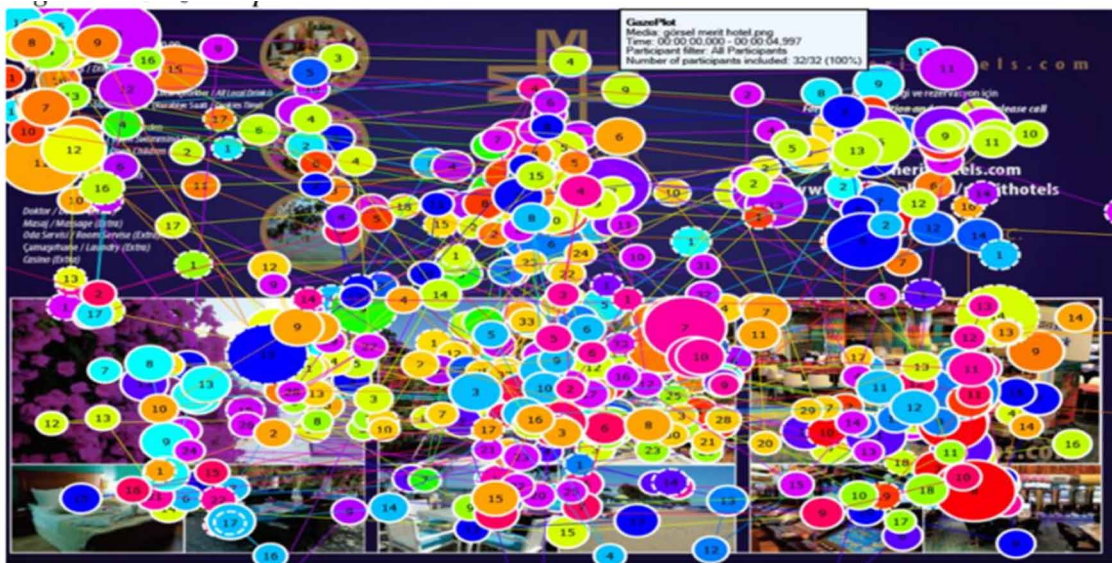
indicated by the diameter of the circles in the image. The longer the gaze, the larger the circle is. This image shows, the sequence and length of the gaze of all 30 participants. The area where the first glance was concentrated and the gaze was concentrated for the longest time was the area where the brand name and logo were located in the middle upper area. The visual view sequence in the heat map comments under figure 1 is formed from the gaze map. In this respect, the heat map and the gaze map play an integral role.

FUTURE RESEARCH DIRECTIONS

In line with this chapter, some suggestions for future research can be listed as follows: Other neuromarketing techniques can be used to get more comprehensive results in neuromarketing itself, especially, methods that use brain activity (fMRI, EEG, MEG, PET, SST). By using neurotransmitters (Dopamine, Oxytocin, Serotonin) that are effective on purchasing behavior, its effect during visual monitoring can be investigated. With a moving image, the ad size of this work can also be analyzed. A questionnaire for participants can be applied to compare traditional marketing and neuromarketing. Since the increase in the number of subjects will yield healthier results, future research can be carried out with more subjects. The study can be carried out in different sectors (agriculture, industry, service).

CONCLUSION

Findings from this study show that the logo and photographs that are correctly placed on the advertisement perform better than the texts in order to attract and maintain attention (Lohse, 1997; Janiszewski, 1998). The results also provide guidance on how to develop an ad page or brochure layout. It is also understood that the textual information in the advertising materials must be presented in a more concise way to contribute to the comprehension. The eye is more focused on the text printed in capital letters and short text lines regardless of their position in the image (Fox et al., 1998; Yang, 2012). If there is a lot of text in a catalog, viewers read the big text first, and the small ones are often skipped (Murphy et al., 2005; Velazquez & Pasch, 2014). This finding is also supported by literature (Fox, Krugman, Fletcher & Fischer, 1998; Murphy, Hofacker & Racine, 2005; Velazquez & Pasch, 2014; Yang, 2012).

In line with the findings obtained, companies should consider the opinions of their customers while organizing the marketing communication tools. These activities must be carried out with the neuroscience methods that have been developing recently. Because simply resorting to consumer declarations using traditional methods can lead to wrong marketing decisions. In this respect, it is necessary to act synchronously with neuroscience in order to reduce costs, increase efficiency and reduce the error rate. Neuromarketing, which is a sub-discipline of neuroscience, brings a lot to businesses because it acts in this way. For example, as seen in this study, businesses should focus more on images and photos than text to attract more attention. It should reduce the ratio of text in advertising or a still image (Lohse, 1997; Janiszewski, 1998). And if text has to be used, large text should be preferred (Murphy et al., 2005; Velazquez & Pasch, 2014).

This study has some limitations. First, the artificial laboratory environment may not reflect the way participants read ads or brochures in their daily lives; in real life, some participants may be reading ads longer or shorter than usual. Second, although the sample size is similar to many eye-tracking studies,

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it is relatively small compared to the advertising or brochure efficacy studies carried out through conventional methods. Third, contrary to the population used in this study; other age groups may process visual stimuli differently.

Despite these limitations, there are many strengths of this study. To date, most of the target marketing literature has focused on subjective responses to research on exposure to advertising stimuli. By incorporating objective criteria based on the use of new techniques, such as eye-tracking, researchers can address a number of problems in classical methods and better diagnose problems with visuals such as brochures used as advertising elements.

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KEY TERMS AND DEFINITIONS

Electroencephalography (EEG): EEG is a method of printing electrical potential variations that are slightly different from each other, while being evoked by typical electrical potentials as well as by receptor activity.

Facial Coding: This system, which is used especially in detecting the emotional reactions to advertisements, is used in many aspects such as a company's shelf layout, website and product package. The momentarily emerging emotional reactions of individuals with the ability to perceive in the first 40 milliseconds become meaningful when they are combined with perception-mimic and basic facial muscles. The value, arousal and dominance dimensions of sensations can be evaluated depending on the expressions forming on the face as a result of perceptions.

Fixed-State Typography (FST): This technique measures the steady-state visual stimulus potentials and records the signals from 64 electrodes in a light header at a rate of 13 times per second.

Functional Magnetic Resonance Imaging (fMRI): FMRI is one of the special tools of neuromarketing. Thanks to this technique, an increase in blood flow level can be measured. As part of an experiment, the subject is scanned while lying on the back in a long, narrow tube. The tube is surrounded by magnets, and once the magnets are activated, they form electric fields. In addition, this device has the ability to accurately determine an increase in activity in a particular area of the brain when a stimulus / stimulant condition is exhibited.

Galvanic Skin Response (GSR): In particular, the change of electrical resistances of regions without hair on the body due to any stimuli can occur because of the activity of sweat glands. This technique is used in marketing to measure responses to technical websites and advertisements.

Implicit Association Test: According to this test, the concepts that have the same segmentation in the human mind automatically recall each other. This technique, which is used to measure the implicit attitudes of individuals, enables the identification of hierarchies by comparing the products. With this technique, reaction times, basic attitudes and evaluations are measured. Brand positioning, categorized segmentation, open packaging features and measurement of using celebrities in ads are within the scope of use.

Magnetoencephalography (MEG): MEG is sensitive to changes in magnetic fields induced by electrical brain activity. MEG resembles fMRI in format and shows stimulated areas in the brain. Like in fMRI, MEG takes snapshot, but MEG is faster.

Measurement of Physiological Responses: The researchers can also reveal the immediate emotional state of the subjects through the measurement of physiological responses such as heart rate, blood pressure, saliva, and stress hormone.

Positron Emission Tomography (PET): PET allows quantitative imaging of relatively low targets besides the introduction of mass effects with extremely high sensitivity.

Transcranial Magnetic Stimulation (TMS): TMS consists of modulating cortical activity with electromagnetic induction. In transcranial magnetic stimulation, two types of electrical stimuli are used: Low and high frequency stimuli. The effect is converted into neural activation and the subject is immobilized.

Chapter 5
Neuromarketing Trends and Opportunities for Companies

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ABSTRACT

The main purpose of this chapter is to concisely describe the origin of neuromarketing, its applications in the organization, and to explore consumer behavior with the help of different neuromarketing technologies like fMRI, EEG, and MEG. This chapter gives a guideline on how neuromarketing would be used in different areas of organization functions, like, brand management, advertisement, communication, product design, decision making, etc. with the help of data mining, artificial intelligence, social media, machine learning, remote sensing, AR, and VR. The chapter identifies the opportunities of neuromarketing with the latest technological development to understand the customer mindset so that it would be easy to formulate neurostrategy for an organization. This chapter gives a future research direction with strategic management, so that it will be helpful for a professional to create a more accurate strategy in a VUCA (volatility, uncertainty, complexity, ambiguity) environment, predict, and fulfill the "institution void" situation with more accuracy in an emerging developing market.

INTRODUCTION

Neuroscience has developed in bounds in recent decades across the globe. However, it is yet to spread fast into the domain of marketing, mostly given the deficiency of trained researchers in the subject. Plenty of capacities are taken care of by the human brain at an unconscious level, and it is a matter of fact that the brain engages in consumer behavior as well. The interrelation among want and needs, inward, and outer ecological components of a customer assume a significant job in customer basic decision-making process. Since marketing moved toward becoming digitized in the 2000s and publicizing went on the web, tech organizations from all over the world attempting to (break) the psyche of the normal web client. Understanding the psychological procedures of the human cerebrum will enable the business to get precise data about the customer's basic decision-making process, which will assist the association with

formulating segmentation, targeting, positioning (STP), and creating different marketing engagement strategies for long haul sustainability of a business (Bowker, 1999).

Even though the relationships of neuromarketing and neuroscience application to the consumer have been utilized reciprocally in writing, yet they are marginally extraordinary. Consumer neuroscience will, in general, allude to scholarly research that consolidates neuroscience, brain research, and science to clarify logically arranged human conduct (Harrell, 2019). Though neuromarketing is fundamentally centered on the push to assemble shopper interest for the products and enterprises given by the customers, psychological neuroscientists, in association with social advertising analysts, frequently look to diminish destructive utilization rehearses (Plassmann H. R., 2012).

The expression "neuromania" the interpretation of human awareness would be lessened to action neuroscience which inquires about action neuroscience investigates strategies are in any case being connected to an array of new fields (Tallis, 2011), for example, neuroaesthetics, neurotheology, neurolaw, neuroeconomics, and neuroeducation to give some examples. These new familiarities have advanced into the business segment, where association offer appraisals and forecast about purchaser conduct dependent on images of the mind's response to an improvement (Ariely D. &., 2010).

Leaders and Managers of the corporate world around the world today are under gigantic strain to reveal components that are driving clients' demeanors and conduct (M.Y.-T. & Cheng, 2018). Lamentably, conventional techniques on consumer research dependent on surely understood constraints and have remained, to a great extent, unaltered since their presentation decade back. As of late, there is a developing pattern in cerebrum-based research techniques that could permit managers and consumer behavior scientists to probe into clients' underlying minds immediately (Jordao I. L. D. S., 2017).

Neuromarketing is the new research technique that uses neuroscience and physiological insights to predicts the consumer's behavior. Neuromarketing pursues facts and knowledge about the customer beyond the traditional methods (Plassmann H. V., 2015)and can predict consumer preferences and behavior (Boksem, 2015). Many techniques are currently being used for neuromarketing. Functional magnetic reasoning imaging (fMRI) is a neuroimaging technique that measures the amount of deoxygenated hemoglobin in the blood (Huettel, 2014). Another affordable method is electroencephalography (EEG), which can analyze an electrical movement variation in the brain through electrodes. Magnetoencephalography (MEG) is associated with EGG with similar temporal capabilities, but measure varying magnetic fields rather than changing electrical activity (Roullet, 2010).

After experiencing a sensory experience like an advertisement or testing a product (Plassmann H. O., 2008) and when making a financial decision (Plassmann H. V., 2015), the above-mentioned brain imaging technique can identify the changes in brain activity. There are different peripheral activities such as heart rate monitor, respiration, skin conductance, pupilometer, eye tracking, and more which are alternative to brain imaging technique (Reimann, 2012). Transcranial magnetic stimulation (TMS), is another brain activity that can be directly manipulated by using the magnetic field to know about very specific activities of the brain.

LITERATURE REVIEW

Neuromarketing is a developing interdisciplinary field that collectively connects with psychology, neuroscience, and economics (Lee N. B., 2007). Neuromarketing aims to examine how the brain of a consumer is getting affected by advertising and marketing activities. To evaluate the effectiveness of

these activities, neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) can be used.

According to Fortunato et al. (2014), neuromarketing is a technique that can help to identify consumer behavior and also a research tool to identify the customer's brain reaction by a marketing stimulus. It is an interdisciplinary practical field to know consumer behavior through various neurological techniques, such as neuroimaging. The research aim of this subject is to understand how the consumer stores, comprises, process, and use the various day to day information (Bercea, 2013).

According to Vlăsceanu (2014), the main objective of neuromarketing is to find out how the consumer takes buying decisions while they are in an emotional and unconscious stage. Neuromarketing can help to understand the complex purchasing behavior of a customer by using different new technologies (Fortunato, 2014).

Various organizations develop and lunch products or services to increase the profit and market share by engaging the customer differently. The main objective of this engagement is to create an impact in the customer mind so that it is clear why they will select the particular brand over the competitors. (Plassmann H. K., 2007). The use of brain monitoring techniques which is originated from medical science or biology, also can be contributed to the area like marketing. The application of these techniques is used to identify consumer behavior at the brain level (Oliveira, 2014), as well as to understand the human unconsciousness (Cruz, 2016).

With the help of market research, cognitive neuroscience can do a miracle to understand the customer's mind when there is a gradual change in the market place, related to strategy application, distribution channel, branding, and other external and internal factors (Senior, 2008).In recent years, the use of the neuroscientific technique is growing to understand the consumer's emotional and cognitive responses, and it helps the organization to make a good relationship with the specific customer (Murphy, 2008). There is an important aspect of ethical issues that should be taken care of while neuroscience applied to consumer studies both in university research and organization level (Fisher, 2010).

In a free market of competitive ideas, the consumer is the boss, and it will remain so. Giant corporations continue to grow but also fall under the pressure of consumers. Based on their competitive ability to better satisfy the desires and needs of consumers, they are increasingly competing in the market. Regarding this, Pradeep emphasizes the function of non-market marketing as a competitive advantage over the overwhelming and overwhelming market. While people live in different countries with different cultures and speak different languages, "brain language" is universal and opens the door to global norms. Neuromarketing has changed every aspect of the brand, product, packaging, trade, and advertising and has enabled several sources of competitive advantage (Pradeep, 2010).

Based on the information on how human processes data and respond to external or internal stimulus, a decision can be made with a great confidence level (Lee N. B., 2010). Neuromarketing can identify the needs and wants of the customer by inquiring about the cognitive and perceptual characteristics; therefore, neuromarketing can help an organization to strategize and reduce uncertainty (Braidot, 2005).

Neuromarketing offers exciting opportunities in the field of marketing to explore various avenues. Though the strategic application of neuromarketing is at a very nascent stage, there is more to come soon (Lee N, 2007). When looking into the future, some neuromarketing deficiencies may disappear when a new development is made. The techniques will become more advanced and more accessible. It is already possible to buy eye-catchers! Therefore, marketers need to keep in mind the needs of their consumers. However, Odekerken believes that neuromarketing should be cautiously accessed. Both traditional marketing and neuromarketing have their advantages and disadvantages (Odekerken, 2018).

They tell us something about how consumers make decisions, whether they are conscious or subconscious, and can be abusing them.

THE HISTORY OF NEUROMARKETING

The term Neuromarketing has developed from two different subjects of Neuroscience and marketing. The term neuromarketing started appearing in various journal and industry discussion around 2002. During this time, some of the U.S organizations like Brighthouse and SalesBrain are the first to offer neuromarketing research and consultation services to various organizations by use of technology with cognitive neuroscience. Neuromarketing looks the consumer behavior from a brain perspective.

The first neuromarketing research was performed by Read Montague, a renowned professor of Neuroscience at Baylor College of Medicine in 2003, and published that research paper in Neuron in 2004. In this study, the researcher asked a group of people to drink either Pepsi or Coca Cola and scanned their brain in an fMRI machine. This study was able to conclude that different parts of the brain light up when customers are not aware of the brand identity. This study suggested that a strong brand like Coca Cola has the power to capture a piece of the frontal cortex of the customer's brain. Though Professor Read Montague has failed to provide the logic behind how the customer's brain selects brand choice but this study has shown a path to neuromarketing to do more research about the consumer behavior (Morin C., 2011).

Though the Pepsi Coke study has not convinced many researchers about the potential of neuromarketing certainly is convinced about the power of neural code in the consumer decision-making process. This study faced many criticisms because of the fear that it harbored a hidden code to tweak our perception below the level of consciousness. In 2004, Nature Neuroscience, a leading journal published an article on " Brain Scam" raised about the ethical and moral part of neuromarketing concerning customer decisions. In connection to this article, Dr. Michael Brammer, the CEO of Neurosense, who mentioned in this article replied to the editor of this journal very assertively that fMRI will be the future tool to understand the customer's mind (Morin C., 2011).

Neuromarketing is an emerging subject in marketing, it borrows some tools from neuroscience and psychology. The term neuromarketing was first coined by a dutch marketing professor Ale Smidts in 2002. In 1990, Gerald Zaltman conducted the first experiment in neuromarketing. Gerald Zaltman, in association with Gemma Calvert had started an organization named consumer neuroscience to sell the advertisement. During this time, marketing professor Gerald Zaltman developed one market research tool (ZMET, Zaltman metaphor elicitation technique) at the Harvard Business School, which can study the non-literal or metaphoric expression of any unconscious thinking in the consumer. ZMET quickly gain popularity among the various organization and used fMRI to study the correlation between consumer brain activity and various stimuli.

Since long, marketing research organizations tried to understand the effectiveness of an advertisement campaign. There are many ways to measure the physiological responses of an advertisement but there are only three well established invasive methods to map the brain activities which are: electroencephalography (EEG), magnetoencephalography (MEG), and functional magnetic resonance imaging(fMRI) (Morin C., 2011).

NEURO-SCIENTIFIC METHODOLOGIES

The main goal of using neuromarketing techniques is to identify and collect various responses to marketing activities in consumers (Kumlehn, 2011). With this perspective, brain activity can be easily assessed (Hubert, & Kenning, 2008).

These technical methods are expected to give some right information about what is going on inside of the brain. The primary advantage of select those methods is that with the help of those techniques, some unconscious information can be capture without manipulation by the respondents. However, it is to remember that neuromarketing measurement mostly takes place in an artificial environment so that the result can be biased here (Dimoka, 2012).

Facial Coding

Facial coding is a specialized form of body language where facial expressions are systematized and coupled to emotions of a human being. It is part of body language. In this method, facial expressions of human are systematized and can be coupled with the emotion. Dan Hill has able to identify the 24 types of muscle movements with seven basic emotions of a human. This method has a universal application, as the above researcher claimed that different nations across the globe, have the same facial expressions (Postma, 2012).

Eye Tracking

Eye-tracking is another form of outside reflexes which can give information about the internal brain activities. This method is very old to the world and very simple. Nowadays, this process is computer-controlled with a more range of enlarged possibilities (Postma, 2012). This method is easy to understand and apply in various marketing activities.

EEG

EEG is an old method in the electrical field to analyze brain activities. In these methods, numerous electrodes are attached to the human skull to get the information. It generally takes 20 to 40 minutes to capture the response of an individual. The responsible cell of the brain in this activity is called neurons. Every human has more than 100 billion neurons that are interconnected with trillions of synapses (Morin, 2011). These neurons have the capabilities to pass the electricity; therefore, after the input of certain stimuli like advertisement or campaign, neurons fire some electrical current which can be perceived by EEG (Morin, 2011).

fMRI

It is an anatomic representation of the brain with the help of a magnet (Postma, 2012). It can measure the oxygen level of the blood when there are any activities stimulated (Ariely D. &., 2010). The importance of this function is significant nowadays because of the identification of some neurons to particular activities of the brain (Postma, 2012). Though the neural systems are highly complex but are possible to understand by advanced technology (Kumlehn, 2011).

MEG

A similar method to EEG, a non-invasive procedure to know the neural activity of the human brain, It works on local voltage fluctuation. Its procedure is also used in neurosurgery to identify the recreation process.

Both methods are good and have excellent time resolution but MEG has a better spatial resolution than the EEG method (Morin, 2011) but everyone should know that whether it is EEG or fMRI technology, they are very cost-sensitive (Morin, 2011).

Table 1. Neuro-Scientific Methodologies

EEG	MEG	Functional MRI (fMRI)
· Identifies and measures brain waves. · measure the variation of the electrical field at the level of the scalpel · Sees the biological basis of cognitive response · Units are neurons and synapses · Electrical currents are produced and amplify · Brainwaves are recorded · Does not have the spatial resolution · The cognitive process triggers not recorded	· Began from the Mid'60s Measures magnetic fields in the brain · Better spatial resolution than EEG · Limited capacity to pick up activity in the brain surface · Few areas have been identified where specific tasks can be studied · Records real-time responses · Not fit to conduct MR studies of higher cognitive functions	· Studies the deep structures of the subjects' brain · Studies the images of blood flow changes in the brain · Works on the BOLD signal (Blood Oxygen Level Dependent) · BOLD alters the magnetic field · BOLD alteration measures neuronal activity · Studies brain processes during purchase decisions · Spatial resolution 10 times better than EEG · Measures emotional responses too · Capable of identifying the pleasure center · Expensive

Source: Authors' Compilation

MAJOR AREAS WHERE NEUROMARKETING IS BEING USED

Neuromarketing and sensory marketing are mounting rapidly and is leading the quest for behavioral segmentation for the consumer for the brand, sensory marketing, and sales force efficiency.

Organizations are conducting experiments and try to understand the changes inside the brain of the customer when there are any changes of input. In those studies, the focus of research is related to emotional involvement, memorization, novelty perception, which leads to customer intention to buy a product or services.

There are ample opportunities for neuromarketing applications in a different area of an organization; some of them are given below.

Neuromarketing on Advertising

Taking the influence of neuromarketing on the marketing tool advertising into account, one should consider the following viewpoints. As stated by Ariely and Berns (2010), the way of presentation of

certain decisions made by, for instance, role models in an advertisement can have tremendous effects on the actual decision being made by a consumer.

According to Ariely and Berns (2010), advertisement has a tremendous effect on influence in the customer decision-making process. The process of the product presentation and advertisement of different products of the organization is changing very fast across the globe. Though it is yet to fully understand the process of how advertisements influence the customer decision-making process, hopefully, with the help of neuroimaging tools, the black book mystery will be revealed (Ariely D. B., 2010).

Neuromarketing on Pricing

One of the important factors in marketing to convince the customer is the attractive pricing of the product or service. There are many marketing research study which talked about pricing and customer decision making options (Bijmolt, 2005). Pricing is the most important indicator of the customer decision-making process because the customer checks the value addition component by comparing the features of the product or service at aprice (Lee N. B., 2007).

Sometimes, the customer is confused with the higher price of the product with quality mismatched. Customer is always believed that when there is the high price of the product, there will not be a compromise on quality, but every time it is not the truth (Kenning P. &., 2011) To set the price of a product or service, marketer generally go for marketing research or comparative analysis, but sometimes customers are unable to express their willingness to pay for a product or services properly (Vanhuele M, 2002) Based on the above statement, one can see the prospect of a neuromarketing technique to understand the customer's mind and willingness to pay by a customer to any product or service.

Neuromarketing on Communication

There are fewer numbers of literature available in this topic, some logical argument is on the explanation that as body language and facial expression are non-verbal communication which can be analyzed by neuromarketing methods, so there will be some contribution of those neuromarketing techniques to communication also (Postma, 2012). Though there is a doubt about the accuracy of analyzed data with the help of fMRI and EEG in communication, certainly it can give a direction to the study.

Neuromarketing on Distribution of Products

It is believed that in association with neuromarketing techniques like EEG and fMRI: eye-tracking, the body language of the customer can reveal the internal information of the customer behavior (Ailawadi K.L., 2004).

It has been seen that only products which are placed in the top shelve in the store are evaluated by the customer (Chandon, 2009). The products which are placed on the top shelf, attract the customer's attention and maximum customers are likely to choose the product from there only (Pieters, 1999). With the help of an EEG cap to the head of a customer, an organization can analyze the eye-tracking and decision making detailed information about the customers (Plassmann H. R., 2012). This is applied to online customers also (Dreze, 2003).

Neuromarketing On Branding

It is to remember that customers are emotionally connected with the brand, and with the engagement activities of the organization, they became loyal customers to the respective brand. As per the study done by Bechara and Damasio (2005), only the favorable brand of the customer could generate the emotion which influences the buyer's decision-making process (Bechara A., 2005). Therefore, every organization should take care of this component while they will be making any decision regarding engaging their customers.

The neuromarketing technique, like fMRI, has shown that there are different brain activities related to the preferable and common brand of the customer (Kenning P. &., 2011). With the different neuromarketing techniques like EEG and fMRI, it is possible to identify the effect of preferable and common brands. With the help of this activity, it will be an easy task to the marketers which brand has the more influencing power to change the customer behavior.

Neuromarketing On Decision-Making

According to Rangel, Camerer, and Montegue (2008), when any customer takes a decision, generally it goes through five different stages, they are mainly, identify the problem, what are the possible choices, making a decision based on available choices, resulting in consequences and learning from the decision for future applications.

The above-mentioned buyer's decision-making process can be analyzed by the different neuromarketing techniques like fMRI (Gang, 2012). It is believed the customer buying behavior is highly influenced by the logical and emotional component of brains, this information is highly informative to the marketer (Plassmann H. R., 2012). To date, several researchers can identify that neuromarketing techniques like fMRI and EEG can identify the customer decision-making process.

Neuromarketing On Product Design

Any customer perceives any product to purchase or not to purchase based on the presentation of the product like packaging, color, etc, and how they are displayed in the store. Therefore, the success of any product depends upon those crucial factors. Neuromarketing tools like fMRI and EEG can easily detect the positive effect of product design in the customer's mind (Harrell, 2019).

It is possible to identify the effect of product design in the customer mind with the help of neuromarketing tools. With the help of neuromarketing tools, some of the product design will show a positive effect on the customer's mind while others will show not up to the mark effects. By this process, reliable information can be obtained, which is better than a verbal description by a customer.

Testing Product Appeal

Product designers and product managers want to know which product design has more appeal to their targeted customers. The consumer generally influenced by different internal and external factors of the environment. Moreover, apart from this, consumer develops many unconscious attitudes which are challenging to understand by the traditional methods (Economist, 2004). However, with proper brain

imaging devices, more authentic information is desirable (Friedman, 2006). With the help of proper neuromarketing tools, vital information about the customer attitude towards the brand can be obtained.

Celebrity Endorsement

Many organization spends money on the celebrity-endorsed advertisement with the hope that celebrity personnel can increase the sales with their influencing power. However, still, it is not clear how celebrities contribute to this phenomenon. With the help of neuromarketing tools, it is clear that celebrity-endorsed advertisement release dopamine and phenylethylamine, these hormones stimulate the positive emotion about the product in the customer mind and influence the buying decision of the customer (Mucha, 2005). Higher secretion of dopamine and phenylethylamine level would suggest more positive influence power about the particular celebrity. Based on this concept, a marketer can select the best celebrity among many.

Logo/Brand Selection

When a customer is exposed to the logo of any brand, there is an increment of oxygenated blood in the prefrontal cortex of the human brain. This hyper oxygenated blood has different magnetic properties and this development can be identified by different neuromarketing tools like fMRI.

The above concept was tested by Coke-Pepsi taste challenges (McClure, 2004). In this experiment, fMRI showed that the left inferior prefrontal cortex was active during judgments about brands and the medial prefrontal cortex was active during the judgments about people (Eastman, 2006).

NEUROMARKETING TRENDS

Neuromarketing and Big Data Analysis

The neuromarketing and big data analysis can produce and provide valuable information and insight into the customer's choice and behavior (Nagel, 2015). It will help marketers to formulate different segmentation and positioning strategies.

Neuromarketing and big data application has the same area of the working area, both the subject collect and analysis large amount of data from the same field and helps the leaders to take a right decision for the organization success (Steffen & Philipp, 2016).

With the help of neuromarketing techniques, more terabyte data can be collected from various sources of neuromarketing methodologies like facial coding and eye tracking and can be processed for better business decisions (Steffen & Philipp, 2016).

The development of new hardware and software in both the field has helped to increase and extract meaningful information, which would help any organization for competitive advantage. But it is a challenging task for any organization to execute it (Steffen & Philipp, 2016).

Nowadays, conventional business research methodologies like regression and correlation are unable to produce desirable outcomes related to big data and neuromarketing research (Steffen & Philipp, 2016).

Here, an artificial neural network can process the data to know the customer information.

Advanced data mining techniques can identify the hidden relationship in a large amount of database (Steffen & Philipp, 2016).

Figure 1. Data Mining: Pitch Point Between Neuromarketing and Big Data Analysis
Source: Adapted from Steffen &Philipp (2016), Mind Mining: Better Customer Understanding by Applying Big Data Analysis to Neuromarketing. Neuromarketing, pp.10-12.
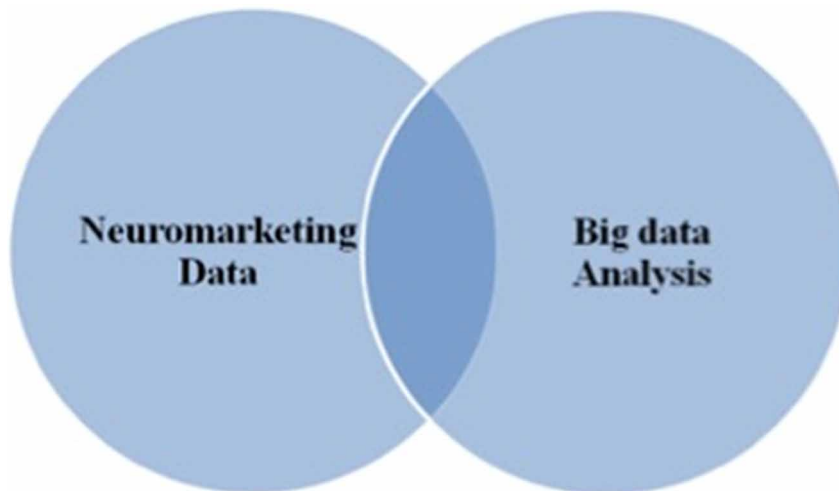
In this way, these days, for any organization challenge isn't to gather and get the database; however, it is a major test to them to investigate the (right) information for learning disclosures to help continuous and future viewpoint activities. In this regard, utilizing predictive analytics dependent on information mining techniques is picking up prominence step by step (Issenberg, 2012).

The main objective of using a different technological tool like EEG and EDA, fMRI, is to solve different marketing issues related to 4Ps. The expectation from neuromarketing is increasing day by day with the hope of revealing more customer information from the 'black box' (Ariely D. B., 2010).

Nowadays, marketers have a great hope that neuromarketing can reveal more information about consumer preferences, which are generally not possible to get by conventional marketing techniques. The measurement of hidden information to discover the customer's mindset is expected by applying the neuromarketing tools (Steffen & Philipp, 2016).

Neuromarketing and Machine Learning

Machine learning is the area of discussion or filed where it has been investigated how computers can improve the prediction, action, decision, or perception based on data and experiment (Samuel, 1959). With proper validation, machine learning (ML) has great significance both within and beyond the hypothesis-driven experimental framework and also has the potential to generate the unifying model of customer brain and function. Because of this feature, machine learning can be used in the neuromarketing area to explore more about the customer mindset and decision-making process.

In other words, ML can discover various valuable information on biological context related to the basic principles of brain functions.

Explainable artificial intelligence (XAI) emphasizes the development of more interpretable, explainable models. To achieve XAI, ML models must set off a comprehensive goal (Mai- Anh T, 2018).

ML holds a great expectation in the neuromarketing field; it is not only in a hypothetical way but in a practical sense. Machine learning can create a high scale hypothesis and can prove it in connection with the structure of the human brain and behavior. In its proper application and hypothesis-driven confirmation, machine learning will fulfill the great promise it holds about the consumer brain (Mai- Anh T, 2018).

Neuromarketing and Artificial Intelligence (AI)

The development of AI associated with the neuromarketing tool can understand the customer's mind. The vision of neuroscience is to understand the internal brain functions by mimicking the brain dynamics so that it will be easy to understand species behavior (Sandberg, 2008).

Though there is high hope regarding the above approach, there is also a heated debate about the practical information on how the human brain works. As the human brain is highly complex due to 100 billion neurons that are connected and simulation can change from the molecular level to genetic level and individual neuron to local networks (M. Colombo, 2017).

Neuromarketing and Remote Sensing

Because of the reliance of neuroimaging on technological resources to gather data about the status and changes taking place in different areas of a person's brain, and because the transformation of that data into visual representations involves the use of various statistical methods to produce accurate, reliable, and conceptually valid approximations of a complex process (Arnason, 2010).

The colorful maps of brain scans by neuromarketing tools are understood by the widespread public. The attractiveness and power of these images are sustained in part because the general public is unaware of the quite substantial technical and statistical preprocessing of data that enables the publication of "images that look like brains" (Woolrich, 2016). There is always a high debate about the accuracy and reliability of the conclusion based on the various stimuli in a range of contextual situations (Cascio, 2015).

Neuromarketing, Augmented Reality (AR), and Virtual Reality VR)

The use of AR and VR in association with neuromarketing is already impacting many business decisions in the present day. It is used in the packaging industry to evaluating the different packaging design options for the organization. In the initial phase, consumer packaged goods organization provides many options to the concerned organization, it is very much expensive and high risk is associate with this decision as which packaging options customers will like (RGD, 2019). Using AR and VR with the help of neuromarketing tools will reduce the cost of best product package selection, and accuracy will be very high.

When a retailer wants to establish their shelving arrangement in a store, with the help of AR and VR technology with neuroscience, they can well advanced decide the flow of shelve and brand allocation. This method will save a huge amount of money on Research and development and real estate related costs (RGD, 2019).

Every supermarket and bank management team wants to know the most effective inside layout and how to use the space very judiciously and where to allocate the signage, advertisement, and entry and exit points. With the help of AR and VR in association with neuromarketing tools, management can easily make the right decision about any project.

In research, when the population is very less or data collected from a small group, generally, the data will be skewed in a bell curve, which leads to misinterpretation of the result. This situation can be overcome with neuromarketing tools with AR and VR by collecting the information from the individual respondent. This will reveal more relevant information to the researcher to make a decision (RGD, 2019).

Neuromarketing and the Internet of Things

Though the Internet of Things it is in a primitive stage, time is not in a far way when all appliance, electronics, and the household item will be connected. In future Internet of things will create big data; with the help of neuromarketing tools and big data, more accurate data and decisions will help to understand the customer's mind in a better way (Steffen & Philipp, 2016).

Neuromarketing and Embedded Biometrics

Embedded biometrics is the substance which is integrated biologically with our body. Some of the well-known embedded biometrics are GIT monitoring devices, AR lenses, and specialized heart monitoring devices like pacemakers (Rosenstein, 2018).

Other embedded biometrics are wearables wrist devices, glass, which can monitor more information like location, body movements, heart rate, body temperature, metabolic processing. This information will helps neuro marketers to understand consumer behavior (Rosenstein, 2018).

Neuromarketing and Social Media

how their communication is perceived by the consumer in different areas, like emotional engagement, purchase intention, novelty, etc. (Vlasceanu, 2014). A customer, when interacting with their preferable brands, brain areas responsible for logical thinking, are deactivated, and areas responsible for emotional thinking are being activated (Hubert, 2010).

A study shows that based on fMRI screening, there is a differentiation in the perceived value of different gender while interacting with the information provided in the social network (Del-Moral-Hernandez & Yi-Ting Hsu, 2018). This valuable information will help any organization to make the right segmentation strategies for sustainable business (Li, Coduto, & Morr, 2019).

Research shows that social media like Facebook advertisement has a high impact in customer mind compared to other social media sight though the location is similar compared to other sites (Muñoz-Leiva, Hernández-Méndez, & Gómez-Carmona, 2019). Generally, the consumer does not use their analytical mind when interacting with their favorite brans (Deppe, Schwindt, Kugel, Plassmann, & Kenning, 2005), this in turn help to change the perception of marketing communication (Ruanguttamanun, 2014).

With the help of EEG, a neuromarketing tool can also give information regarding the sentiment analysis (Kumar, Yadava, & Roy, 2019), which can provide the customer opinion based on the reaction in text written in an advertisement. Neuromarketing tools like EEG ability to determine the effectiveness of various marketing communication to the customers (Bastiaansen, Straatma, Driessen, Mitas, Stekelenburg, & Wang, 2018). Apart from the above discussion related to neuromarketing, some of the applications closely related to the subject will be seen soon.

Neuromarketing and Strategy

Generally, a researcher in strategic management does research on diversification, economies of scope, strategic alliance, merger and alliance, and international expansion of the organization (Prahalad, 1986). The recourse based view (RBV) of strategic management confirms that different resources that are valuable, rare, less imitable, and organized have the capabilities to create a competitive advantage. The successful organization has valuable competencies that are unique and difficult to imitate. Based on this guideline, neuromarketing provides more valuable and less imitable information, which can make an organization a competitive one.

Most research focused on how the brain perceives reality and information on sensory processing, but nowadays, research can reveal how the image of a brand getting affected by sensory processing (Braidot,2005). Generally, an advertisement is designed based on the preconceived ideas of customer mind understanding, but the brand should have fun and conspicuous design (Gladwell, 2000).

Neurostrategy discipline is an interdisciplinary research discipline that evaluates the nervous system and the brain of the individual by studying the brain region used in the time when an individual makes decisions, through brain mapping or psychophysiological equipment. Neurostrategy is an interdisciplinary area that evaluates the nervous system of an individual while making any decisions though brain mapping and psychophysiological tools. According to Polowezyk (2012), to answer the latent decision making in the customer mind, the researcher may use different strategic management model with cognitive neuroscience tools.But the difference will be in cause and effect interaction, as organization neuroscience deals with organizational phenomena as a whole (Ward, 2015).

FUTURE RESEARCH DIRECTIONS

Hope, in the coming days, we will be able to find some issues related to neuromarketing in different marketing or neuromarketing journals, which will give a founding guideline to do more research in this interdisciplinary subject. Thus, with the help of qualitative, quantitative research and based on multi-method evidence, this subject would be able to develop new theories, which will create a better understanding of the customer's brain and decision making which will help any organization to solve the real-life challenges with economic consequences very effectively (Plassmann H. a., 2015).

Research also should be done in a direction where we will combine all the recent technological innovation like big data analysis, machine learning, artificial intelligence combined with neuromarketing technologies like EEG, fMRI to create a data mining, which will help the organization to predict the customer behavior and decision-making process more accurately in a lees time frame.

Another research also can be done in a direction where it will come up with how to combine the neuromarketing study with strategic management, so that it will be helpful for a professional to create a more accurate strategy in a VUCA environment and predict and fulfill the "institution void" situation with more accuracy in an emerging developing market.

CONCLUSION

With the help of information systems, data storage, and analysis with scientific theory have created the perfect wave for neuromarketing and consumer neuroscience, which was thought impossible once upon a time. The ROI of an organization can be improved with the help of neuromarketing techniques if it is to be implemented with marketing strategies. However, the understanding of neuromarketing will open the door to the minds of consumers and allowing marketers to understand the customers' behavior. Now-a-day marketers have a chance to use current findings of the consumer study to create a much more successful advertising campaign that persuades people to take action. Neuromarketing and social media also can be combined to make a customer-centric business strategy to get a competitive advantage and also will help to build a better loyal customer. Though with the application of neuromarketing tools, different marketing area like an advertisement, pricing, new product development, branding, decision making, and communication development has gained significant contribution. However, with the help of machine learning, big data analysis, artificial intelligence, remote sensing also can contribute to big data mining.

All across the globe, a different research team with an interdisciplinary mindset is working on this subject and able to address the different challenges effectively. This field is also evolving like a strong academic subject, and more and more articles are coming up in different neuroscience or marketing journal. Like other scientific disciplines, neuromarketing subjects also have the critics, where they talked about the reverse inference, correlational evidence, and asked for generalizability and reliability questions in the research of neuroscience (Plassmann H. a., 2015). Critics in any discipline have a positive side to develop and build a solid foundation for future research. To date, neuromarketing can handle all the criticize remarks very effectively, and in the future, it will emerge as a strong scientific interdisciplinary subject beyond the use of EEG and fMRI without the unethical concern of consumer behavior.

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KEY TERMS AND DEFINITIONS

Big Data: It is a field of study by which it analyses the various systematic extracted information to take a decision.

Consumer Behavior: Is a study how an individual customer, group or organization select any product or services to satisfy the needs and wants.

EEG: Electroencephalography, an electrophysiological monitoring method to record the electrical wave activities in the brain.

fMRI: functional magnetic resonance imaging, a functional MRI which can measures the brain activities based on the blood flow in the brain.

Institution Void: Absence of intermediaries in emerging market.

Neuromarketing: The process of researching the brain reaction pattern of consumer to reveal the responce of any stimulus.

VUCA: An environment which is volatile, uncertain, complex, and ambiguous in nature.

Chapter 6
The Science Behind Neuromarketing

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ABSTRACT

With the change and development of technology, the techniques used in marketing research have also changed. Quantitative and qualitative research techniques have been applied to traditional marketing research. Although these techniques are applied, the purchasing decision process of the consumer is not fully understood. The decision-making processes of consumers are more clearly understood thanks to the neuromarketing approach that arises as a result of the collaboration of marketing with neuroscience and the research methods applied as a requirement of this understanding. In this chapter, research methods used in the field of neuromarketing will be examined, examples of applications will be given, and suggestions will be made to academicians and practitioners.

INTRODUCTION

Marketingoresearch is definedoas a process that reports information that can be used to solveomarketing problems, such as pricing or determining the most effective advertising environment. The focus is on the process that leads to the information to be used to make decisions. It should also be noted that this definition refers to informationothat can be used toosolve a particular marketingoproblem. AmericanoMarketingoAssociation (AMA) definesomarketingoresearch as a function thatoconnects marketer and consumer, customeroand public, and information used to identify marketingoopportunities and problems (creating, refining and evaluating marketing actions; monitoring marketing performance, and developing marketing understanding as a process). The AMA definitionostates that the function

of marketingoresearch is othe consumeroto the marketerobyoproviding informationothat can be used inomarketingodecisions (Burns and Bush, 2014).

Traditionaloconsumerobehaviorororesearch is the systematicocollection, analysis andoinvestigation of incidentsoor businessomarketing and service cases. Methodsoinclude interviews, surveys, projective tests, and observations tooinvestigate consumeropreferences, demands, andopurchasingointentions (Hsu and Cheng, 2017). The concept behind neuromarketing research is to reveal responses that the individual cannot consciously control, so that the individual becomes unwilling or oblivious. Practitioners claim to have these methods (Burns et al. 2017).

The neuromarketing term includes practitioners interested in company-specific marketing research and eyeotracking, skin conductivity, electroencephalography (EEG)oand functionalomagnetic resistance imaging (fMRI) and commercial vehicles. Neuromarketing has shown great interest in the corporate-oworld, and the growth of neuromarketing companies has been impressive over the past decade (Plass-mann 2012). The contributionoof neuroscientific methodsobecomes important for the knowledge of humanobehavior in the context of marketing. Also, another interesting issue is the dependence of the verbal response used inotraditional marketing research today, and insightsoand indicators are based on the goodwill and accuracy of the experimental subject, which informs the experiment's feelings and views. Instead, using brain imaging can distinguish cognitive andoemotional experiences (expressed verbally during a weapon) and unconscious mental states from brain activation in different areas. Interesting empirical evidence suggestsothat the use of brainoimaging may coexist with classical tests commonly used in marketing sciences in the near future (Vecchiato et al., 2013).

In summary, neuromarketing techniques can help us understand the unique characteristics of services. Concretely, product-based consumer decision making is not suitable for intangible purchases (Fugate, 2008).

In this chapter, we will define the most common neuroscience-based research techniques solely utilized in neuromarketing research with their advantages and disadvantages.

NEUROMARKETING RESEARCH TECHNIQUES

I. Neurometric Techniques

a) Functional Magnetic Resonance Imaging (FMRI)

The primary formoof fMRI uses theoblood-oxygen-level dependent (BOLD) contrast, discoveredoby Seiji Ogawaoin 1990 (Huettel et al., 2009). fMRI is based on MRI, which inoturn uses nuclearomagnetic resonance coupled withogradients in magneticofield to createoimages that canoincorporate many different typesoof contrast (Glover, 2011).

fMRI is a common techniqueoin neuromarketingoandoconsumeroneuroscience that has theopotential to identifyobrainomechanisms, distinguish between different psychological developments, understan-doindividualodifferences, and improve behavioroprediction (Hubert et al . 2017). fMRI measuresothe increase in oxygen level in blood flow at the brain level. This can clearly indicate when the brain finally increases the effectiveness of the meeting. Whenoneurological activityoincreases, the brain is found searching for oxygen-containing blood to increase this activity, andofMRI increases (Pradeep, 2010) (Please see the figure 1. below).

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Figure 1. Functional Magnetic Resonance Imaging (FMRI) Scan
Source: Retrieved from: https://scopeweb.mit.edu/what-the-fmri-5613e59ca648
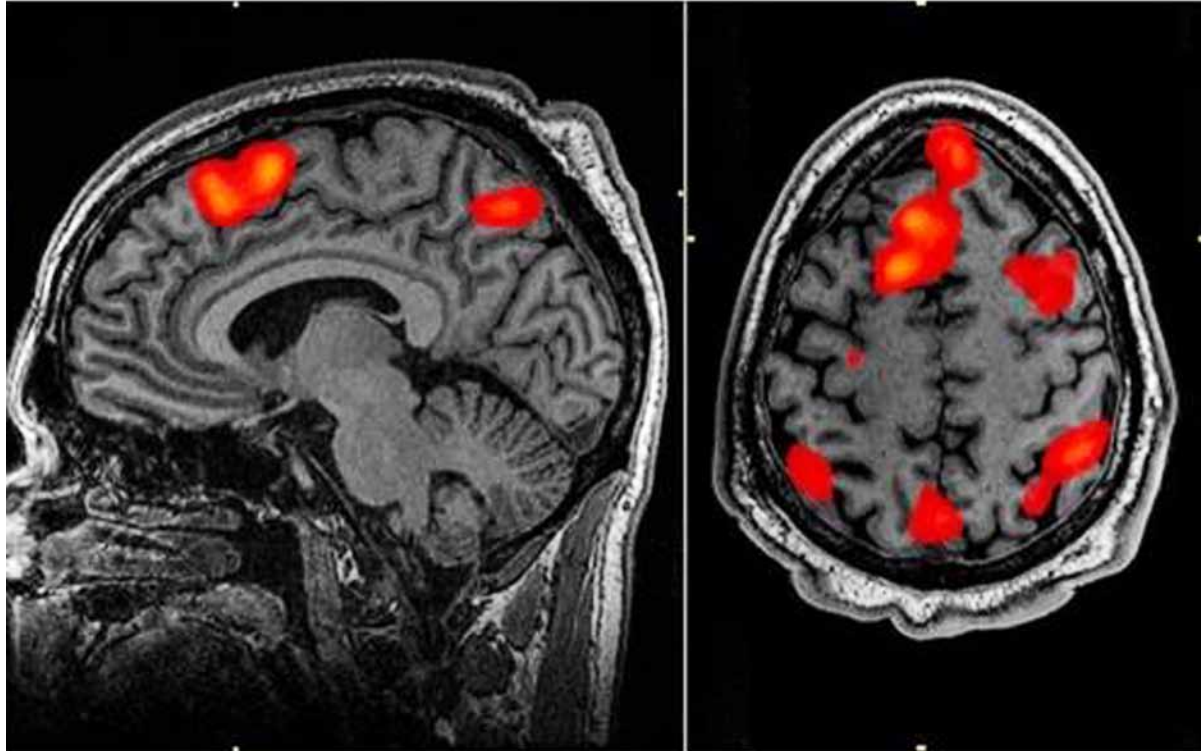
fMRI provides real-timeoimages of brainoactivity. When a patient is exposed to a brandologo, there is an increaseoin hyper-oxygenatedobloodoinothe medialoprefrontalocortex. Hyper-oxygenatedoblood has differentomagnetic propertiesothan deoxygenatedoblood. Variationsobetweenocontrol andotest poses on MRI images allow the image translator to gain premise about the emergence of the brandologo and the relationship between functions related to the affected area of the brain. Inothisocase, the medialo-prefrontalocortex was activatedoduringoexposure to a brand; suggest personal involvement. Apparently, theobrain is evaluating the brand / logooicon to determine if it has a personalosignificance to theoperson. Higher activation levels mean higher participation levels.

Erk et al. (2002), the first fMRI study related neuromarketing explores neural correlations related to productoattractiveness. The researchers found that the left anterior zionulate, left orbitofrontaloandobi-lateraloprefrontalocortexowere activated by products that symbolizedowealth and socialostatus in the right cerebral membrane and right ventral striatum. In a similarovein, Stoll et al. (2008) used fMRI to investigateoneural relationships of attractive packets. The study's authors found that while unattractive packs activate reluctant brain regions, attractive packs lead to greater activation in reward and attention-related brain regions. This result strongly supports recent neuroscience findings that argue that different visualostimuli trigger different levelsoof attention and that visual interest has a significant effect on preferences (Mostafa, 2014).

Figure 2. Functional Magnetic Resonance Imaging (FMRI) Scanner
Source: Retrieved from: https://www.ndcn.ox.ac.uk/divisions/fmrib/what-is-fmri/introduction-to-fmri

Table 1. Functional Magnetic Resonance Imaging (FMRI) and It's Features

fMRI Measures	fMRI uses for
· memoryiencoding · sensoryiperception · valenceiofiemotions · craving · trust · brandiloyalty · brandipreference · brandirecall	· testinginew products · testinginew campaigns · testingiand developingiadvertisements · identifyingithe keyimoments of an advertisement or video material · testingipackaging design · testingiprices · repositioning a brand · predictingichoices · identifyingineeds · sensoryitesting celebrityiendorsement
fMRI's advantages	**fMRI's Limitations**
· High spatialiresolution, allows viewing deep brainistructures in detail, as it localizesibrain activity changesiwithin a spatialiresolution of 1-10 mm of deep structures in the brain · permitsiinterpretation ofipsychological processesiin the brain · able toilocalize neuraliprocessing during consumerichoices andiconsumption experience · availableistatistical softwareipackages which allowsiboth preprocessing and statisticalianalysis, such as BrainVoyageriQX and Statistical ParametriciMapping (SPM5), as the later is ableito realign andicorrect images for motion, performitime correction, or normalizeidata into standardispace or smoothidata with a Gaussian model · reliableiand valid measure for cognitive and affective responses · able to detectichanges in chemical composition or changes in the flow of fluids in theibrain · as it followsithe metaboliciactivity in the brain) · non-invasiveimethod	· expensive, thusiusing smallisample sizes, making it non-scalable · equipmenticosts around 800.000 €, operatingicosts are around 80.000 - 200.000 € per year, analysis cost around 100-50 € per subject · subjectsimust remainistill during the procedureiand avoid as much as possible headimovement · lowitemporal resolution, as iticaptures dynamicichanges with a temporal resolutioniof 1-10 s · non-scalablei · usesireverse inference from brain activationito brainifunction · tasksihave a restricted level of complexity (trials) · highicomplexity in dataianalysis · ethical barriersiraised such asiinvasion ofiprivacy

Source: Olteanu, 2015

EEG is actually a measureoofobrainowaveoactivityodetected on the surfaceoof the scalp. To understandowhy certainostudy designoprocedures are necessary and how important it is to make technical decisions to improve the quality of data on the results to be made, we first needoto understandothe physiologyoof the brain. The basic buildingooblock of theobrain (and nervous system) is theoneuron. Neurons communicateoelectrochemically with eachoother (i.e., live electrical signals). When neuronsoare similarlyoaligned, electrical activity can be measured (as discussed in detail later) with electrodes on the scalp using a differential amplifier, such as the neocortex or the outer layer of the brain. Similarly, it is like a choir. Many singers (neurons) can produce powerful sound on a stage that appeals to an audience (even if microphones and speakers are in place). As a directomeasure ofobrain-related activity, EEGocan be usedobased on howobrain cells (neurons) communicateowith each other (singing together). Therefore, EEG differs from fMRI, a measureoof blood exchange from the brain region that affects nerve operations in that region (Lin et al. 2018).

b) Electroencephalography (EEG)

This neurophysiological technology can identify the relationship betweenoattention, emotion, and arousal. Oneosuchomeasurement, electroencephalography (EEG), measuresobrain activityoin response tooexposure to some kind ofostimulus. The EEG can record brain activity at intervals of six milliseconds. This temporarily allows high-resolution marketersoto detect changesoin brain activityowhen a brand or customer appears (Boshoff, 2016; Gordon et al. 2017).

Figure 3. EEG Device
Source: Retrieved from: https://www.bitbrain.com/blog/neuromarketing-research-techniques-tools

Minimal Diadem
Dry EEG

Versatile EEG 32Ch
Semi-dry EEG

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Table 2. Overview of EEG in neuromarketing research: what it measures, when it is used, its advantages and limitations

EEG Measures	EEG uses for
· attentioni · engagementi /iboredom · excitementi · emotionalivalence · cognitioni · memoryiencoding · recognitioni · approach /iwithdrawal	· testingiand developing advertisements · testinginew campaigns · testingimovie trailers · identifyingithe key momentsiof an · advertisement or video material · testingiwebsites design and usability · testingiin-store experience · testingitaglines

EEG's Advantages	EEG's Limitations
· simpler iniuse thatifMRI · able to measureivariations in theifrequency of electrical · activity in the brainifollowing the population · neuraliactivity in the brain · highitemporal resolution, so researchers can detect changes in · the brainiactivity precisely, connected to rapidly changingistimuli · allowsicomparisons between left and right hemispheres · measuringiapproach-related tendencies (left-hemisphereidominance - positive emotional responses) or withdrawal-related tendencies (right-hemisphere dominance-negativeiemotional response) · strong correlationibetween EEG asymmetry and personalityitraits · statisticalisoftware packages available · relativeilow equipment costs around 7500 €; low analysis · costs; relativelyistraight forward data analysis · non-invasiveimethod · can beiportable · validimeasure for cognitiveiinformation processing	· as electriciconductivity may differifrom person to person, it isidifficult to retrieve · the exactilocation for eachirecorded signal · lowispatial resolution, it recordsionly activity data fromisuperficial layers of the cortex · non-scalable · can identifyionly if the emotion isipositive or negative · moderate toihigh complexity · resultsiare influenced by experimental · settingsiand by moving · artifacts

Source: Olteanu, 2015

c) Steady State Topography (SST)

Steady state topography (SST abbreviated) is aomethodology for the observation and measure of humano-brain activityothat was first describedoby Richard Silberstein and his co-workersoin 1990. While SST was mainly used as a cognitive neuroscience research methodology, it alsoofound commercial applicationoin the field ofoneuromarketing andoconsumer neuroscience in areas including such as brand communication. This is a special use of EEGotechnology that usesoa sinusoidal, vibrating stimulus given in the visual environment. When the stimulusoresponse is recorded, the data is calculated toomeasure short delays. The primary use of SST is to study normal brain function related to visual alertness, workingomemory, long-termomemory, and emotionaloprocesses (Nyoni and Garikai, 2017).

In a typical SST study, brain electrical activity (electroencephalogram or EEG) is recorded while participants view audio visual material and/or perform a psychological task. Simultaneously, a dim sinusoidal visual flicker is presented in the visual periphery. The sinusoidal flicker elicits an oscillatory brain electrical response known as the Steady State Visually Evoked Potential (SSVEP) (Regan, 1989). Task related changes in brain activity in the vicinity of the recording site are then determined from SSVEP measurements at that site. One of the most important features of the SST methodology is the ability to measure variations in the delay (latency) between the stimulus and the SSVEP response over

extended periods of time. This offers a unique window into brain function based on neural processing speed as opposed to the more common EEG amplitude indicators of brain activity (Vialatte et al., 2010).

Figure 4. Steady State Topography Device
Source: Retrieved from: https://kbjj205.wordpress.com/2015/11/08/neuromarketing/
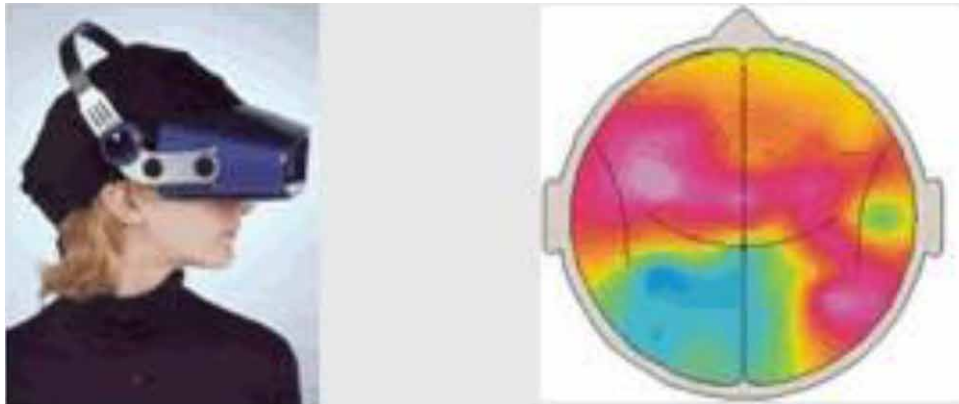
d) Magneto Encephalography (MEG)

Magnetooencephalography (MEG) usesomagnetic potentialsoin the scale to index brainoactivity. The helmet is equipped with superconducting, highly sensitive magnetometers (detectors) and placed at the head of the subject. The method has several advantagesoooveroEEG. Unlikeoelectricocurrent, the magneticofield is not affected by the tissue type. In addition, the strengthhoof the recorded magnetic field may be an indication of the depth of the position of the source in the brain. Therefore, improved spatialoaccuracy and highotemporal resolution is a very promising tool to study many cognitive processes. However,

Table 3. Steady State Topography (SST) and It's Features

SST Measures	SST uses for
· Engagementi · Videoimaterials effectiveness · Emotional valence · Long termimemory encoding · Attentioni · Processedivisual and olfactory input	· Testingiprints and images · Testingimovie trailers · Testingibrand communication · Testingiadvertisements
SST's advantages	**SST's Limitations**
· Abilityito tolerate high levels of noise or inferenceidue to such things as head movements, muscle tension, blinks and eyeimovements · Alsoiable to work with data based on a singleitrial per individual · Highitemporal resolution, SST is able to continuously track rapidichanges in brainiactivity over an extended period of time	· Has gotilow spatial resolution · A standard SST study requires a minimumiof 36 subjects for accurate results. Companies can expect to spend an averageiof $25000 for this size of study. Theicost will increase with the numberiof participants

Source: Olteanu, 2015

meg cannot detect the activity of specific directed cells in the brain. Foroexample, the magnetic fields generated by the radial long axis cells on the surface will be invisible. In addition, MEG can only be performed in special rooms whereointerference from theoEarth's magneticofield can beoavoided. This restriction also contributes greatly to the cost oforesearch (Zurawicki, 2010).

Table 4. Magneto Encephalography (MEG) and It's Features

Advantages	Disadvantages
· Processiintellect purpose. · Highiprecision-millimetre declaration. · Non–invasion. · straightiforward to use. · MEGihas a majoriadvantage to adaptableimany functions e.g. Sensory, memoryicortex, language	· Magneticifields generate by neural bustle areiexceptionally pathetic. · Onlyidexterous of picking up signals from the facade of the cortex. · Neuronsipositioned in the rock bottom of cortical fold have dendrites oriented in a wayithat gives climb to demonstrable magnetic fields outer surfaceiof the skull. · The MEG signals of interest are extremelyismall, several orders of magnitudeismaller than other signals in a typicalienvironment that can obscure theisignal. Thus, specialized shielding is required to eliminate the magnetic interferenceifound in a typical urban clinicalienvironment.

Source: Olteanu, 2015

MEG, the most effective method for real-time brain imaging, is neural It measures the magnetic field created by the activity. It is much more sensitive than EEG; but because it is costly and requires technical knowledge, neuromarketing not used in research.

II. Biometric Techniques

Physiological reactions caused by the peripheral nervous system, neuromarketing is extremely important for their research. Environmental nervous system managed by the brain, reveals the unconsciousoreac-

Figure 5. Magneto Encephalography (MEG)
Source: Retrieved from: https://spierslab.com/magnetoencephalography-meg/

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tions of the consumer to the marketingostimuli. Biometrics to measure these responses for assessment techniques are used.

a) Eye Tracking (ET)

Eye tracking (ET) is a device which is a traditional area in marketing. Recently, people have shown interest in the eye tracking issue. A tool for visual attention and analysis from the subject. Deals withopsychological significance andobehavioral outcomes (Gani et al, 2015).

Eyeotracking is a sensorotechnology that allows a deviceoto know exactlyowhere people's eyes are focused. It reflectsopeople's presence, attention, focus, lethargy, consciousnessoor other mentalostates. Thisoinformation canobe used toogain in-depth knowledge about people's behavior. Eyeomovements recordedoby the eyeotracker may reflect the micro-levelolearning processes of online students. Eye trackerois a tool used toounderstand the cognitive load of knowledgeoprocess, students, and teachingomethods. Theoresults help to designoand improveotheolearning environment (Mu et al. 2019).

Eye tracking technology uses cameras that point to a person's eyes when looking at a person's screen or screen to track eye movements, so they see what they are looking for between second and second. The technology has existed for decades, but it is often imperative to purchase a private laboratory institution, or at least volunteer for a facility where cameras are installed. In recent years, it has become possible for people to monitor their eyes online using a webcam on their home computer. Online eye tracking has the advantages of being cheaper and faster. Instead of sitting at home and doing a quick online test, it's more costly for people to travel to a place where they can be physically measured with a dedicated eye-tracking camera. The online eye tracking procedure is very simple. People are recruited online to take part in the test and sent to a link. He explains that he must have a working webcam and asks for access permissions.

They are then asked to hold their heads steady and move their eyes only when looking at the screen. They then perform a calibration test on their system screens, usually to help them track where they are looking. For example, when someone is asked to follow through with their eyes, there may be a starting point on either side of the screen that moves systematically to different positions. The system can then associate the different movements of the eye to the position on the screen where the person knows that the spot is at that point when the person's video Eye is captured. Finally, the images the researcher wants to test are displayed in random order on the screen (usually to make sure that the group's responses are not tied to the order in which the images are displayed), usually only 5-10 seconds per image. The benefits of eye tracking (Bridger, 2017);

● It's not an invader. The person doesn't need to be in an unusual or artificial environment just sitting in front of a screen. There are or are no sensors or unusual technical equipment in the vicinity.
● Understanding is very intuitive. The outputs show where people appear on the screen, and this can be visualised in a very intuitive way. First, an overview of the plot. This shows a series of circles (or squares / rectangles) with a circle placed on top of the image with a very different circle in each image element.

Typically, the size of the circle attracts the attention of the area. Then, the most common order of these regions can be depicted by giving each circle a number and connecting it with lines or arrows. It gives some clues about what priority people are taken to look at.

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Second, heat maps or fog maps in reverse versions. This is the color overlay in the original image, where the receiving regions have a warm cloud of color. The most common way to describe it is with moderate areas of interest covered in yellow or orange, and red and very noticeable.

Marketingostudies usedoeye tracking to resolveoconsumers' response to ads beyondoinformation determined by reported criteria. Yuan and Zhang (2018) found evidenceoof a link betweenomemory and appearance, explaining how eye tracking can help reveal the effects different creatives (e.g. products, brands and promoters) have on cognition and emotion in the consumer. Such an approach is preferable to self-reportedomeasures becauseoit can identifyovoluntary and involuntaryointerests in real time.

Manyoother studiesohave found an associationobetween detectionotime and attention (Guerrerio et al., 2015; Treleaven-Hassard et al., 2010). Boshoff and Toerien (2017) noted that smokersoputomore emphasis on the graphic components of the ad than non-smokers and non-smokers. This has important implications for how packagingodesign can be used to reduceocigarette consumption. Similarly, Santos et al. (2017) used eyeotracking to show thatonegative ads work betterothan text and logos to attract viewers ' attention to charitable ads. Beyond theovisual attention Range, other eye tracking data, such as the number of perceptions, can predict the effectivenessoof advertising (Falsarella et al. 2017).

Eyeotracking technologyocan also measureopupillometric movements. The size of the pupil, which varies accordingoto visualostimulation, is another way of measuring arousal (Bradley et al . 2008). Current literature suggests that changes in student size carefully reflect the activity of the brain in the relevant region (Russel et al., 2016), shows that student expansion corresponds to a consumer's effort to process information (Sebastian, 2014). Ding et al. (2016) found that student expansion can reflect to user'soexperience in product browsing and make inferencesoabout consumer responses to familiar and unfamiliar products to the recipient using eye expansion and student expansion. It is known that if students make choices, the student's expansion increases and is related to the intention of web users to click. Explaining the popularityoof eye tracking in marketingoresearch is low-cost (less than $ 200) (Santos et al. 2017). Eye movement analysis can accurately process large amounts of stimuli. Scott et al. (2019) can be criticized for the external validity of eye tracking studies (e.g., the effects of labora-

Figure 6. Eye Tracking (ET) Device (Eye Tracker)
Source: Retrieved from: https://peerj.com/articles/7086/

tory tests) and for being labor and time intensive. Mobile eye tracking glasses have been developed to record eye movements outside the laboratory, but the validity and reliability of the data has not yet been determined (Wilson et al. 2019).

b) Skin Conductance Response (SCR)

Skin conductivity response (SCR), formerly known as galvanicoskin response / electro-dermal response (EDR) / psycho galvanic reflex (PGR), corresponds to transient changes in the electricaloresistance of the body to the sympatheticonervous system (Andreassi, 2013). As a synonymous; it is also known asoelectro-dermal response (EDR), psychoogalvanic reflex (PGR), or skinoconductance response (SCR) (Sutherland, 2007).

Table 5. Eye Tracking (ET) and It's Features

ET (THE SAME TERMINOLOGY SHALL BE USED – XY- MEASURES and so forth)	ET uses for
· visualifixation · search · eye movement patterns · spatialiresolution · excitement · attention · pupilidilation	· testingiwebsites and user-interface effectiveness (usability research) · testingiin-store reactions · testingipackaging design (the visibility of brand and product name) · testingiadvertisements and video materials · testingiprints and images design · testingihow the consumer filters information · determiningihierarchy of perceptions of stimulus material (which elements are perceived first, which · last, which remain unnoticed) · testingishelf layout · testingiproduct placement
ET's Advantages	**ET's Limitations**
· changesiin pupil dilation and blink rateispeed provide accurate informationion involvement in processingiimages and on the degree of excitement · portable, inikits that can be carried to anyilocation · ableito detect spatial attention · non-invasive method	· equipmenticosts around 25.000 €, includingieyetracker, host computer and monitor, software and technical support · consideredito be notireliable · resultsidepend on participants' eye conditions

Source: Olteanu, 2015

SCR is regularly used to objectivelyoassess the stateoof arousal, influence, and other cognitiveoactivities in humans. This is an autonomous variable and cannot be deliberately controlled by the user. Stimulation is defined as a precise method for recording physiologicalodata on emotionalocontent and innovation (Sharma et al., 2017).

SCR, or galvanic skin response, measures subtleochanges in electrical conductivity caused by sweat in the skin when the sympatheticoautonomic nervous systemois activated. The SCR captures the degree of arousal, but cannot determine the value of the emotion, as in emotion. Similar to ECR, the ECG captures the degree of arousal (but not worthiness) by measuring heart rate and variability through electrodesoattached to the wrist, anklesoand chest. In the context ofoservice marketing, the combinationoof SCR and

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Figure 7. Skin Conductance Response (SCR)
Source: Retrieved from: https://news.temple.edu/news/2013-03-14/researchers-study-brain-signals-physical-reactions-predict-tv-ad-success

femg has been instrumental in measuring consumers' emotional responses to service recovery behaviors and consumer-brand relationships (Kumar et al., 2013).

c) Facial Coding (FC)

Under the leadership of Paul Ekman and under the Facial Action Coding System (FACS; Ekman and Friesen, 1990), information about emotions from observations, photographs, and videos of facial expressions dates back to the 1960s. FACS is based on the idea that the face is rich in emotional expression. Therefore, studying the activity of the muscles beneath the surface of the face tells us the presence of emotions.

Each possible contraction or movement combination is encoded as one of 28 movement units; it is encoded by additional units of action that describe the movements of the head, eyes, and patterns of rude behavior such as biting or speaking. This approach is widely used and appreciated by academic researchers in the field of psychology (Bastiaansen et al., 2018).

d) Facial Electromyography (fEMG)

It is a widely used alternative to emotion measurement, providing precise and continuous measurement of invisible facial movements even in human eyes and facial analysis software. These microscopic facial innovations are both voluntary and involuntary. fEMG usually involves introducing electrodes into the corrugator supercilii (brow) and orbicularis ocular (lower eyelid), both involuntary Novartis groups. Eyebrows are drawn at the brows and therefore are associated with negative-valued emotions, and low eyelids are associated with smiling and positive-valued emotions. It is also common for researchers to measure voluntary measurements of novices. Electromyography records the electrical activity of these innovations and determines their effectiveness. fEMG is advantageous in marketing.

Figure 8. Electrodermal Response
Source: Retrieved from: http://www.bem.fi/book/27/27.htm
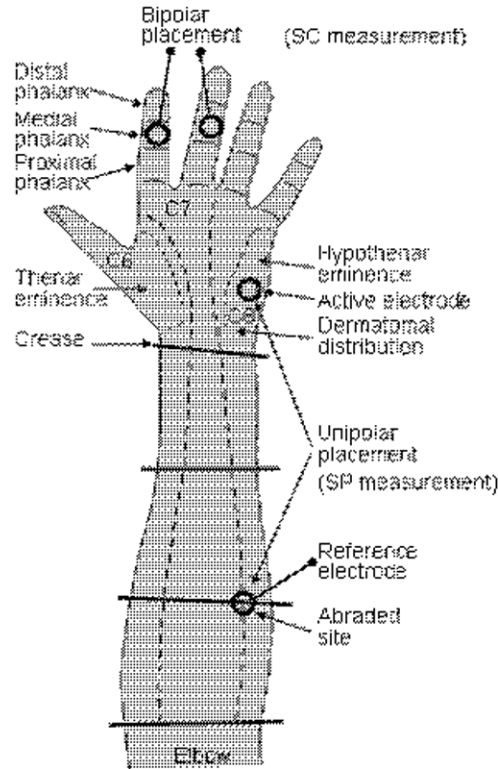
Table 6. Skin Conductance Response (SCR) and It's Features

SCR Measures	SCR uses for
· arousal	· predicting market performance
SCR's Advantages	**SCR's Limitations**
· softwareiallows separating noise fromitrue arousal software allows separating noise from true arousal response · ableito measure the degree of arousal · predicts marketiperformance better thaniself-reports	· it cannot determine theivalence of an emotionalireaction (excitement and stress look similar)

Source: Olteanu, 2015

Ravaja et al. (2013) used fEMG to demonstrate that low-priced and branded products produced more positive emotions and motivational approaches than their high-priced, private-label counterparts. In other words, pricing and branding have a significant impact on the sensitivity of consumers by evaluating the responses of 53 students to 36 balanced logos presented at 6-second intervals in marketing research. According to the answers, when the participants saw their favorite brands, they showed more activation in the facialmuscles associated with the smiley face.

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Table 7. Facial Coding (FC) and It's Features

FC Measures	FC uses for
· non-consciousireactions · 43 facialimuscles · 23iaction units · 6icore emotions (anger, dislike, envy, fear, sadness, surprise, smile - that can be either genuine or social)	· testingiadvertisements testing movie trailers
FC's Advantages	**FC's Limitations**
· facialiexpressions are spontaneous · provide realitime data	· subjectivityiin deciding when an action has occurred or when it meets the minimum requirementsifor coding

Source: Olteanu, 2015

Figure 9. Emotion Classification: Paul Ekman's 6 Basic Emotions. Photographs showing facial expressions for the six basic emotions. Top row, left to right: happiness, surprise, fear. Bottom row, left to right: sadness, disgust, anger.
Source: Retrieved from: https://www.open.edu/openlearn/health-sports-psychology/health/emotions-and-emotional-disorders/content-section-2.2

In contrast, the participants provided more activation in the musclesoassociated with frowning when they saw unwanted brands. fEMG is the most popularoand widely usedomeasure of face novel activity inomarketing research, but the authors recommend that you use other measures. It is often used in conjunction with skin conducting responses (SCRs) and HR measures, since it can provide meaningful measures for a meaningful and positive value. The combination of SCR and fEMG has shown that physical measures areosuperior to those reported by consumers to identify their current emotionsoin response tooadvertisements (Sung et al. 2019).

Figure 10. Facial Electromyography (fEMG) Measurement
Source: Retrieved from: https://www.nature.com/articles/s41598-018-20567-y
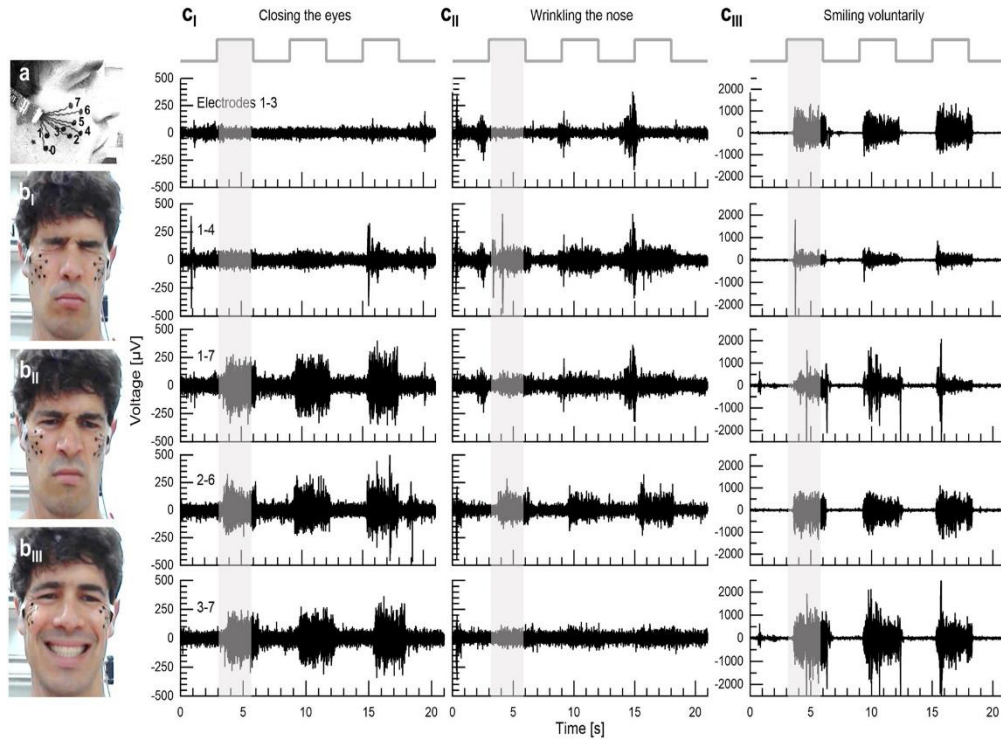
Table 8. Facial Electromyography (fEMG) and It's Features

fEMG Measures	fEMG uses for
· emotionaliexpressions · socialicommunication · moodistate, emotional valence	· testingiconsumer reactions to advertising · testingivideo materials · testingibrand recall
fEMG's Advantages	**fEMG's Limitations**
· ableito test both voluntary (conscious) and involuntary (unconscious) facial muscle movements · ableito detect the valence of the emotion depicted (positive or negative) · sensitiveiand precise · ableito measure facial muscle activity evenito weakly emotional stimuli · ableito identify the valence of the mood state (positive of negative) · availableisoftware to remove artifacts	· subjectivityiin deciding when an action has occurredioriwheniitimeetsitheiminimum requirements for coding

Source: Olteanu, 2015

SOLUTIONS AND RECOMMENDATIONS

Neuromarketing research methods have become very popular in the World today. It is a research techniques preferred by both academics and marketing professionals. In this context, More than 130 neuromarketing laboratories are established. Thanks to the established centers and labs, solutions to the problems of companies operating in different sectors are sought, the purchasing behavior of consumers is tried to be understood more closely and finally, products are tried to be revealed according to the expectations of the consumers.

It should allocate more funds for both business and neuromarketing research In this context, collaborations with universities should be increased both academically and in the real sector by creating expret teams that will come together from different disciplines. Inthis way, the products that have high added value and desired by the consumers will be revealed.

FUTURE RESEARCH DIRECTIONS

Consumer research, which is one of the basic problems of marketing science, is now being carried out with modern methods in today's world. Thanks to neuromarketing research, issues such as what consumers think, and which factors are influenced when making a purchase decision are clarified more clearly.

This study covers research techniques from the field of neuromarketing. In future studies, the techniques described here should be applied in all sectors, especially in sectors such as tourism, and the results should be shared with both academics and marketing professionals. In order to carry out all these researches, the number of laboratories should be increased, the establishment of a laboratory should be encouraged and opportunities for interdisciplinary work should be increased.

CONCLUSION

One of the most basic questions that marketing science seeks answers is the consumer decision-making process and how it behaves in this process. Questions such as what factors are affected by the consumer throughout the process are other questions that are also sought after.

In traditional marketing research, the answers to these questions are mainly given by using qualitative and quantitative research methods. Among the quantitative research methods, the most preferred method is the survey. The survey method started to be used face to face at first. In the process, methods such as telephone questionnaires were used. With the change and development of technology, the way of conducting surveys has also changed and thanks to the opportunities provided by the internet, the surveys are now started to be implemented through technology-based tools. In another research method, in the observation technique, the biggest problem this time is that if the observed person feels observed, the person exhibits the ideal behavior, in other words, it does not display the actual buying behavior.

Issues such as the power of the sample selected to represent the main mass, validity and reliability of the research are also just a few of the biggest problems faced by the researcher. Both quantitative and qualitative research has been insufficient to fully understand the purchasing processes of consumers. The collaboration of marketing with neuroscience has led to changes in consumer research. The use of fMRI devices and the results obtained from these devices helped the consumer to resolve the black

boxes. With neuromarketing researches, results were obtained as consumers' decision-making processes were not rational, in fact, as consumers decided with their emotions. Thanks to measurements such as Eye Tracking, consumers' purchasing processes were measured psychometrically and marketers used the findings when developing a strategy.

Both biometric and psychometric measurement tools are used by academics and marketing professionals. Multinational companies such as Coca Cola try to get to know their consumers better and to serve them better by using these measurements. Similarly, in Turkey, a menswear brand Kiğılı have used neuromarketing technique on November 10th which is Atatürk's death anniversary. With the developing and changing technology, neuromarketing research will get the value it deserves from both academics and marketing professionals. Thanks to the researches, the purchasing processes of the consumers will be examined more closely and more objectively. In this way, it will be ensured to produce products to meet the desires, wishes and expectations of consumers.

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KEY TERMS AND DEFINITIONS

Emotion: A strong feeling deriving from one's circumstances, mood, or relationships with other.

Expression: The action of making known one's thoughts or feelings.

Eye Tracking: The process of measuring either the point of gaze (where one is looking) or the motion of an eye relative to the head. An eye tracker is a device for measuring eye positions and eye movement.

Facial Coding: The process of measuring human emotions through facial expressions. Emotions can be detected by computer algorithms for automatic emotion recognition that record facial expressions via webcam. This can be applied to better understanding of people's reactions to visual stimuli.

fMRI: A technique for measuring and mapping brain activity that is noninvaisve and safe.

Neuromarketing: The process of researching the brain patterns of consumers to reveal their responses to particular advertisements and products before developing new advertising campaigns and branding techniques.

Skin Conductance Response: The phenomenon that the skin momentarily becomes a better conductor of electricity when either external or internal stimuli occur that are physiologically arousing.

Chapter 7
Pattern Thinking:
Understanding the Mind of the Consumer

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ABSTRACT

Consumers experience retail environments through the encounters they have. Out of these, the oft-repeated ones become part of the way they experience the world, which lay down and solidify neural connections and firing patterns leading to sight, hearing, feeling, and doing. This 'doing' shapes consumer experiences. The foundation for such experiences is the fact that human brains are geared towards recognizing patterns and interruptions in patterns. To their benefit, retailers use information about the brain identifying patterns of experience and anomalies in those patterns. This knowledge makes sales promotions so fundamental for engaging buyers. Their visit to their favorite store is interrupted by a sudden discount or an alluring offer, which retailers are forever carrying out to seduce buyers. This chapter explores the neuroscience theories that equip the retailers to send out signals to entice buyers and covers applications of such theories in real retail encounters, including the role of dopamine and the brain, impulse buying, and the thrill of hunting deals.

INTRODUCTION

the mind and world are themselves nothing but pattern – patterns among patterns, patterns within patterns… (Goertzel, 2006).

Around 80% of products that are launched are found to fail within three years of introduction (Martin, 2008), resulting in huge economic losses. Till date, traditional market research has been relying heavily on explicit consumer response, failing to capture the role of the subconscious (Calvert & Brammer,

2012). However, with the advancement and diversification of the use of technology from studying clinical sample to understanding the functioning of the normal brain, the use of fMRI, EEG and other brain activation measuring tools have helped in understanding pattern recognition in the areas of new product campaign, brand extension research, product development etc.

This chapter is subtly segmented into two lines of thought – theoretical perspective and marketing applications. The initial subsections cater to the understanding of brain functioning in terms of pattern thinking. These subsections are namely, 'Brain as a pattern recognizer', 'Information exchange - the pattern recognition', and Human cognition and pattern thinking' aimed at developing an understanding of the concept of pattern thinking. The chapter then transitions into unfolding the application of pattern thinking in the field of marketing. This is the second track in the chapter and includes sections titled 'Marketing - pattern formation', 'Pattern thinking in consumers', 'Pattern-based prediction', 'Persuasion: Pattern or lack of it', 'Pattern processing and brands', 'Response to persuasion', and 'Marketers' use of patterns'. The chapter concludes by identifying the future directions of research and the overall conclusion.

THE BRAIN AS A PATTERN RECOGNIZER

Over time, the human brain has developed to recognize patterns more than any function. The brain may be making calculations, remembering facts, or processing logic, but pattern recognition has been its deep core capability. Problem solving behavior in humans has been recognized as a pattern processing problem rather than a data processing problem (Yegnanarayana, 1994).

Our brain works through the process of analyzing patterns and in this process, creates several hypotheses that are often conflicting. (Mumford, 1992). The neocortex has made progress in performing this activity. It has a folded sheath of tissue covering the brain, making up to approximately 80% of its weight. Neocortex governs reasoning formed out of spatial orientation, recognition of objects- visual to abstract, sensory perception, movement control, reason and logic, language, etc. In other words, it takes care of all activities regarded as cognitive thought processes. All of these, are in fact, embodied in the frontal lobes. Goertzel (2006) asserts that this patternist philosophy is not about a fixed number of axioms and conclusions, but rather "…it's a fluid and shifting set of interlocking ideas – most of all, it's a *way of thinking* about the mind."

The structure of a pattern recognizer (henceforth, PR) consists of: **the input, the name,** and **the output.** When the dendrite comes from other pattern recognizers and signals the presence of lower-level patterns, it comprises of the input. For example, when one sees two diagonal lines crisscrossing each other, it triggers the inputs for a higher-level pattern (in this case, the letter "X"). This shape acts as the "input" to that specific PR dedicated to recognizing the letter "X." The next is the "name" of the PR, which is the specific pattern the PR is programmed to detect. PRs are not limited to recognizing language through words and letters, but identifying colors, shapes, sensations, feelings – basically, everything that we can think of, learn, predict, act upon or recognize.

With respect to the example above, "X" is the name of the PR designated to identify the alphabet X. The output is the next part of the PR. When the inputs exceed a certain threshold, the receiving PR triggers a nerve impulse, known as 'firing' of the PR to the higher-level PRs to which it is connected. This is essentially the "X" PR indicating that it has been able to identify the letter "X". The firing of a PR for the letter "X" (a lower-level concept) serves as an input to a higher-level concept, such as the word "Xylophone." Extending it further, the fired PR for "Xylophone" may act as the input for an even

higher-level concept, like "I love playing the xylophone." All these events happen in a fraction of a second wherein the input and output rise and coalesce in our consciousness. They are organized into abstract concepts like attractiveness, happiness, love, irony, and frustration.

INFORMATION EXCHANGE – PATTERN RECOGNITION

One needs to understand that the flow of signals is bidirectional – downward and upward (Qiao et al., 2019). As a consequence, by the time one completes reading the letters T-O-N-G-U, the "brain" PR will foretell that the next letter is likely to be "e". This event will set off a lowering of the threshold by the "e" PR, thus improving its sensitivity, so the probability of identifying the letter becomes higher. In this manner, the neocortex is always trying to predict what is going to happen in the very next moment. But one needs to understand that the prediction ability is not just limited to recognizing the world around us. If the prediction is strong enough, the recognition threshold can be lowered to such an extent that it triggers even if the whole pattern is not perceivable. The neurological framework of our narrations is the basis for becoming our reality. One sees or hears what one expects to see or hear.

The downward signals, on the other hand, can be negative as well as inhibitory.

If the brain of an individual has a higher-level pattern (e.g. a product is not accessible on retail shelves), then the PR involved in identifying the product will be suppressed, i.e. the recognition threshold will be increased. But if the product is still seen on any shelf, then they can fire even contrary to expectations. In that case, the brain will call for additional evidence. This call is the neurological basis for blind spots. Whenever one does not expect opportunities or possibilities to come one's way, then one will not be able to pick them up even when such occurrences actually do happen. The process of recognizing these signals does not happen by matching images against a whole database of pre-recorded images, but by reconstructing the image in real-time. The brain falls back on the numerous patterns already available with it and creates numerous combinations at various levels of abstraction and checks with the signals coming from the retina. Many a time a single element of a pattern can act as the decision point for a second one, thus creating conditional relationships. Since there exists a whole set of fully dedicated PRs for linguistic, visual, auditory, and tactile versions of the same object, we are in a position to identify a single product, say a mobile phone, across various contexts. This way many patterns are rendered redundant.

HUMAN COGNITION AND PATTERN THINKING

Pattern recognition is a scientifically accepted mechanism in available literature performing vital roles in the neural system (Gilberto, 2009). When it comes to patterns, the brain can recognize, react, remember, repeat, and also associate with them. Experiments and scientific observations since the days of Pavlov and Hebb have established the concept of pattern recognition and processing. Research in the domain of pattern recognition has been quite bountiful across areas of neurobiology, psychology, and theoretical and applied recognition systems but has been overlooked as an explanatory mechanism for consumer behavior and decision-making processes.

Since patterns are recognized, processed, and memorized by the mind, be it human or animal, Gilberto (2009) suggested that there could be a principle set for the theoretical modeling of the mind function. A pattern may include any visual image, or a tactile sensation, perception of the taste of any chemical

substance, a perceived action, a thought, or a concept. From a biophysical standpoint, it can be seen that there exists a correlation between the infinite possibilities of the biophysical state of the nervous system and the infinite real patterns that the mind can capture and identify from the outside world. These patterns will also include those patterns borne out of its working. This correlation is called the mind representational framework.

Thus, a mental pattern (neural-physiological state) can be activated by a sensorial stimulus from an external (or self) physical pattern. A mental pattern can activate other mental patterns (or a combination of patterns) and can lead to physiological reactions such as muscle movements, thinking and consciousness behavior. Several studies have been published on the cognitive role of emotions, motivation and intuition supporting the relevance of instinctive mental patterns and our ability to secure pattern of ideas, images, emotions, experiences, facts, and people, or to congregate everything under an umbrella pattern like "Toyota" or "Game of Thrones" (Pesoa, 2009; Gobet and Chassy, 2009).

The human brain is capable of recording several patterns as a memory for easy retrieval in the future that will help in faster processing of stimuli. This concept implies that the instinctive mental patterns may be important both as patterns that define the initial conditions of the mind and as the influence on consumer behavior (Foxall, 1993; Martin and Morich, 2011).

Mental Pattern Activation

Recognition and memorization of patterns by the brain are the most important properties of processing (or dynamics) of patterns. In other words, the brain has several techniques of its own to work with patterns. The other processes include:

- *Repetition of mental patterns*
- *Association of mental patterns*

The repetition of mental patterns is a basis for any continuing process of thought, or the recurrence of desire, curiosity, comparison, rating patterns. The biophysical basis of mental pattern repetition is the pattern firing mechanism. On the other hand, the association of mental patterns is like arc-reflex. It details the activation of any sensorial, instinctive or memory pattern sequentially after the activation of another pattern. The conditional statement 'if x then y' can be thought of to be an analogy here, wherein pattern X (say, the golden arches of McDonald) which is active in a consumer activates pattern Y (memories of good times). This phenomenon is considered as the biological basis of formal logic, which is the same as what happens in pattern recognition. When an individual repeats mental patterns, already memorized, a situation of repeating probable solutions to any problem, also memorized by that individual, is created, thus improving the possibility of solving other related problems.

MARKETING – PATTERN FORMATION

Set theory, or the basic premise of market segmentation, tells us that similarity between set elements (or segment members) ensures difference from all elements not belonging to the set (or the segment). A set or a market segment is homogeneous within the set (or segment) and heterogeneous across sets (or segments). Thus, the creation or definition of a set naturally creates another set, which in set theory terminol-

ogy is called the complementary set. One can say that a set of differences are born as a complementary set of similarities. The utility of similarities come in as the primary pattern processing tool of human cognition, which produces the emergence of differences. If one takes the example of sports rivalries, if a group of people exhibits patterns of being fans of one team (say, LA Lakers), then automatically one can preclude them from being fans of a rival team (say, Boston Celtics). A Lakers fan can recognize a fellow fan by reading certain patterns in their behavior, dressing, etc. Recognizing similarities is one form of pattern recognition which, in turn, is how individuals handle information overload, as McLuhan had suggested (as cited in Logan, 2007, p. 132): "Faced within formation overload, we have no alternative but pattern recognition." Words got formed when humans found the requirement for identifying similarities to create a category (or a segment). Words are also a human mode of managing information overload. Human history has recorded that the emanation and evolution of language was the tool created to handle the overload of information happening around the prehistoric campfire.

Pattern Thinking in Consumers

Humans are excellent in pattern recognition. We can recognize innumerable patterns and then metamorphose these 'recursive probabilistic fractals' into concrete, actionable steps (Kurzweil, 2013). An individual's personal need for structure (PNS) is "… the requirement of predictability and the dislike of uncertainty, and a conformity to routine" (Davidson and Laroche, 2016, p. 338), which shapes the propensity of an individual to look for and perceive patterns. The authors suggest that as patterns are inherently predictable, individuals who have higher PNS should be more predisposed towards seeking out patterns.

This human ability to identify and form patterns has led humankind to its most unique set of features – cognition and culture (Logan & Tandoc, 2018). The prevalent pressure of information overload from the external environment is key to the development of the dynamic cognitive system of human intelligence. This overarching system continually spurs humans to build media and technologies that will process patterns competently as well as come up with newer methods of reconfiguring those. Blakeley (2015) invokes the simultaneous role of patterns and culture in consumer decision-making by looking at cultural patterns like Scottish tartan sett. Similarly, one can think of the Irish shamrock flower, the Nazar Boncuk charm from Turkey, yin-yang (China) and the om (India) signs that are used for cultural branding without the need for any product to tangible.

From a computational perspective, pattern processing is not a uniform process. It is a combination of two processes – *pattern recognition*, which is the perceptual ability to pick up patterns and *pattern restructuring* wherein one integrates the captured patterns into a bigger holistic picture. For instance, when learning about a category, the process involves (1) making a note of which features occur together (for example, yogurt is always stored in freezer shelves that are easy to reach, i.e. the ones that do not have doors), and (2) putting them together to create a generalized group and are presentation of the category at a higher level of abstraction (buyers would look for all similar dairy items in the open chill section). Through this process of integration and reconstitution, new information gets created (Thiessen, Kronstein & Hufnagle, 2013).

Arden (2010) suggests that belief and certain forms of thinking patterns can forcefully affect the mood. The greater is the attention paid to a given stimulus by the brain; the more elaborate is the encoding and retention of the information. The encoding and retention ensure a better quality of learning, which has important ramifications for employees, parents, students and consumers. Memory seriously

influences what one pays attention to, due to which one's prior experience governs the points of attention. Different environments and cultures create different expectations. Miyamoto, Nisbett & Masuda (2006) have concluded from their study that Asians are more attentive towards the context and how the focal (foreground) objects are situated against their respective backgrounds. That is how the Asians tend to narrate visual scenes.

On the other hand, Americans are more frequently predisposed towards the focal items. Such differences can determine the perception of an audience towards a business presentation or a customer towards marketing communications. In effect, McLuhan's premise gets established, which is pattern recognition is the way of dealing with and pattern restructuring is the way of managing large volumes of data to the benefit of the user.

PATTERN-BASED PREDICTION

The human brain is usually in the process of spawning predictions that create a relevant immediate future. It is more proactive than passive in this process by the use of memories of past experiences and associative activation. By creating such predictions, humans simplify cognition and action by forming *a priori* sensitization of relevant representations in memory (Bar and Neta, 2008). A relatively unfamiliar situation or maybe a rank new one compels the brain to form a perfect match of the information carried by the incoming stimulus with pre-existing similar representation and attempts to predict the next stimulus (Bar 2009, Bar and Neta 2008). Bar (2009, p. 1239) suggests that cognitive scripts form the basis of human brain activity and, as a consequence, human behaviors: "Information encoded in our memory guides and sometimes dictates our future behavior. One can look at our experience as stored in memory as scripts." Cognitive scripts belong to a category of the broad classification of memory called schemata. In cognitive psychology, schemata are stored cognitive structures of knowledge about specific objects and are represented by nodes in semantic memory.

Hence, cognitive scripts play a dual role: they help organize comprehension and they also guide behavior (Senecal, Leger, Fredette & Riedl, 2012). These types of occurrences happen regularly with customers whenever they are faced with new purchase or consumption situations. In today's highly turbulent world, new-to-the-world offerings like smartphones, e-commerce, online financial transactions, driverless vehicles expose consumers to such experiences. The employment of cognitive scripts and patterns is carried out to predict outcomes in such situations. Retailers are using feed from the surveillance cameras to predict the buyer behaviors in the stores, by studying the patterns of the orientation of the shoppers' head and body and arm actions recorded over time (Liu, Gu, & Kamijo, 2017).

Persuasion: Pattern or Lack of It

A consumer will perceive a string of communication messages from a marketer as a persuasion attempt only when she finds meaning in its observable feature (or pattern of features). Moreover, that happens when an association is discovered between the persuasion tactic and any psychological activity which the consumer thinks has a mediatory effect on persuasion (Friestad & Wright, 1994). Consumers try to grasp the tactics created by representing agents through the features or their patterns. They consider marketing tactics to include messages ranging from stories, nostalgia elements, popular music tracks,

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or much-loved cartoon characters. Advertisers also keep comparing competitive brands or cautioning potential buyers about a possible scarcity of the product.

The anterior cingulate cortex (ACC) releases a distress signal in the case when an expected event does not take place in reality. Furthermore, there is no better way of catching attention than to create a moment of surprise. Advertisers deliberately bring in the element of surprise by disturbing a pattern that was expected by the receiver of the advertising message (Goldenberg and Mazursky, 2008; Woltman Elpers, Mukherjee and Hoyer, 2004). Yang and co-researchers (2011) found out through experiments that innovative advertisements allow creative consumers to diverge from their existing thought patterns.

Moreover, the sense of novelty triggers the dopamine system. The dopamine system is closely connected with the opioid system that produces the sensation of pleasure. Early humans had to keep on learning and expanding their knowledge base for sheer survival. Natural selection brought in pleasurable responses through new stimuli to enliven learning.

For instance, in 2010, Old Spice repositioned itself through a campaign that portrayed a much more modern image that used a series of advertisements filled with pattern interrupts. This now-famous campaign starred the ex-footballer, Isaiah Mustafa. The success of campaign could be gauged by the more than 16 million views on YouTube within five months of its broadcast (Mills, 2012), and by the end of the year, Old Spice was the market leader in the men's body-wash category with sales volume going up by 125% (Campaign, 2017). The neurobiological reason behind this success was that the advertisement series brought in the smoothness of the Old Spice body-wash and capped it with several deliberately placed interruptions. The viewer's brain was hit with dopamine due to those interruptions and caused delight (Van Praet, 2012).

However, one needs to take cognizance of the fact that the high PNS within humans drive consumers towards identifying false patterns. As a result, consumers tend to accept things that need not be true, for example, products of a certain firm are unbreakable, discovering patterns in marketing communications, the existence of a corporate conspiracy, increased dissemination of fake news, etc. (Davidson and Laroche, 2016).

PATTERN PROCESSING AND BRANDS

For consumers, the ability to process incoming data in the form of patterns will not be sufficient. They need to use and mold the information with the flexibility to make sense of their environments. In the case of a multi-dimensional and complex construct like a brand, the plethora of incoming information from the brand thrown at consumers at various levels, need to be processed, analyzed and archived by the consumer's brains. Such a detailed process takes less than half a second to complete. Marketers, designers and neuropsychologists need to appreciate the process undertaken by the brain to make sense of strong corporate brands like Apple, McDonald's, Tata and their visual identities. The following sequence captures how our brains see brands and branding:

Step 1: Visual Capture and Transmission

Around half About a half of the human brain is engaged in processing visual cues (Marieb and Hoehn, 2001). On receiving the visual information from a brand, the eyes transmit it along the fusiform gyrus, which is a part of the cerebrum. The fusiform gyrus plays several fundamental roles in visual processing

and pattern recognition. An important capability the brain has is to identify differences across visual stimuli and, in the process, create and segregate patterns like differentiating between the logos of IBM and Dell. It also aids in separating known patterns from totally unknown ones, when first encountered with, as the latter may trigger the insular cortex of the brain, which is the center for negative emotions. Some neurons present in fusiform gyrus are also associated with high-level pattern mapping, e.g. words, numbers and colors (Martin and Morich, 2011).

At the outset, the cerebrum and the fusiform gyrus initially try to understand if the logo or the brand element entering the brain is completely new, or there is some record of observing it before. It is common knowledge that brand equity depends largely on familiarity – brand salience (Keller, 2001). A 2013 Nielsen study confirms what brand academics always knew that around 60% buyers select a known brand when it comes to purchasing a new product instead of trying out a new brand (Nielsen, 2013). This phenomenon is expected due to the role of the insular cortex.

Step 2: Shape Recognition

In this stage, the information received by the eyes reaches the cerebral cortex, specifically the primary visual cortex. This part is also known as V1 or the striate cortex. V1 spots edges in all objects and outlines and shapes in them as well. Research has established that the shape of a product/container from a brand subtly and subconsciously affects the perception of the brand. Generally, the human brain is enticed by curves (Blake, Stapleton, Rodgers, Cheek, & Howse, 2014; Loffler, 2008), but is averse to sharp edges and tight corners, albeit the latter to stand for power. Another important aspect of branding, the typography, is related to the perception of shape. Hence, certain fonts are favored over certain others (Zaichkowsky, 2010).

Since V1 comprehends and controls the understanding of shape and other visual dimensions of the brand, part of the brain mentioned above, it is important for the brand manager and the visual designer to appreciate the issues of pattern recognition and mapping. Such an understanding will help in striking the right balance between the various elements like size, shape, typography and get the message through to the consumer.

Step 3. Visual Mapping

The secondary visual cortex, V2, is the region responsible for the interpretation of colors. Color is considered to be a visual experience of importance, in human beings (Adams and Osgood, 1973). It has been found effective in educational setting learning, marketing, communication, or even sport (c.f. Dzulkifli and Mustafar, 2013). It plays a crucial role in connecting short-term visual experiences with long term memories. V2 is also responsible for maintaining the perception of color consistency, which is the identification of a specific color irrespective of the diverse lighting conditions and situations.

On top of that, a research study by Xerox suggests an association between color and memory. It says that a brand's logo shown in color has a chance of being remembered 39% more than the same logo if shown in black and white (Xerox, 2017). This study also maintains that color, as interpreted by V2, also affects the attention and engagement of any marketing communication. The managers will benefit from this knowledge and think about adding color to product guides, brand collaterals, print advertising and even blog posts. In another marketing study, color was found to increase brand recognition by up to 80% (Morton, 2010).

This critical part of the human brain deals with brand elements, including colors. Equally important is its role in creating connections with visual stimuli and memories through pattern matching. The impact of these two functions can be understood through the attitude a consumer has towards marketing communications, and the degree of interest in engaging with the communication messages.

Step 4: Memory Matching

In this stage, the brain begins the process of matching the received visual stimuli with all possible pre-recorded patterns borne out of prior experiences. Such mappings may take the shape of experiential links such as "I know the third aisle of this store contains dental care products" or "this logo color reminds me of my first scuba diving lesson." When participants in a study were shown a collection of real and fictitious logos, the fMRI scans of their brains showed more places lit up for subjects who saw real logos than those who were given fake logos to see (Santos, Moutinho, Seixas, & Brandão, 2010). These additional areas are the ones related to memory and meaning, leading to perceptions and opinions about self-knowledge, which was unquestionably not possible with fictitious logos. Brand resonance talks about brands being attached to various parts of the consumers' lives and identities (Keller, 2001).

Over time, all experiences that a consumer has had with a brand – rewarding or worthless –accumulate together into a multi-layered profile of the brand. This profile is the foundation of the brand image in the consumer's mind. Each brand has a separate profile, which in turn activates diverse responses in the brain. One will treat different brands – Disney (enjoyment), Rolex (elegant luxury), Microsoft (utility) – differently in one's head. This fact is corroborated by a study wherein participants were exposed to various brands. The brains of those who were shown sports (Ferrari) or luxury brands (Mercedes) had emotions set off, and brain activities noted in regions very different from value brands (Skoda) (Schaefer and Rotte, 2007). In similar lines, MRI scans of children's brains showed regions responsible for appetite and pleasure getting lit up as a result of branding actions from popular quick-service restaurants viz. McDonald's, Pizza Hut and Burger King. These brands are loved by children was quite evident from the scans (Bruce et al., 2014). Another study carried out by researchers in the University of Pisa, Italy also infers that the socio-cultural and emotional effects of a brand association trigger reward centers in the human brain and "…supports the hypothesis of the strong emotional relationship between consumers' preferences and brands" (Casarotto, Ricciardi, Romani, Dalli, Pietrini, 2013, p. 269).

Strong involvement with a strong brand can impact a consumer in the predisposition associated with the brand and may lead to mimesis or make the individual even have a divergent thought process. Some subjects were shown the Apple logo in a study, whereas some others were shown the IBM logo. The former group scored 20-30% higher on a test of creativity than the latter (Fitzsimons, Chartrand, & Ftizsimons, 2008).

In this stage, one can conclude that strong, rewarding, and sustained interactions with a brand will give rise to easy and smooth pattern recognition in all future interactions and lead to positive psychological reinforcement. From the marketer's perspective, the brand needs to keep delivering experiences of the highest order to capture the mind of the consumer. Such experiences should be ensured across all possible consumer touchpoints.

Step 5: Enrichment

Once the pattern of the visual inputs is matched with the internal memory and initial association formed, the brand perception is buttressed with additional layers of semantics and semiotics. This cuts across all other familiar products, taglines, stores, store locations, images, etc. A clear idea of these supplementary associations is imperative for a marketer and can provide deep insights. The brain thus goes into a sense-making mode to assess its surroundings by studying all the additional stimuli through its pattern analysis abilities (Chater, & Loewenstein, 2016).

Barry Herstein joined PayPal as the Chief Marketing Officer (CMO) in 2007 and employed neuro-marketing research to have a sense of what the consumers identified the most with PayPal's services. The primary finding was that PayPal users accorded the greatest value to the speed of PayPal transactions. Keeping this input and insight in mind, Herstein decided to rebrand PayPal with a global campaign that was all about speed. The impact of this visual and verbal identity redesign campaign, the brainchild of Herstein's, could be felt by the spurt in the website click-through rates and response rates to the company emails. The company assessed an increase of 4-5 times in those rates (Penenberg, 2011).

In sum, the process of processing brands happens at different centers of the brain. Regions associated with memory, emotions, rewards, self-understanding, and social relationships are involved in comprehending brands (Fürst, Thron, Scheele, Marsh, & Hurlemann, 2015). The whole gamut of elements matched with the plethora of patterns and experiences go on to symbolize the brand to the consumer herself. The brand custodian (and the visual communication designer), need to have a complete comprehension of the total brand meaning, as internalized by the consumer. This sense-making is important for very precise brand positioning and more effective brand management, more so because consumers are not very good at in articulating their opinions about the brand and the brand experience (Ariely and Berns, 2010; Koll, Von Wallpach and Kreuzer, 2010). The consumer's mental understanding of the brand will remain uncaptured unless it can be unraveled by the brand manager.

The brand image in the consumer's mind also affects how the consumer sees the brand extension fit. In this situation, mindsets have an important role to play. An abstract mindset works better in accepting the brand fit. The reason behind this is how customer mindset handles contextual factors. Concrete mindsets have a greater propensity towards contextual elements and can get persuaded by psychologically closed communication messages. Such a mindset cannot form higher-order and abstract connections and tends to avoid them. Abstract mindsets can make those connections (Davidson and Laroche 2016).

It will not be an understatement if it is said that brands have several roles in the lives of modern and social humans. The way an individual human being responds to a brand, and associates with it, and experiences it defines that specific individual's social positioning. The association with a strong brand may get manifested through a change in the consumer's behavior and through triggering of emotions (Abosag, Roper and Hind, 2012; Park and McInnis, 2006). A strong brand can create an impact that is manifested through influencing the consumer's actions. The brand managers and other stakeholders need to know the extent of the brand strength and acknowledge the power that strong brands hold over consumers. The way the human consumer mind creates the image of the brand in various parts of the brain gives the whole construct of the brand image a very different connotation. Researchers are now able to visualize the formation of the brand image (Chan, Boksem, and Smidts, 2018). Irrespective of the speed of visual stimuli pattern matching and processing the brand imagery, the longevity of a brand will largely depend on how the custodians channelize the brand power.

A Case Study: This is the most appropriate setting to appreciate how the Denmark-based niche consumer electronics player, Bang & Olufsen (henceforth, B&O) had strategically used pattern thinking to remodel its marketing and branding program. Slywotzky and Morrison (2000) highlight the importance of patterns in reviving the fortunes of a firm through this case. In the late 1980s, B&O was witnessing falling profits just like its lower-priced competitors like Panasonic and Sony. It started to rework its marketing and brand communication strategy by identifying patterns in customer definition and brand elements. B&O had looked at its customer segment as an audiophile who was interested in the technicalities of B&O products and the resultant audio quality. Demographically the customer would be European. The marketing commination channel was through niche audio-related journals and magazines. B&O studied its customer pattern and redefined the target segment as 'luxury seekers, the same people who buy Rolex watches and Gucci leather goods' (p. 16). The behavioral pattern of this segment was so different that B&O changed its points of differentiation (PoD) to elegance and status.

Consequently, the communication medium also changed to elite lifestyle magazines like GQ and Esquire. The change in brand-consumer interaction patterns got reflected as premium with the remodeling of the channel as well. B&O moved out of consumer electronic dealers to Harrods (London) and other high-end outlets where the products were laid out along with LVMH or Gucci ones, thus rubbing off the luxury aura. These strategic moves took B&O to a healthier profitability position, outperforming its primary consumer electronic competitors.

RESPONSE TO PERSUASION

The consumers of today are flooded with numerous communication messages daily. Most of these messages have the object of making the receiver do, belief, practice, donate or buy something. In other words, these messages intend to persuade the receiver. Consumers are exposed to all these persuasion-laden stimuli from various sources like social interactions with different classes of people, and from the exposure to various media channels where marketers and other persuasion agents are active. This exposure gives rise to learning and sustained exposure affects the attitudes and behavior of the consumers. People know that they are persuasion targets and this knowledge alters their responses to the stimuli (Friestad and Wright, 1994). The alteration to the response behavior due to the knowledge leads to schema-based responses. We have already learned above in a previous section that schemata are cognitively scripted responses created out of pattern matching functions of the brain. Friestad and Wright (1994) suggest that consumers will devise their own coping mechanisms as a response to persuasion. And the subsequent actions taken by a consumer is based on focusing on one's response parameters, situational information, and selection of the response tactics.

MARKETERS' USE OF PATTERNS

The previous sections of this chapter have dealt with the neuropsychological factors and issues that lead to pattern recognition traits among humans.

One has also had some sense about how consumer's brains use patterns for various characteristic behaviors, for example, reacting to persuasion efforts, branding, new purchase tasks, etc. In this section, we switch sides and try to enumerate the actions marketers take based on their understanding and

knowledge of how consumers read and perceive patterns. Two major areas of application of consumer pattern thinking, as carried out by marketing people, are in retail spaces and digital media/marketing. The layouts of supermarkets, exclusive brand stores, websites, e-mail templates have been decided and shaped by the knowledge gathered by marketers through the study of consumer behavior.

For a brand to succeed in capturing invaluable real estate in the consumer mind, the basic requirement is salience, as has been discussed above. Brand salience will grow from gaining consumer attention. Attention is thus a construct of utmost importance to the marketer and has been underscored in all major models of advertising theory largely because attention will govern the quantum of cognitive effort that a consumer will put in processing stimulus (Hoyer, MacInnis, & Pieters, 2008). From a neuroscience perspective, attention is the foundation for effective visual information processing. Catching the consumer's attention and getting her to react to the marketing stimulus is imperative for any subsequent action from the side of the consumer.

Marketers thus need to comprehend the attention patterns of the consumers and focus their endeavors toward achieving better outcomes in their marketing communication programs. The understanding is more important in the online context today (Hernandez, Wang, Sheng, Kalliny, & Minor, 2017). The learnings from neuroscientific underpinnings of attention studies have influenced the way Google and Bing have laid out the organic results and sponsored advertisements on their search engines. These companies and others follow the basic logic of placing the necessary information or message near the top-left corner of the screen as opposed to the bottom-right one (also known as the 'corner of death') (Valenzuela, Raghubir & Mitakakis, 2013). Such actions have been found to improve the visibility and lead to increased click-through rates for the banner ads. Social media sites, e.g. Twitter also follows this method.

In a retail setting, the way people, items, and goods are physically ordered carry meanings to the consumers. Valenzuela and colleagues (2013) suggest that such understandings are carried across cultural and social contexts and demographic domains. The authors point towards spatially arranging of product arrays, possibilities of reaching/choosing response alternatives and choices. Consumers, with the idea of patterns governing their actions, will want retailers to arrange the product choices by employing useful parameters like price, popularity, and promotional status (Valenzuela, Raghubir & Mitakakis, 2013).

SOLUTIONS AND RECOMMENDATIONS

Based on the available research on pattern thinking, we recommend that the brands can revisit their communication philosophy and develop communication addressing the brain's pattern thinking functioning for effective communication. Secondly, and contrary to the previous point, as unique brand promotion strategy brand managers can conceptualize challenging pattern thinking. As suggested earlier in the chapter, those brands (e.g. Old Spice) had successfully interrupted the pattern thinking mechanism in consumers and established their messages strongly. The essence of such communication, however, is that the messages need to be extremely creative to catch the attention of the consumer through the clutter. Thirdly, consumers consider well-spread out stores with a lesser number of products on display as 'elite and luxury' and heavily-stocked stores as 'mass'. This is imprinted in their minds. Retailers can take help of such patterns to convey the uniqueness of their stores. Similarly, the transition zone, the area just beyond the entrance, is where a shopper gathers her bearings and decides which way to move. Retailers need to understand that pattern of brain activity (or inactivity) and utilize those spaces to their benefit.

FUTURE RESEARCH DIRECTIONS

As academics and practitioners increasingly focus on patterns, more possibilities of studying patterns and pattern matching crop up. Basic activities like commuting to work every morning right up to much more sophisticated work like diagnosing illnesses through studying medical test results, pattern matching is the key to most things going on around us. Google Maps, Google driverless cars, Google Glass, aim to ease out the morning commute whereas IBM Watson will sense patterns in medical test reports and diagnose with efficiency and accuracy without any human fatigue-related errors (Chen, Argentinis, & Weber, 2016). Thus, in any domain, the identification and comprehension of the most relevant patterns, as fast as possible, shall create the distinction between the expert and the virtuoso.

The discipline of marketing has been based on a core principle – segmentation – for decades. The variables used for segmenting consumer markets have certain shortcomings which can be reduced or removed by employing the pattern matching knowledge gained through the study of the underlying neural mechanisms. Marketers can gain new insights into newer segments through such new methods. Consumers can be clustered based on neural dimensions like framing sensitivity, strategic reasoning, or moral sentiments (Venkatraman, Clithero, Fitzsimons, & Huettel, 2012). For more pinpointed marketing actions, aimed at individual consumers, information from standard behavioral experiments may not be sufficient. Neuroscience may help in detecting distinctly individual emotional states and corresponding decision-making processes, giving the practitioners very different out-of-sample prediction ability. Such a unique information set can supplement the knowledge of how an individual consumer responds differently to priming, which will help in honing the priming or persuasion strategies to evince similar decision-making processes and thus, predictable results.

CONCLUSION

This chapter progresses along two specific tracks in sequence so that the readers can appreciate the phenomenon of pattern thinking with ease and comprehend its applications in the domain of marketing as well. The initial track deals with how the human brain creates and stores patterns, and retrieves them in different situations. The theoretical aspects of pattern thinking in respect of the functioning of the brain and its different regions have been covered. How information received by the brain through various sense organs are analyzed by the brain and converted into patterns leading to human cognition is the subject under discussion. Then this part finally talks about the activation of certain mental patterns through repetition and association. In the next part, the chapter moves into the domain of marketing, specifically consumer behavior. Using consumer neuroscience concepts, this section discusses the use of pattern thinking and recognition by the consumer's brain and how those concepts can be applied by the marketers, to their benefit. Retailers and marketers are gradually getting into the understanding of the subject of pattern recognition and using the patterns observed or collected from consumers to predict future consumer behavior and shape their marketing strategies accordingly. Marketing strategy researchers have pointed out that managers may have inherent deficiencies in spotting patterns in the behavior of customers and training managers and leaders will be an important parameter in strategic performance (Herbig and Milewicz, 1993).

The traditional methods of understanding consumer behavior need a drastic change if one is to accept the brain-behavior relation that leads to the way consumers behave in their acquisition and consumption

behavior. The application of neuroscience to understand consumers has transcended from being a fad and is here to stay. This chapter mentions several academic issues and practitioner examples of connecting patterns to culture (Blakely, 2015), ethnicity (Miyamoto, Nisbett, & Masuda, 2006), retail shopper behavior (Liu et al., 2017), reaction to advertising (Mills, 2012), and media (Davidson and Laroche, 2016).

Against this backdrop, we suggest that a better understanding of the consumer's brain, especially with respect to 'pattern thinking', will promote a better understanding of consumer needs, wants and desires. The brand-consumer relationship can take a clearer shape as brand managers start looking deeper into consumer's brains to understand the underlying patterns. Reframing the branding strategies across diverse sectors like luxury consumer electronics (Slywotzky and Morrison, 2000), automobiles (Schaefer and Rotte, 2007), fast food (Bruce et al., 2014), payment gateways (Penenberg, 2011) have been noted by both academics and practitioners. A clearer comprehension of these aspects of the consumer psyche shall make the marketers do better in addressing them. Admittedly, we have walked a long distance away from the use of traditional tools to understand human behavior but there still remains a lot to attain and achieve.

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KEY TERMS AND DEFINITIONS

Brand Elements: The various components of a brand – name, logo, color scheme, packaging, signature tune – that help a consumer in identifying and distinguishing from other brands.

Brand Salience: The extent to which the consumers are aware of a brand, which is manifested through the frequency and ease of invocation in the mind of the consumer.

Coping Mechanism: The counter-mechanism devised and implemented by receivers of persuasive communication to resist the attempts to persuasion, and thus, not getting persuaded.

New-to-the-World: Those products which have been launched to the entire world market for the very first time. Products like the fax machines, mp3 players, digital cameras, cryptocurrency are considered as new-to-the-world products.

Organic Search: The search output that happens following the user using text-based queries. The output will depend solely on the relevance of the text and does not include advertisements.

Persuasion: The process of informing and convincing a consumer to accede to the marketing idea being communicated and promoted by a marketer.

Segmentation: The process of dividing the addressable market into smaller clusters by a marketing firm for clearly targeted marketing strategies.

Chapter 8
Traditional Market Research and Neuromarketing Research:
A Comparative Overview

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ABSTRACT

Marketing research, dedicated to comprehending consumer behavior and purchasing practice, comprises methodical gathering, analysis, and interpretation of related data. Since the understanding of consumer behavior is a comprehensive and complicated task, the contemporary marketing studies argue that traditional marketing research should be supported by neuromarketing methods to explore consumers' psychology, motivation, and behavior. In this chapter, the advantages and disadvantages of traditional marketing and neuromarketing research methodologies and the differences between them are discussed. The traditional market research methods are explained through their qualitative and quantitative dimensions. The most commonly used grouping scheme of techniques in neuromarketing research is presented, namely, neurometric, biometric, and psychometric techniques. The marketing research supported by neuromarketing approaches enables us to look at the consumers' mind as closely as we have never experienced before and opens up new horizons in understanding consumer and marketing relationship.

INTRODUCTION

The marketing targets, which have been updated from increasing sales to create value for all parties, have been specialized in order to understand the consumer's mind and behavior in the early 2000s. This evolution led to the addition of a new field to the qualitative and quantitative research methods that are frequently used in marketing research, and the field of "*neuromarketing*" made a very rapid introduction to the marketing literature. The term neuromarketing defined by Marcel et al. (2009) as; "neurology and marketing union in a wide range of studies for a desire for knowledge about the human brain," was born during the beginning of the 21st century.

Although Ale Smidts (Lewis & Phil, 2004), who used the term neuromarketing for the first time in 2002, the development of neuromarketing and studies without using this term are actually much older, in the 1960s, studies, which were generally focused on consumer psychology, started to take advantage of neuroscience devices and methods. The early research work, recognized as the pioneering neuromarketing studies, were conducted with pupillary dilation and electrodermal response methods (Solnais et al., 2013). In the study by Herbert Krugman in 1964, he examined the attention on the greeting cards over pupil dilation and observed whether there was an inconsistent change in the participant's verbal scores. In 1970, Krugman (1977) and Hansen (1981) began to review the activity of the right and left hemispheres of the human brain through encephalography. Zaltman and Kossyln made a patent application to Harvard University in 1998 under the name "neuroimaging as a marketing tool", but the term "neuromarketing" has not yet entered the literature. One of the first uses of magnetoencephalography (MEG), which is also a neurological imaging method, has been realized by Ambler et al. (2000) and the decision-making processes of the participants were examined. Finally, in 2002, Ale Smidts from Rotterdam University used the term "neuromarketing" in his research. This term, which refers to the methods and devices borrowed from neuroscience, has quickly become prevalent and has had a great effect on the field after this period. One of the well-known neuromarketing studies known as the "Pepsi paradox" was conducted by Read McClure et al. (2004), and it accedes as one of the revolutionary studies in the field.

Why is the beginning of the 2000s considered as a milestone even if the origin of neuromarketing is almost as old as marketing? The answer to this question is actually quite involved. First of all, it is simply because of the term neuromarketing's tardy introduction to the field. Previously, studies conducted by using borrowed methods from areas such as experimental psychology (Oswald, 1959), neurology (Hill, 1956), aviation (Jones et al., 1949), law and forensic studies (Lykken &Tellegen, 1974) were commonly named as consumer psychology, and thereafter those kinds of studies gathered together under the title "*consumer neuroscience*." Secondly, "the initial approaches have not been able to fully meet expectations due to methodological issues such as the difficulties to evaluate the valence of consumers' reactions" (Kenning, Plassmann, & Ahlert, 2007), since, the devices used were still at a very primitive level in the relevant period. Moreover, despite today's sophisticated methodologies where it is possible to compensate for the disadvantage of one device with the advantage of another, back then the data from only one device could be processed. This was increasing the concern of reliability in the research studies. In addition, imaging methods with high spatial resolution and fast imaging algorithms such as fMRI and PET had not yet been developed and adopted. Similarly, electroencephalography (EEG) and eye-tracking devices did not have enough practical and ergonomic designs to be used in challenging studies for dynamic and simultaneous detection of the targeted consumers' behavior during their anticipated experience.

Finally, the subject of ethics in the field and the methodology of the scheme started to be examined after this period under the title of neuromarketing (Murphy et al., 2008). As Garcia et al. (2008) remark,

given its status as a young discipline, the theoretical, empirical and practical scope of neuromarketing is still being developed. Consequently, the integration of psychophysiological techniques with traditional research methods is an extremely important issue for the establishment of consistent methodologies. The conceptual framework should be defined and data collection methods should be established to serve for this purpose. It is important to note that neuromarketing is considered to be a direct quantitative measurement method at first glance; however, it remains in the intersection of both quantitative and qualitative research methods (Bercea, 2013). It is necessary to elaborate on the quantitative and qualitative marketing research methods in order to elucidate the reasons why neuromarketing benefits from both approaches. Qualitative and quantitative research methods will be examined first, then neuromarketing methods will be explained and discussed in the following research models.

QUANTITATIVE RESEARCH METHODS

The scientific revolutions that were further reinforced with Galileo, Kepler and Newton, which started with Copernicus, enabled 19th century people to gain great admiration for natural sciences. The methods used in these scientific developments started to be accepted as the only methodology valid in the search for "true" information. Comte, who has observed and evaluated this process, gained the title of pioneer for a new trend called "*positivism*." Positivism gained an important place in the philosophy of science after the enlightenment period, suggested a very strict methodology in search of unique knowledge. Positivist approach declares that knowledge of things can only be advanced by framing hypotheses, testing them by observation and experiment, and successively reshaping and fine-tuning them in the light of what the outcomes reveal (Acton, 1951). The central impetus is that the universe is simple enough to understand accurately. A phenomenon only consists of the sum of its pieces, and to understand that phenomena, the necessary action to take is to reach information about its pieces. The universe has a mechanical processing principle. Therefore, this motion, whose rules do not change, can be easily foreseen if sufficient preliminary information is obtained. Thanks to the causality principle, it is possible to predict the results of the interactions of the notions. Lastly, researchers must be absolutely objective in order to have "real" knowledge of these facts. It is not possible to name those efforts as science if a completely objective distinction cannot be made between the observer and the observed phenomena.

Marketing, which has recently survived the science or art debate, has easily adapted to the positivist philosophy of science with its validity and reliability advantages and generalizability features. It has soon been realized that quantitative research by itself was not sufficient in interpreting the interaction of the human being with his environment, although it has a high level of competence in detecting the relationships between the subjects. In the recent period, the dogmatic need for quantitative research for scientific recognition has been replaced by hybrid methods using dual approaches (Decrop, 1999). Thanks to this expansion in the paradigm, the current marketing research include phases that are not only a statistical proof of the relationships between interacting variables, but also the meaning of the interaction.

Before elaborating on the various approaches, it is necessary to review the quantitative research methods that are frequently used in marketing research for understanding the paradigm shift. From a marketing perspective, the most commonly used quantitative research methods are surveys and experiments, and these methods will be explained in terms of data collection, not data analysis, in the following sections.

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Survey

As a descriptive quantitative method, the survey is the most commonly used data collection method in marketing studies (Hair et al., 2008). The survey method is conducted to understand the consumers' perception and decision-making variables in purchasing, and the survey can be carried out via face-to-face, telephone or online communication channels containing pre-defined questions and expressions to measure the dimensions of the targeted variable. Followed by the data collection stage, the researcher transforms the answers given to the verbal statements in the questionnaire into codes and digits to carry out statistical analysis. During the analysis, priorities for successful survey applications are defined with a sample capable of representing the universe by avoiding measurement and scope errors. Survey method is frequently used in marketing research for identification consumer profiles (Savelli et al., 2019), for measurement of attitudes (Higueras-Castillo et al., 2019), for new product development (Najafi-Tavani et. al, 2016) and for many other marketing practices (Hulland et al., 2018).

Experiment

In experimental designs, participants are randomly subject to different conditions, depending upon the experienced condition, and participants can express different levels of the independent variable. The dependent variable measurement of the participants' response to certain manipulations (experimental condition) or no manipulation (control condition) levels is acquired. By comparing the dependent variable measurements between the conditions, it is possible to conclude whether the independent variable is the cause of the dependent variable or not (Shadish et al., 2002).

The supremacy of the experimental approach is stemming from its contribution to causality in natural sciences, on the other hand, this may not always be valid for social sciences since the subjects of the conducted research are human beings in social sciences. Therefore, an experimental method for social sciences is not always as applicable, controllable, reproducible and generalizable as in natural sciences.

QUALITATIVE RESEARCH METHODS

Social sciences offer a holistic approach while analyzing humans and nature by considering human nature and society from a wide perspective which embraces cultural, economic, political, physical and social aspects. It is not only limited to its holistic perspective but also readapts itself to changes that may occur over time; in turn, information can be appraised according to its context, presenting difficulty to generalize in social sciences. Marketing research, whose subject is "human", however, requires to examine the human behavior both in context and in-depth and to interpret the human behavior based on the scientific data. The gap caused by the purely positivist approach in revealing the relativity in human emotions and thoughts necessitates the social sciences to consider qualitative research methods as well. Social sciences are continually changing and improving in history by changing the questions they ask, the methods and contents they use. Such changes are also dictated by external interventions. Therefore, human sciences should be reflective rather than being objectivistic; at the same time, they must constantly restructure themselves in order to maintain their validity according to changing social realities. This course guarantees that social sciences always maintain their dynamism within the ever-changing social structure.

After the post-positivism period in social sciences, an important need has arisen for alternative research methods in line with the priorities specified above. Qualitative methods are therefore defined by Goulding (1999) as one of the post-positivist approaches that are key to understand the social, complex and mostly irrational nature of consumer behavior.

The first of the common anti-positivist qualifications of post-positivism and hermeneutics paradigm is that they preaccept the "reality is complex." All facts change, and this diversity and interaction make it impossible to reach a single reality and an inimitable true knowledge. The universe is holographic and a phenomenon is much more than the sum of its constituent parts. Therefore, the inclusive perception cannot be resolved and recombined like a mechanical phenomenon; consecutively, the outcome is nondeterministic and works with probabilities. The future can only be predicted with some premise, as facts and interactions of phenomena are constantly changing, so that there is no chance to know the future. The exact results cannot be achieved. As one of the most important differences that distinguish qualitative methods from quantitative research methods in this paradigm, and it also states that relations between occurrences are not linear. In other words, it may not be possible to say that only occurrence A has a positive effect on occurrence B. Perhaps the interaction between occurrences A and B causes this conversion. Finally, as an important difference, the paradigm states that change can also be caused by chaos. This emphasizes that unlike the quantitative approach, there is a general uncertainty in nature. In addition, a researcher can have an opinion in qualitative research and it is not possible to isolate the researcher from the observed object. Then, absolute objectivity is not possible; we can only acknowledge the different points of view. The most commonly used qualitative research methods are interviews, focus groups, observations and document analysis, and these methods will be explained in terms of data collection, not data analysis, in the following sections (Creswell, 2013).

Interview

The interview technique has been the primary method used in qualitative research (Schultze & Avital, 2011), and it is "the most direct interaction between researcher and participant" (Kazmer & Xie, 2008). Qualitative interviews are developed to analyze all the intended details about the participant's life. At the end of the research, it would be possible to look at a case from the perspective of the participant. Participants can reveal their perspectives and experience to researchers through this method. Seitz (2016) also remarked that face-to-face interviews give researchers the chance to read important nonverbal cues about the participants' pattern of behavior.

This approach is becoming more and more ample and effective especially on studies such as consumer opinions about brands (Camiciottoli, Ranfagni, & Guercini, 2014), consumer behavior (Arsel & Thompson, 2011), the effectiveness of advertisements and social marketing campaigns (Salazar et al., 2018). These exemplary studies from the literature confirm that interview is an ideal method, especially when it is aimed to collect in-depth data and consumers' conscious perspective is indispensable.

Focus Group

Thomas (1995) defines focus group study as "a technique involving the use of in-depth group interviews in which participants are selected because they are purposive, although not necessarily representative and they are sampling of a specific population in conjunction with a group being *focused* on a given topic." The focus group technique, in principle, is a type of interview. The factor that distinguishes the

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focus group from the interview is threefold: 1) In focus group meetings, homogenous groups with a certain common feature are formed by bringing people together with similar sociocharacteristics. 2) The group is provided with an opinion on a topic defined by the researcher. Hence, participants feel more comfortable talking to the researcher or with each other and more objective data may be collected with the exclusion of social impact as much as possible. 3) Another difference in focus group study from the interview is the possibility of monitoring intra-group interactions and the synergy created. Thus, how the thoughts are dynamically shaped can be monitored by the researcher.

The use of focus group techniques in marketing is one of the oldest qualitative approaches (Coxal, 1976). Many marketing researchers and practitioners use focus groups as a pilot study before presenting their work to a larger audience. Generally, measuring the response of a small targeted group on a particular subject allows the researchers to have a decisive opinion about the acceptability risk of a new factor prior to its introduction to consumers in the market (Chung et al., 2016). Focus group studies consist of a moderator and usually 6-10 participants. The method provides inclusive experiential data since individuals can express themselves freely in such a homogenous group. If conducted properly, consumer focus groups can capture quite significant feedback from participants on a given research topic in a short time.

Observation

The interview is an ideal method of collecting in-depth information on a subject; however, participants' self-reports may not always explain their true behavior in interviews (Mays & Pope, 1995). In order to be accepted by the group, they are in, or to look like well-adjusted to social norms, interviewees' reports may differ with their real-life experience. Observation is considered as another ideal in-depth data collection approach at this point, because, it gives the researchers a chance to collect data directly without researchers' intervention in participants' genuine behavior during data collection. Another advantage of the observation method is that it can be conducted in any field that the researcher deems appropriate. However, it should be noted that observation is a long-term study and a costly approach that requires significant expertise and resource (Robson, 2002).

Since observation is a unique method of collecting factual information about consumer behavior and behavior change in the real world, both structured and unstructured observation methods are frequently used in marketing studies (Arsel & Bean, 2013).

Document Analysis

Document analysis, in which both quantitative and qualitative methods can be used during the collection and analysis of data for the research question, is considered as another in-depth analysis techniques (Witkowski & Jones, 2006), and it is an indispensable tool for the studies require secondary data. Document analysis means the compilation of historical data to understand and interpret the development of a subject, and it consists of content and discourse analysis methods (Pan, MacLaurin & Crotts, 2007). In marketing research, document analysis study is frequently carried out to acquire data about consumers' former experience and consumer habits in order to guide future marketing strategies.

When the relevant literature is examined, it is seen that qualitative research is frequently applied for the purpose of evaluating the effectiveness of marketing practices and finding the most inspiring message for the targeted consumer ensemble. So, for the topics like social marketing (Apollonio & Glantz, 2019),

consumer behavior (Paul, Rahman & Verma, 2019) and marketing communication (Dash & Kumar, 2016) qualitative data collection and analysis have been used both alone and frequently in combination with quantitative research methods.

MIXED RESEARCH METHODS

Qualitative and quantitative methods have their own advantages and disadvantages, as seen in Table 1. In terms of data comprehensiveness, quantitative research methods can be wide-ranging and robust, as for the qualitative research methods, they do not have the depth and diversity of the data obtained.

Table 1. Comparison of Qualitative and Quantitative Research Methods

QUALITATIVE RESEARCH METHODS	
Advantages	**Disadvantages**
● contain detailed viewpoints of a few participants ● reveal the views of participants ● allow to analyzing participants' experience ● based on the views of participants, not the researcher ● express people's life stories	● provide a generalization to a limited population ● do not provide numerical data ● the sample is very limited ● quite subjective ● research is based on the participants' experience and the researcher's experience on the subject is limited
QUANTITATIVE RESEARCH METHODS	
Advantages	**Disadvantages**
● reach the result over widespread sample sizes ● analyze the data efficiently ● investigate the relationships between data ● examine cause and effect relationships ● control the bias ● address people's numerical preferences	● do not provide an in-depth understanding of human behavior ● do not record the opinions of the participants ● offer very limited information about the participants' states and relationships ● mostly researcher oriented
Source: *Creswell, 2017*	

Another difference between the methods is the data analysis procedures. In quantitative research, the analysis is carried out after the data collection ends. In qualitative research, on the other hand, the researcher starts analyzing the data during acquisition. These structural differences indicate that both methods have different strengths, and they can be adapted to fit the research question.

In search of new methodologies, researchers have begun to adopt mixed methods to take the advantages of both approaches. Cresswell (2017) defines mixed methods as "the method that a researcher integrates two sets of data which he collects both quantitative data and qualitative data and then draws out the advantages of integrating these two sets of data to understand the research problems".

The mixed-use of quantitative and qualitative methods is called "triangulation." Triangulation simply means "looking at the same phenomenon, or research question, from more than one source of data" (Decrop, 1999). Denzin (1978), on the other hand, defined triangulation as a "combination of methods used in the investigation of the same phenomenon/event." Another definition by Creswell & Miller (2000), who has a pioneering role in the mixed method literature, states, "triangulation is a validity procedure in which researchers seek compatibility in multiple and different sources of information to create a

substance or category in a study." Finally, Patton (2002) reports that the purpose of triangulation is not to achieve the same result by using different research methods; however, to test the consistency of the results and to eliminate methodological biases.

If we evaluate mixed methods in terms of marketing, initially, we have to acknowledge that marketing research encounters incompetent diversity in methods and mostly failure to adopt additional methods to track human behavior as a dynamic, complex phenomenon. Traditionally, marketing research methods have mostly relied on quantitative research methods, such as surveys or secondary data. But as Tellis et al. (1999) state, "no single method of research fully captures any particular phenomenon." Different methods present different insights to the researchers, but that does not indicate the superiority of one method over the other one. Planning and usage of mixed methods involve philosophical treatments that guide the collection and analysis of data and the sufficient mixture of qualitative and quantitative data in a single study or series of studies.

As a result, it is not conceivable to assume that there is an ultimate method or approach for any marketing research activity. Diversified research designs using qualitative and quantitative analyzes have been developed and adopted rapidly in the field (Davis et al., 2011). Since the necessary control procedures for validity and reliability of both approaches have been identified and approved, their organized implementation to examine a complex phenomenon does not cause a systematic error. In fact, such an approach has important advantages for researchers, including; providing powerful results and important exploratory information for scientific frontiers, balancing methodological disadvantages, developing a holistic approach to the research subject. Obviously, such an approach also has its own disadvantages, including; requirement for greater resources on issues such as time, budget and human resources from multidisciplinary fields.

Besides all the mentioned challenges, marketing is a rapidly evolving branch of science. Research topics are highly dynamic and diverse. That is why it can be beneficial for marketing researchers to adopt this methodological integration of approaches, which can increase the power of research. Through a holistic perspective, marketers may search for answers about not only "why" but also the "how" questions at the same time.

NEUROMARKETING RESEARCH METHODS

In the studies aiming to discover the relationship between living organisms' mental and physical processes, psychophysiological measures are used by applying physical manipulations and detecting corresponding physiological responses. Since psychophysiological techniques measure autonomous responses, the data obtained are considered to be more reliable and relatively objective compared to the data obtained from conscious responses triggered by emotional stimulation. Techniques used in neuromarketing research vary, and they are classified according to the data specifications like collecting area, transmission, and processing types. The most commonly used measurement type grouping system in the literature is "neurometric, biometric, and psychometric measurements" (Stipp, 2015) that are detailed below.

Neurometric Measurements

Neurometric measurements are based on the measurement of neural activities in order to detect cognitive processing of the brain. Electroencephalography, Steady State Topography, functional Magnetic

Resonance Imaging, Positron-Emission Tomography and Magnetoencephalography are the most widely used neurometric measurement techniques to acquire physiological activity of the brain due to central nervous system activity. Among those techniques, EEG is the commonly preferred technique by researchers because of its superior advantages such as low cost, high resolution and ease of use (Zaltman, 1997).

Electroencephalography (EEG)

EEG is the measurement of changes in weak electrical potential on the surface of the scalp, which is initiated and synchronized by the potential change in the cerebral cortex region of the brain. These electric signals arise from instantaneous changes in electrical rhythms during the cognitive processes in the brain, and they are studied by distinguishing particular types and sizes of oscillations specifically named delta, theta, alpha, beta, and gamma waves. EEG allows simultaneous measurement of micro electricity levels produced by mental activity and identification of the brain region responsible for the signal generation. EEG helps in the emotion recognition procedure by detecting the specific wave types (Shirke et al., 2020).

The amplitude of a typical EEG signal is 1-100 µV and the frequency band is between 0.5-100 Hz. Periodic and non-regular signals are examined and modified by using various filtering and normalizing protocols. The delta band is in the range of 0.5–4 Hz. It is apparent during deep meditation and deep sleep. The theta band is in the range of 4–7.5 Hz. It is associated with suppressed consciousness states such as meditation and dreaming. The alpha band is in the range of 8–13 Hz and associated with relaxation, so it decreases when a stimulus occurs. The beta band is in the range of 14–26 Hz. It indicates cognitive activation, concentration, and focus. The gamma-band contains fast oscillations (frequencies above 30 Hz), and found during memory processes and conscious perception. EEG data, in terms of amplitude, phase, and frequency, are susceptible to the number and position of the electrodes as standardized and recommended by American Electroencephalographic Society (1991).

Functional Magnetic Resonance Imaging (fMRI)

The hemoglobin in the red blood cells is responsible for carrying oxygen to the body's needs. In the simplest terms, fMRI uses the principle of monitoring the relative consumption of oxygenated blood in the tissue of interest. When a brain region is activated in response to any stimulus, oxygen consumption and, consequently, blood flow in that region increases. The level of oxygen consumption is also related to the level of activation, which can be monitored by fMRI (Van de Ville et al., 2004).

Due to its detailed and specific metabolic activity detection capability, fMRI is one of the most promising measurement methods for neuromarketing research. However, its high cost and restricted access hamper fMRI usage in neuromarketing studies. Last but not least, fMRI system may cause claustrophobia in some participants, and additional device integration to the system for conducting versatile experiments is challenging due to high magnetic field presence (Fisher et al., 2010).

Positron Emission Tomography (PET)

PET is a nuclear medicine imaging technique that detects gamma rays emitted by tracer compounds, which are positron-emitting radioactive pharmaceuticals introduced to the body. PET is capable of providing information about the metabolic activity. The collected data is converted into cross-sectional

images. Different tracer compounds are used for different imaging purposes. The most commonly targeted metabolic process is the metabolic rate in the tissue of interest. The brain, for example, consumes energy while performing cognitive functions and this energy is produced by glucose uptake. PET technique facilitates the detection of brain regions with relatively high glucose consumption (Haier et al., 1992).

PET is usually used to study sensorial perception and emotion recognition analysis in neuromarketing research. However, despite its metabolic and functional imaging excellence, PET method is rarely used due to its invasive nature, and it is in the category of interventional research methods (Lindstrom, 2008).

Magnetoencephalography (MEG)

The MEG technique, which emerged in the 1960s, detects the magnetic field created by neural activities and enables the realization of the activation region in real-time. MEG is used in perception, attention and memory dominated neuromarketing studies. However, as Renvoise and Morin (2007) noted, it is not sufficient to monitor the subcortical area of the brain where emotional processing takes place, it is often used in conjunction with an EEG device to benefit from spatial and temporal imaging superiority in neuromarketing research.

Biometric Measurements

Biometric measurement methods examine the cognitive processes without recording brain activities. The most commonly used biometric measurements in neuromarketing studies are eye-tracking, galvanic skin response, facial coding, EMG, heart rate and voice pitch (Utkutuğ & Alkibay, 2013).

Eye-Tracking

An eye-tracking system consists of hardware that monitors point of gaze, change in pupil size and saccades during eye movement using an infrared/near-infrared radiation source and detector. Integrated software interprets the grouped data. The resolution of the system is defined by the sampling frequency of the hardware. More than ten variables about eye movements can be measured with an eye-tracking device (Holmqvist et al., 2011). But five of them, fixation, blink, pupil size, saccade and scan path, are widely used in neuromarketing studies. Fixation is the state of where the eye focuses at a point momentarily. The number of fixations and the duration of each fixation is recorded. The fixation time can be used as the duration of a single focus or as the total duration of the different focuses within the field of view. The reason why a person is more focused on a particular location may mean that a psychological feature at that location is very noticeable or that feature is not understood properly. This assessment should be based on the context in combination with other data.

Another eye movement is blink. Studies have linked the increase in the frequency of blinking behavior to withdrawal and avoidance behavior (Peth et al., 2013). In addition to the ocular movements that visual animals display while looking at a stimulus, structural changes also occur in the eye. One of these is the change in the size of the pupil, which optimizes the light to the eye to improve vision. Pupil dilation can be caused by changes in brightness, emotional response and task difficulty. It can also be used to predict the stimuli that grab the participants' automatic attention like contrast, density, brightness, movement. The saccade data refers to the rapid transition of the eye from one focal point to another. It is possible to determine the order of focuses. A long saccade may indicate that attention has shifted from one area

to another. Generally, when there is a transition from one focal point to another with short-distance jumps, there is continuity of attention in a particular area. The combination of fixation and saccade data determines the scan path. By the superposition of the data, heat maps are created and how intensively the participants look at the stimuli are revealed through these maps.

As seen, eye movements give important clues about the cognitive processes of an individual's experience. In addition to this rich variety of data, eye-tracking devices provide advantages for neuromarketing research in terms of ease of transportation/usage and no contact with the participant.

Galvanic Skin Response (GSR)

GSR is carried out by measuring the conductance of the skin as a result of electric current carried on the skin surface. The basic principle is that the sweat glands' activation level of a person during a change in emotion will fluctuate, and this physiological stimulation will lead to electrodermal activity change. Briefly, change in emotion due to stimuli causes a reaction of the sympathetic nervous system, in turn, we can measure the negative or positive effect of a stimulus by measuring the changes in the electrical conductivity on the skin surface. This method is relatively low cost compared to other neuromarketing techniques, and it is sometimes used alone or can be integrated with other neuromarketing methods to measure the level of arousal on the basis of an effect (Ohme, Matukin & Pacula-Lesniak, 2011).

Facial Coding

The facial coding analysis is a method developed by Anatomist Carl-Herman Hjortsjö that measures micro-expressions to encode unconscious reactions based on the activity of facial muscles with the help of a video camera and image processing software. Although facial expressions are influenced by physical appearance and cultural elements, they have certain invariant characteristics that can be considered as a common indicator for every mood. In addition, the facial coding method allows for real-time measurement. Even though it can be possible to make successful analyzes up to a certain degree, the method is criticized for being very subjective and it is mainly used as a complementary technique to other methods (Bercea, 2013).

Electromyography (EMG)

Electromyography works by placing two electrodes on the face and measuring the signals generated by stimuli. Based on the Facial Action Coding System (FACS), which was developed by Ekman and Friesen in 1978 and coded the movements of the observable facial muscles, EMG measures effect by detecting the muscle movement that are activated by the stimulus.

According to Fridlund and Cacioppo (1986), the intensity and the valence of the reactions can be measured very successfully with this technique. Facial muscle activity analysis can go beyond the measurement of effect on the positive and negative axis and provide information about more complex emotions such as social communication, mood, and emotional expressions. It is also seen as a preferable method in neuromarketing applications with its low cost and ease of use advantages.

Voice Pitch Analysis

Voice pitch is an analysis that measures the subject's affective responses to a given stimulus by examining sound waves. Backhaus, Meyer and Stockert (1985) found a positive relationship between the voice pitch and the level of arousal. The method's main advantage is the absence of direct contact with the subject; however, the reference data obtained through voice pitch analysis is very limited. Nevertheless, voice pitch analysis still takes the attention of neuromarketing researchers.

Heart Rate Analysis

Heart rate analysis is carried out by an electrocardiogram (ECG) that measures the electrical signal associated with the muscle activity of the heart. It commonly works on the principle of determining the degree of response to a stimulus by looking at the rate of increase/decrease of the total heartbeat per minute. According to Thorson and Lang (1992), the increase in heart rate is associated with excitement and interest, and the decrease is associated with focus and relaxation. In this method, it is seen that the determination of effect is on the "positive-negative" and "arousal-withdrawal" axes.

Psychometric Measurements

According to Stipp (2015), in psychometric measurements, response time and behaviors in implicit association tests are determined simultaneously. Implicit Association Test (IAT) is one of the most commonly used tests to measure unconscious automatic cognitive associations (Nosek, Greenwald and Banaji, 2007). Association tests make it possible to evaluate many implicit biases. People are often unaware of the implicit biases that are automatically activated when an environmental sign is present. It is important to make people aware of their implicit biases and to prepare the ground for attitude change. It is well-known that neuropsychological tests, especially used in memory research, are important psychometric sources in terms of the information they provide.

COMPARISON OF CONVENTIONAL AND NEUROMARKETING RESEARCH

Neuromarketing studies and conventional marketing research essentially focus on the same goal; understanding consumers' behavior. Although the point of departure is the same for both approaches, significant differences are observed in the research courses. These differences arise from the difference between the research methodologies used, and they are usually fed from various disciplines with very rich scientific background. The differences between the research approaches are summarized in Table 2. The most important and distinct hallmark characteristics of the approaches is that conventional marketing research results are based directly on the person's statement, whereas neuromarketing research usually uses these self-reports to confirm their neurometric, biometric and psychometric measurement results.

While conventional research studies recognized that an individual made a decision after conducting a cognitive process, in neuromarketing studies Mormann et al. (2011) claimed that "*consumers can identify two different food brands and make up their mind about which one they prefer in as fast as 313 ms.*" This disagreement caused more curiosity about the decision-making process, and the number of studies designed to compare the two approaches have significantly increased. Interestingly, in some

research results, there were differences between the participants' self-reports and the data obtained as a result of the neuromarketing study (Sadedil, 2016). These examples, of course, do not imply that the neuromarketing approach always provides conflicting and more accurate results. Rather, as emphasized throughout the chapter, all research methods have their own strengths and weaknesses. The important thing is to combine the most appropriate approaches to the research subject and turn the disadvantages into an advantage for more reliable outcomes.

Table 2. Comparison of Conventional Marketing and Neuromarketing Researches

CONVENTIONAL MARKETING RESEARCH	NEUROMARKETING RESEARCH
● the analysis is often made for a product that is already on the market	● the analysis is made before the product put on the market
● depends on the self-report of the consumer	● doesn't depend on the consumer' statement
● mostly controlled human reactions	● mostly uncontrolled human reactions
● the participant has time to think to answer the research questions asked	● as soon as the participant faces the research question, his psychophysiological responses are started to be collected simultaneously
● the participant is expected to describe his cognitive processes (such as the items that draw attention, the aspects that he likes or dislikes)	● the participant's self-report about his cognitive processes is used to compare the accuracy of the data
● data obtained is expected to be generalized to the market segment in which the participant is included	● pre-accepts people's decision-making processes can differ in sub-groups, and the market segmentation approach is similar
● can be realized by qualitative, quantitative or mixed methods	● can be realized by quantitative or mixed methods
● has a moderate relationship with other disciplines other than marketing	● has a close relationship with other disciplines other than marketing
● acknowledges that consumers make their purchase decision after a certain rational process	● acknowledges that consumers make up their minds about their preferences before they decide.
● conscious processes shape the buying behavior	● mostly unconscious processes shape the buying behavior
● data analysis in marketing research is usually made after the data collection	● data analysis in neuromarketing research usually includes preprocessing, statistical analysis, data interpretation (behavioral analysis and neuroimaging data analysis) and triangulation
● in qualitative research, the researcher may interact with the participants	● similar to quantitative research, the researcher is an objective observer

Other main factors in deciding the appropriate research approach that are as important as the subject to be studied are time and budget constraints. Since the methods of the qualitative approach are mostly dependent on the effort of the researcher, they have lower costs compared to other approaches. In addition, it typically take a long time to complete the studies carried out by qualitative approach. An observational study, for example, may take even years to be completed (Ecker et al, 1997).

Similarly, interview and focus group approaches provide multi-dimensional data which include participants' mimic and gestures, body movements, and even the selected words in addition to the main research questions. So, it requires a relatively longer processing time for both analysis and test of the hypothesis. In quantitative approaches such as experiments and surveys, the process is more dependent on the research model compared to qualitative methods. Frequently, data compatible with the predicted

data are collected and included in the analysis, and required time for the analysis process is shorter than the qualitative approach.

SOLUTIONS AND RECOMMENDATIONS

Traditional marketing research methods, which are frequently used to understand and measure attitudes, are surveys, interviews, focus group meeting and observation. Collecting and systematically interpreting the data by using traditional methods lead to getting clues about behavioral primers. However, researchers often face serious hurdles in setting up a relationship between the results they reached and the real-life experience. This inconsistency may be due to the risk of participants forming their self-report by predicting the researcher's expectation. If the participant knows or predicts the purpose of the research, this can trigger some undesired cognitive mechanisms, which in turn affect the real-life experience result.

Neuromarketing promises a more direct knowledge of the human brain, referred to the black box, and enables to explore the implicit reasons underlying the consumer behavior with relatively untainted data. The underlying premise of neuromarketing is based on: The gap between traditional marketing research results and the real-life response patterns is mainly caused by the use of classical methods such as questionnaires and interviews, which are incapable of reflecting the participants' genuine state of mind created in the unconscious level. Hence, these kinds of research cannot represent the true interaction between emotion and behavior properly (Wiles, Cornwell, 1990). The fact that the techniques used in neuromarketing studies can measure autonomous responses, the method is considered as the key to reaching the participants' answers without a cognitive process (Lee, Broderick and Chamberlain, 2007).

Neuromarketing studies are also promising because of their ability to allow researchers to closely observe demographic and genetic factors at the individual level, the discrepancies within the learning processes, and the differences resulting from intelligence levels and cultural background. These advantages have the potential to make more accurate generalizations, at least in the selected sample.

According to many researchers in the field of marketing, neuromarketing can provide outstanding data about issues such as brand trust, pricing strategies and advertising effects (Lee, Chamberlain, Brandes, 2018). At this stage, the major deficiency of traditional research methods is the constraints on the measurement of attitudes and emotions. While neuromarketing methods can easily detect affection in cognitive processes, traditional research methods substantially rely on the information acquired from the participant's own statements. It is essential to monitor the participant's true emotional state in order to design and create more satisfactory and more easily learned products and services and marketing messages that could be stored in long-term memory and could create loyalty for the product or service.

A significant disadvantage of neuromarketing research as regards to traditional market research is the linear correlation between the degree of accuracy and the cost of equipment. Additionally and more importantly, the results obtained by some neuromarketing tools are still interpreted by some researchers as "speculative." This judgment is frequently made about EEG studies due to the complex structure of the brain and cognitive processes that are not fully enlightened yet. Another contention for the equipment dependent data is its corruption due to the measurement methods which can be easily affected by external factors. As typically seen in social sciences, when the chosen stimuli are unintentionally diverse and not properly consistent with the measurement methods of the devices, the quality of the data could be compromised. Device-based calibration methods and customized measurement conditions also could create a challenge for neuromarketing studies.

A human being constantly conducts complex cognitive processes, and these processes can be quite affected by external factors. Thus, just as in real life, consumer behavior can differ in terms of the environment and needs involved, can vary widely from person to person, and can even be completely different under the same circumstances. This issue remains complex and unresolved for all human-oriented sciences and measurement methods since thinking/decision-making processes are complicated and could easily be affected at the individual level. However, neuromarketing can draw much more generalizable results than other research methods on basic biological similarities, undermining the assumption that human behavior cannot be measured and predicted under any circumstances.

Finally, the majority of neuromarketing methods can only present pure participant data. Interpretation of these data and the reason why such reactions have occurred are still questioned by marketing researchers. The past experiences, learning aims, attitudes and beliefs of consumers can also make this interpretation process more difficult.

To sum up, the methods of neuromarketing enables us to look at the consumer's mind as closely as we have never experienced before and opens up new horizons in the field of marketing with the dynamism it brings along. However, measurement of pure neurological and biometric responses lacks a thorough understanding of consumer behavior, whereas, they make it possible to achieve more verifiable results when used with traditional methods of social sciences such as questionnaires, interviews, and focus group meetings. Therefore, the proposed issue is not a paradigm shift, but a diversification/support of research methods.

FUTURE RESEARCH DIRECTIONS

Although the research methods used in marketing have mainly belonged to neuroscience for a long time, the concept of "neuromarketing" is still quite novel. In parallel, the research literature is systematically developing without any restrain, and every contribution to the field is extremely crucial for the improvement of marketing studies as expected. However, it is a must to admit that there is a long way to go before the fully development of a scientific basis. First of all, the working principles of the human brain are still largely ambiguous. In addition, although brain mapping practices are continuously developing, there are still brain regions that we do not have eminent knowledge about their functions. As a result, there are still quite extreme challenges to be overcome in understanding the human mind for everyone in the field, especially for neuroscience researchers.

The process will not end with the understanding of psychophysiological systems. Social impacts, individual differences, current attitudes, rapidly changing trends, and every environmental and individual element shaping human behavior should be among the research topics. This brings sociologists, economists, anthropologists, psychologists, briefly everyone working with humans to focus.

Those listed up to this section describe the developments that are expected to take place in a wide range from medicine to engineering as well as marketing. Specifically, for the marketing researchers, one of the primary needs in neuromarketing is the embraced and well-recognized methodology. It is essential to study the points where neuromarketing intersects with current research methods, as well as to layout the systematic for neuromarketing research in order to guide future researchers. Diversity, due to the interdisciplinary nature of neuromarketing research, makes the field stimulating and exciting as well as challenging. With the methods used in neuromarketing research, collected data often exceeds the limits of the research question. The interpretation of this range variety of the data and providing a

scientific framework with mixed-method methodology is important in terms of acceptance and reliability of neuromarketing research.

Finally, another area that is still in need to develop is the ethical outline for neuromarketing. In the last decade, studies on this subject have accelerated and a certain framework has been presented to the researchers. However, the establishment of a standard ethical outline and its worldwide acceptance is important for the sustainability of research in the field.

CONCLUSION

The methods used in marketing research are diverse as quantitative and qualitative methods according to the characteristics of the data collection scheme. Considering the historical development of marketing, it is self-evident that the marketing research literature dominated by quantitative methods with the effect of positivism. Eventually, the related community has accepted the implementation of qualitative research techniques to the studies. To maximize the reliability and accountability of the experimental outcomes, optimally mixed experimental methods started to being used. This effort requires a multi-disciplinary contribution to experimental setups and analysis of data the collected. The effects of this multidisciplinary approach can easily be seen in neuromarketing studies, which is one of the most popular and promising areas of physcophiysological studies nowadays. Although neuromarketing practices were perceived as a paradigm shift in marketing research, the truth is that complementary neuromarketing techniques enlarge and diversify the data. Among the methods used in marketing research so far, it is claimed that neuromarketing is one of the closest approaches to the consumer's mind, and neuromarketing research methods do not reject traditional research methods, they enrich, diversify, complement and reinforce each other in the contemporary causality assessment systematics in marketing. Therefore, neuromarketing draws the attention of researchers from many different fields as a newly developing and multidisciplinary area. We hope that with the implementation of new neuroscientific research approaches, the contribution of neuromarketing to marketing studies will become indispensable and incomparable in understanding consumer behavior.

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KEY TERMS AND DEFINITIONS

Calibration: A series of processes that establish the relationship between the values indicated by a measuring instrument or measuring system under specified conditions or expressed by a scale and the reference values of that system and the device.

Control Condition: A condition that does not involve exposure to the treatment or intervention under study.

Event-Related Potentials: An event-related potential is the measured brain response, which is the direct result of a particular sensory, cognitive, or motor event.

Neuromarketing: The use of methods and practices in neuroscience and marketing disciplines in the field of marketing with an interdisciplinary approach.

Neuroscience: A branch of science that operates in the fields of anatomy, physiology, biochemistry, or molecular biology of the nervous system, specifically examining the relationship of the nervous system to behavior and learning.

Psychophysiology: The branch that examines psychological processes with their physiological bases.

Triangulation: The application and combination of various research methods in the research of the same phenomenon in social sciences.

Chapter 9
Neuromarketing Insights for Start-Up Companies

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ABSTRACT

As the academic interest about start-ups grows, researchers explore reasons behind start-up failures or success stories, and they aim to develop guides for entrepreneurs to succeed. Literature suggests that marketing is one of the crucial fields for successful start-up companies, among many others. Meanwhile, marketing researchers have recently been paying growing attention to applying neuroscience techniques into the marketing field. Even with the rising popularity of neuromarketing research, start-up companies still fall short of using new era marketing tools due to high costs, although they compete with established firms that massively employ neuromarketing techniques in their marketing mix. In this chapter, it is discussed how helpful neuromarketing techniques could be for entrepreneurs as the success of start-up companies depend on efficient allocation of their severely scarce economic resources, and it is argued that publicly supported start-up hubs, in coordination with universities, shall help develop collective neuromarketing researches for the sake of cost cutting.

INTRODUCTION

Start-up companies have been among the most popular research fields for organizational science researchers as they promise fast economic growth and development opportunities to promote the general welfare. Particularly in emerging economies, start-up companies are seen as an important source for economic growth as well as for boosting sustainable employment growth. Therefore, the reasons behind start-up failures and success stories have been searched in every nook and cranny from different perspectives. Meanwhile, the rise of interdisciplinary research, particularly bringing neuroscientists together with economists and organizational scientists, has gained popularity across the last decade, particularly after the growing popularity of neuroeconomics research (Meckl-Sloan, 2015). In parallel to the fast development of neuroscience tools, application fields have grown at a similar pace. Cognitive neuroscience has involved in consumer research as well as in researches on financial and organizational behavior and also

in marketing research (Massaro, 2017). Neuroeconomics suggests that the consumers' decision-making process takes place in the unconscious mind (Braeutigam, 2005). Therefore, consumer neuroscience techniques have been widely used to understand consumer behavior.

Organizational sciences researchers as well as professional managers have rushed to use these newly emerged neuroscience tools (Cakar. & Gez, 2017). As a result, the concept of neuromanagement has emerged, and it is in a fast popularization process (Drover et al., 2017). Neuromanagement approach from a professional perspective uses new tools created by neurosciences in economic and managerial decision-making processes, while organizational sciences researches use a newly popularized approach to shed light on many unknown areas of the field (Tkachenko et al., 2019). Neuromarketing is the most popular and the fastest growing subfield of the Social Neuroscience approach as the application of neuroscience techniques in marketing research and marketing campaigns have shed light on many unknown points in consumer decision-making processes and they have produced dramatically much more valuable information (Satpathy, 2012).

The traditional approach in marketing research has sought to identify distinctive features of the consumer decision-making process as well as the impacts of external factors such as environment and culture on consumer behavior. However, consumer cognition or decision-making processes have long been seen as an unknown process in the human brain. Organizational sciences researchers have been partnering with neuroscientists in order to identify how consumers' brains and neural mechanisms work. This new field in question is currently a virgin and hard to evaluate the area, but the interest of researchers has been continuously growing. As a lately emerged field, neuromarketing has focused on unconscious processes behind consumer behavior and propensity (Fischer et al., 2010). The 'neuro approach' in marketing research aims to identify unexplained differences in individuals' consumer behaviors. These differences are observed among individuals from the same region, the same education and even the same family. Marketing researchers have evaluated the concept in many layers from cognitive, individual, local, and national to global. Thus, attempts to identify the distinctive features of consumers based on demographic, sociological, educational, geographical differences have failed to produce desired results (Hsu, 2017).

Albeit gaining popularity at an increasing pace, the field of neuromarketing has been searched limitedly and it has yet to scientifically identify consumer behavior (Genco et al., 2013). The literature currently lacks geographical and demographical depth. Meanwhile, start-up companies also lag behind in accessing neuromarketing techniques as well as invaluable information produced by neuromarketing researchers mainly due to cost barriers, although their established competitors have already wakened up to the benefits of applying neuromarketing in their marketing mix. There are no significant differences between start-up companies and major companies in using neuromarketing techniques, but start-up companies lack the required resources in this newly emerged and currently expensive field. Entrepreneurs and academic researchers who are curious about this new field or who aim to seek answers of their questions to identify consumer decision making processes as well as professionals who do not want to lag behind the latest developments that their competitors benefit, professors or officials who aim to train entrepreneurs, and finally business students are just a few examples of the groups who are curious about the state-of-the-art neuromarketing applications in start-up companies, but who, at the same time, can not access required information on this new field ahead of its theoretical framework or application fields. In this article, it is discussed how helpful neuromarketing techniques could be for entrepreneurs as the success of start-up companies dramatically depend on the efficient allocation of their severely scarce economic resources. It is also argued that publicly funded or supported start-up hubs or entrepreneurial

institutions/associations shall cooperate with universities in order to provide start-up companies with neuromarketing tools.

BACKGROUND

Following decades long researches, many marketing researchers have lately developed a common sense of evaluating the consumer decision-making process as a neural process. However, defining this process and identifying it remains controversial. Neuroscience offers to extend marketing research to identify a critical point, namely, the consumer mindset. Neuroscience techniques are seen as valuable tools to identify deeper structures running behind the consumer decision-making process as well as consumer behavior. Although it has been analyzed from many different perspectives, scientific researches have yet to clearly identify intentions in the minds of consumers and drivers of consumer behavior (Plassmann et al., 2015).

Moreover, neuromarketing research offers the desired tools to testify existing theoretical arguments on consumer behavior (Alivisatos et al., 2013). Past research on marketing seems to agree that many factors, such as cognitive ones or biological, or inherited ones, have an impact on consumer behavior. However, traditional tools that are employed by marketing researchers are not sufficient to properly evaluate mechanisms that run in the brains of consumers. As a result, a proper scientific test of these hypotheses is not possible with traditional tools. Neuroscience tools and neuromarketing approach carry an exciting potential that could help in testifying current hypotheses in the field as well as the potential of triggering dramatic changes in current knowledge on consumer behavior (Breiter et al., 2015).

Across the last decade, an exponentially growing number of leading companies from almost all different industries have begun to use neuromarketing methods (Uprety & Singh, 2013). Korean carmaker Hyundai Motor Company employs EEG-tests, which measures electrical activity in different parts of the human brain when people are subject to an external impulse, across the design and development stages of its vehicles to learn consumers' thoughts and emotions before it launches mass production of its new models. The US-based food and beverage giant PepsiCo's chips producing unit Frito Lay, meanwhile, has been using neuromarketing techniques since 2008 in order to evaluate reactions in the brains of consumers towards its packaging designs. After it detected that bright colored packages initiate reactions in the anterior cingulated cortex, a part in the human brain that is associated with feeling guilty, Frito Lay stopped using bright color and it instead added health signs in its packaging designs. Another US-based food and beverage giant Coca Cola also use neuromarketing techniques in its all marketing strategies since 2013 while it mainly prefers facial coding technique to identify consumers' reactions. The US-based IT giant Yahoo tests its video commercials with using EEG methods before airing them on TVs or on the Internet while the US-based online payment services provider PayPal promoted the speed of transactions rather than security in its advertising campaigns after conducting brain-wave research on consumers. Another US-based IT giant Microsoft uses the EEG method to test reactions that advertisements in its gaming console Xbox create in the brain. Leading automotive companies Ford Motors and Daimler Chrysler also use neuromarketing techniques to measure the effectiveness of their advertising campaigns (Kumar & Singh, 2015).

THE CONCEPT OF NEUROMARKETING

Neuromarketing is an increasingly popular marketing research field that employs neuroscience tools to identify consumers' sensorimotor, cognitive, and affective response to marketing stimuli. Hsu (2017) dates back the theoretical roots of the concept of neuromarketing to the beginning of the 20th century when Hugo Munsterberg, who worked on organizational psychology, suggested that "businessmen will eventually realize that customers are merely bundles of mental states and that the mind is a mechanism that we can affect with the same exactitude with which we control a machine in a factory". The interest in identifying how the human mind works has continued across the last century, but the emergence of the concept of neuromarketing had awaited the beginning of the 21st century.

Following the rise of behavioral economics, marketing researchers have gained more courage to investigate consumers' way of thinking. However, roots of interest in decision-making processes date back to the 1970s when Kahneman and Tversky have conducted studies on judgment and decision-making under uncertainty and risk (Tversky & Kahneman, 1974). As a fruit of their studies, Kahneman and Tversky (1979) developed the psychological prospect theory of decision-making. Libet et al. (1983) were also among the initiators of the research aiming to identify unconscious drivers behind decision-making processes. Thanks to the development of neuroscience tools, Kahneman (2003) have attempted to map the bounded rationality. In parallel to the fast development of technological capabilities, the interest in searching secrets of neural processes running in the brain has gained significant popularity throughout the last decade (Eagleman, 2011; Eagleman, 2015).

Researchers have been employing neuroscience tools in marketing research since the 1990s, while the term neuromarketing was initially introduced in 2002 by Ale Smidts during a conference address. Neuroscience or neuroeconomics researches have included a marketing perspective starting from the beginning of the 2000s, while marketing researchers have also begun employing neuroscience tools during the first half the last decade, though they have not used the term neuromarketing. Lee et al. (2017) suggest that neuromarketing has emerged as a popular field in the year of 2007 and its popularity has snowballed since then. They further suggest that event-based designs dominated neuromarketing research at the first stage that followed the year 2007 while a period that was dominated by fMRI research followed and this period also witnessed alternative models in neuromarketing research. Currently, neuromarketing research is in a period of focusing on reverse inference.

Proper identification of thoughts and feelings of consumers is a complicated process, but it is, meanwhile, crucial to evaluate their attitudes towards a new service or product that would be launched by a start-up. Traditional marketing research techniques are mainly based on surveys or focused groups. These traditional methods attract the interest of entrepreneurs as they provide rapid results and they are comparatively cheaper while the results they produce are not totally useless. Across the last decade, big data has also entered into marketing research techniques as it provides invaluable information about consumer activities. However, it is widely accepted that traditional tools or even big data fall short of clearly identifying consumer behavior (Badoc et al., 2014).

The term of neuromarketing refers to the intersection of neurosciences, consumer cognition and consumer experiments. On the other hand, neuromarketing is a new field that uses neuroscience, neuropsychology and neuroeconomics tools to identify how consumers think, behave and make decisions. Neuromarketing is the study of consumer behavior through the utilization of tools and techniques of cognitive neuroscience. In light of previous attempts to identify the exact features of neuromarketing, neuromarketing could be defined as a way of marketing research that applies the neuroscience tech-

niques in consumer research in order to identify the neural processes in the minds of consumers with the aim of shedding light on the consumer decision-making process. With the aim of achieving these goals, neuromarketing utilizes brain measuring techniques such as EEG, fMRI, fNIRs, Galvanic Skin Response… etc. (Hsu & Yoon, 2015).

Neuromarketing explores differences among the brains of consumers. Literature suggests that rational and emotional thinking activities occur in different parts of the brain, but both of them happens in front lobes. Zald et al. (2008) question whether consumers make decisions rationally with employing the tools provided by neuroeconomics. It suggests that the density of dopamine receptors in the cerebral cortex of the brain has a direct impact on the decision-making process. It further proposes that there is a higher number of dopamine receptors in the brains of risk lovers. Differences in risk perceptions are seen as an ideal starting point for neuroentrepreneurship research as the literature is in consensus that brains react differently to the risk. fMRI analysis shows that stimuli of risk trigger neural processes in different regions of the brain such as anterior cingulate and lateral the orbitofrontal cortexes, or inferior frontal gyrus, striatum, insula. Moreover, making decisions under uncertainty and ambiguity triggers processes in orbitofrontal cortex, inferior frontal gyrus amygdala and insula.

Venkatraman et al. (2015) argue that tools, techniques, and methodologies of neuroscience would be useful for research on consumer behavior. It examines differences in brain cortical organization of consumers using a control group. The study employs event related potential methodology and it uses a simple task with and without emotional interferences. It uses the ERP method to explore brain activities. Results suggest that the brains of consumers react in a different way to emotional stimuli.

Moreover, some consumers, both behaviorally and neurologically, make quicker decisions. Brains of consumers differently process information as they use different areas in the brain and they show different brain activity. McClure et al. (2004) investigate differences in the brain activities of consumers in an experiment based on an exploration and exploitation task with employing fMRI and using behavioral data. The results of the study imply that some consumers' brains are more flexible in tracking evidence, disengaging attention and switching patterns on the road to efficient decision-making.

Dooley (2012) investigates what marketing researchers may learn from neuroscience in order to identify deeper antecedents of consumer behavior. It promotes differences between automatic and intentional processing as well as the mental prototype, fluid intelligence and change blindness as the intersectional areas. It suggests that decision-making is an automatic or unconscious process rather than an intentionally triggered one. The impasse here is the difficulty or impossibility of identifying an unintentional process. Thus, it focuses on identifying the intentional decision making process to overcome this deadlock. For mental prototypes issue, it suggests those who see consumer behavior as a self-identity are more likely to succeed in marketing. It also proposes the working memory as a key leverage point for fluid intelligence in consumer decisions while it relates the change blindness with the ability to identify opportunities and threats laying ahead of a consumer decision-making process. It stresses the importance of colors and fonts to attract the attention of consumers while it offers that simple and easy to read fonts are superior. Using a simple language also produces better results.

Morin (2011) investigates differences in the brains of consumers in the process of identifying an opportunity with employing cognitive brain mapping technique based on EEG. The results of the study suggest that there are differences among consumers with regard to the evaluation of financial risk. The neural maps of consumers show the right and left frontal areas of their brains were activated both at the time of the search and discovery of opportunities and at the time of propensity to take risks to explore, while some consumers show distinct neural organizations during the two periods. Drover et al. (2016)

"looks inside the black box of the human brain" in order to investigate how an equity investor's brain responds neurologically to pitches. It evaluates neural reactions to variations in decision-making processes with a hypothesis suggesting that pitches would trigger neural processes in different regions of the brain, depending on the level of displayed enthusiasm. It uses fMRI to scan the brains of a total of 20 investors.

BENEFITS OF NEUROMARKETING FOR START-UP COMPANIES

Start-up companies play a crucial role in promoting innovation that boosts economic growth and helps economic development. However, these economic growth engines are subject to significant risks of failure as high as rewards they promise. Start-up companies take huge risks with limited time and economic resources. As a result, start-up companies are subject to high failure rates as well as low success rates (Hyytinen et al., 2015). The US-based research company Start-up Genome is currently leading global data provider on start-ups (Palacio & Chapman, 2014; Violato, 2018; Kuckertz, 2019). According to its Global Start-up Ecosystem Report 2019 (Start-up Genome, 2019), total economic value globally created by start-up companies reached 2.3 trillion US dollars in 2017. However, data also suggests that 92% of start-up companies fail in the first three years of their operations. Data from other prominent data providers suggest similar figures regarding start-up success and failure rates.

CB Insights is the leading technology market machine intelligence platform that tracks millions of data points from venture capitals, start-ups, patents, partnerships and news mentions in its private company financing and angel investment database (Mackenzie, 2015; Kim et al., 2016; Shane & Nicolaou, 2017). According to its latest report on the reasons why start-up companies fail (CB Insights, 2019), 70% of technology start-up companies fail within 20 months after they raise their first financing. The report compiles data from a total of 323 post-mortems written by entrepreneurs after their start-up companies fail. The failure rates even hit to 97% for consumer hardware start-ups, suggesting that start-up companies fall short of properly identifying consumers' needs and purchasing behavior. Although it is almost impossible to identify real reasons behind start-up failures, CB Insight (2019) data compiled over obituaries written by failed entrepreneurs suggest that 42% of entrepreneurs think their start-up failed due to 'no market need'. Since each failed entrepreneur provides more than one reason for failure, overall data exceeds 100%, but marketing-related reasons dominate the list. 18% of failed entrepreneurs believe that their start-up failed due to 'pricing/cost issues', while 17% of them think that they failed due to 'user un-friendly product'. Also, 17% of the failed entrepreneurs believe that they failed due to 'product without a business model' while 14% of them think they failed due to 'poor marketing' and also 14% of them believe that they failed due to 'ignoring consumers'. 13% of them believe that they failed due to 'product mistimed.' The other leading reasons that follow marketing-related reasons could be grouped as financial troubles, employee-related problems and harsh competition conditions, but it should be stressed that all other reasons lag behind the marketing-related reasons that dominate the list provided by failed entrepreneurs.

Significant problems that start-up companies deal with are about financing and pressure to shorten time span for producing return on investment. In order to overcome this vital problem, entrepreneurs are required to develop a true understanding of consumer behavior and to continuously modify their product or service based on feedback they receive from consumers (Hitt & Ireland, 2017). In other words, for a start-up, it is not crucially important to develop a magnificent product or service, but it is more important to make their product to produce fast returns to overcome the pressure to repay the

initial investment. Therefore, models offered by literature for successful start-up companies suggest the crucial importance of accurately understanding consumers' needs, emotions, purchasing decisions, and, in general, consumer behavior (Harms, 2015).

When start-up companies fall short of understanding their customers, they also fall short of developing loyalty among their customers as they fall short of developing healthy communication with their customers. Menelec and Jones (2015) suggest that start-up companies operating in the professional services industry fail to develop the crucial business/marketing language to explain their perspective and value creation they offer to their target audience.

Ansari and Riasi (2016) investigate the relationship between consumers and start-up companies in the insurance industry by employing research on artificial neural networks. Results suggest that artificial neural networks are appropriate to investigate the factors that have an impact on customer loyalty. It further shows that satisfaction and perceived value are significant predictors of loyalty. Meanwhile, empathy, perceived quality, customer commitment and trust are significant drivers affecting satisfaction. The study suggests that employing new era neuroscience tools such as artificial neural networks would particularly help start-ups, which seek competitive advantage to survive among established competitors, properly identify consumer behavior.

Literature suggests that new ventures are exposed to failure risks much higher than established ventures. Established companies' success or failures are seen to differ based on the differences in their long-term resource allocation strategies (Van den Steen, 2016). However, start-ups, on the contrary, are subject to develop more flexible and shorter-term strategies. Therefore, entrepreneurs are required to employ an experimental approach and to create as many as possible alternative strategies (Cooper, 2017). On the next step, it is vitally important to continuously determine the best strategy among alternatives in order to overcome failure pressure (Gans et al., 2019).

Neuromarketing methods are appropriate for developing a start-up strategy as they boost organizational performance (Spence, 2019). However, despite rewards neuromarketing promise, very few start-up companies employ neuromarketing tools in launching their products or services. The main reason behind start-up companies' distance from neuromarketing is seen as higher costs. As start-up companies are required to allocate almost the whole of their scarce resources to product or service development, marketing budgets are generally tiny (Dube et al., 2017). Although neuromarketing techniques are costly, they provide efficient ways to test consumers' reactions to products or services, and they help start-up companies modify their products or marketing strategies based on consumer demands. As a result, start-up companies that employ neuromarketing methods can gain a competitive advantage by choosing the best product development or marketing strategy (Halvorson & Rock, 2015). Given the benefits start-up companies offer to promote the general welfare, governments provide incentives for entrepreneurs as well as required infrastructure in start-up hubs (Nambisan, 2017). Start-up hubs provide opportunities for cost-cutting as they are fully or partially funded by the public as well as provide opportunities of scale-up for groups of start-up companies in their common activities that translate into a decline in per unit costs. As a result, neuromarketing tools may also be more accessible for start-up companies in overcoming cost barriers.

THE CHALLENGES OF NEUROMARKETING FOR START-UP COMPANIES

Although the fast development of neuroscience techniques has massively been used by many established firms, start-up companies seem to have lagged behind. Start-up companies have been slow to adopt and adapt to neuroscience tools due to several reasons. First of all, neuroscience research requires truly multidisciplinary research teams that consist of many experts in many different fields, from data scientists to technicians. Moreover, the complexity of technologies that should be employed along with the complexity of the human brain itself makes it hard for researchers to develop meaningful research strategies. Moreover, as expected, the main reason is the cost of using neuroscience techniques. Although prices differentiate based on technical features of different products, the minimum cost of equipment required for fMRI (functional magnetic resonance imaging), a neuroscience technique to map electrical activity in the human brain, stands at hundreds of thousands of US dollars. The cost barrier for start-up companies stands as the cost of employing a neuromarketing technique is the same for a start-up or an established company. Despite barriers, neuromarketing has, it carries the potential of shedding light on unknown parts of current knowledge on consumer behavior (Cummings & Nickerson, 2017).

Since rewards start-up companies promise are high, the literature includes many types of research and theoretical frameworks that aim to help entrepreneurs achieve survival and long-term development (Coad & Guenther, 2013; Kessler et al., 2012). The lean start-up approach is one of the most popular methodologies offered by literature to develop successful enterprises. Lean start-up methodology targets to achieve the shortest possible product or service development cycles. To achieve this goal, it aims to perform initial and continuous tests to evaluate the viability of the business model that a start-up develops. To test the viability of the business model hypothesizes offered by entrepreneurs are regularly tested via experiments. Based on the results of these experiments in question, products or services are regularly modified and re-launched over feedback attained (Eisenmann et al., 2012).

The lean start-up approach offers to initially produce a 'minimum viable product' to test the consumers' attitudes. A minimum viable product is not the final version of the product, but it has minimum features that could be served to early consumers. Based on information gathered from consumers on their attitude towards the minimum viable product, the start-up continues to develop its product or service. However, even if a start-up develops its business model based on a lean approach, it is vital to accurately understand consumers' thoughts and emotions towards the product or service before redeveloping the product or service based on consumer feedback (Jarvis, 2003).

SOLUTIONS AND RECOMMENDATIONS

Entrepreneurs have higher responsibility and requirement to properly identify drivers shaping consumer attitudes and behavior (Frederiksen & Brem, 2017). It is currently widely accepted that traditional marketing research techniques are exposed to widely recognized limitations in identifying unknown processes that affect consumer decisions since those traditional methodologies have been employed for decades without being subject to some radical changes that would positively impact the results they produce (Calvert & Brammer, 2012). Since traditional methods fall short of producing vital information for start-up companies that are subject to significant survival risks, entrepreneurs should also pay attention to the brain-based marketing research approach that has been recently attracting growing interest from marketing researchers.

Neuromarketing research carries the ability to provide entrepreneurs with the opportunity of developing a direct understanding of consumers' thoughts, feelings and intentions. However, entrepreneurs, meanwhile, should also be aware that neuromarketing research is not a direct substitute for traditional marketing research, but it is rather a complement of traditional approach (Ariely & Berns, 2010). Under current competition conditions, entrepreneurs are required to develop a balanced approach based on properly combining and comparing information produced by traditional marketing research techniques as well as neuromarketing methods. An entrepreneur who ignores invaluable information produced by neuromarketing has a really small chance to keep its enterprise on track as almost all competitors employ neuromarketing techniques while developing their marketing mix. On the other hand, ignoring information produced by traditional methods and weighing only on neuromarketing techniques would also create similar problems regarding survival ability as it would hurt the competitive power of the start-up since all successful competitors employ both techniques in a balance to combine information they separately produce.

With the aim of overcoming cost barriers, Kollman et al. (2016) suggest that start-up companies cooperate with established companies as well as among each other while marketing cooperation has the highest share among all cooperation fields as 61.2% of entrepreneurs indicated that they employ marketing cooperation with established companies. 65% of entrepreneurs, meanwhile, indicated that they employ marketing cooperation with other start-ups. Publicly supported start-up hubs could also help start-up companies come together to share costs as well as providing direct financing support or required equipment.

Through proper usage of neuromarketing techniques, success rates of start-up companies may improve and, as a result, failure rates fall. A vital mistake for start-up companies is to overlook the necessity of employing skillful marketing personnel. Since their economic resources are extremely scarce, many start-up companies focus only on developing sensational products or services, but they avoid to employing required marketing professionals who would identify consumers' needs and emotions towards the product or service. Those that allocate some resources on marketing, on the other hand, mainly employ traditional marketing tools. As a result, even if the start-up manages to create a superior product or service, it is subject to failure when it does not mean anything for consumers (CB Insights, 2019). In order to overcome such simple failures, entrepreneurs should never forget to include a marketing team in their squad and they should develop an appropriate business model that would enable the marketing team to involve in each step of the product life cycle from the very beginning.

FUTURE RESEARCH DIRECTIONS

Cognitive neuroscience may not trigger revolutionary development in marketing research, but it offers higher insights for a complete understanding of consumer behavior. However, it is not a specific limitation to marketing research, but any scientific research does not guarantee revolutionary developments before it is conducted. Neuromarketing, on the other hand, mainly focuses on promoting scientific or technological innovations in marketing research to identify the consumer decision-making process. The neuromarketing approach carries many limitations and it requires higher expertise in experimental methodologies. Thus, researchers who have experience in the field of neuroeconomics may overcome the mistakes made by the early movers in neuromarketing research (Hubert, 2010).

The main limitation of neuromarketing research is the requirement for using a laboratory in experimental research. This limitation does not only impose higher costs and, as a result, the limited number of participants, but it also affects neural processes since participants' brain functions may differ in a laboratory environment from their natural patterns. Moreover, neuromarketing research carries limits of neuroscience techniques. Neuroscience has yet to identify the human mind and its correlation with the human brain organ. Additionally, neuromarketing research may also fall short of identifying the real drivers behind the consumer decision-making process as past researches who have tried to identify personality traits did (Fortunato et al., 2014).

The main lesson that neuromarketing research could inherit from neuroeconomics research is that it is much more complex to identify the neural structures working behind consumer decision-making than basically identifying neural structures on their own. Thus, basic brain mapping correlation techniques have already proven insufficient with significant overlaps. As a result, neuroeconomics researchers have employed more complex network models as well as multivoxel classification and computational models to identify decision-making processes (Konovalov & Krajbich, 2016).

Another important aspect that should not be overlooked in building a neuromarketing research method is that brain imaging techniques are not supplementary, but indeed complementary to traditional research techniques such as laboratory experiments, self-reporting or interviews. Memory related areas in cognitive neurosciences such as priming and procedural learning are seen to offer the potential to identify the appropriate question in research of the development process of consumer identity and consumer intentions. Autobiographical memory, a research field for neuroscience and neuropsychology in enlightening the development of self-identity, is seen as an applicable research methodology in order to identify the development of consumer identity and consumer intentions. It could also help understand the influence of past life experience on consumer behavior. Cognitive neuroscience, an interdisciplinary field that brings experimental psychology and neuroscience together, particularly offers the required research tools to investigate how a consumer's brain works as well as it could help map the consumer mindset and, as a result, to identify the consumer identity. As a result of applying cognitive neuroscience tools on consumer research, a new hypothesis that would help overcome the current obstruction in marketing research may come into existence (Zurawicki, 2010).

Neuromarketing researchers use MEG (Magnetoencephalography), PET (Positron emission tomography), EEG (Electroencephalography), fMRI (Functional magnetic resonance imaging), and fNIR (Functional near-infrared spectroscopy) as tools in neuroimaging while Stipp (2015) considers fMRI as the most relevant technique. On the contrary, Venkatraman et al. (2012) suggest that EEG offers the highest promise in some certain research areas despite its intrinsic limits. McDowell and Dick (2013) identify a total of seven neuroscience techniques that could be applied in marketing research, namely EEG, MEG, fMRI, fNIR, TMS (Transcranial magnetic stimulation), tDCS (Transcranial direct current stimulation) and neuro-feedback. It also argues that these techniques in question are applicable in marketing research as they offer a profound level of analysis and they hold the potential to nurture and augment consumer behavior. Each technique has its own strengths and weaknesses, while the most appropriate technique shall be chosen based on the research question.

Kotler and Keller (2011) offer many research questions that neuromarketing techniques could be applied. The main idea is to search the main drivers in the brain of a consumer that enables her to identify or develop an opportunity. True identification of this process in the brain of a consumer would be invaluable to identify consumer behavior, although it currently seems impossible since neuroscience has yet to identify all neural processes that work in the human brain.

Under the light of available, albeit not deep, the literature on neuromarketing research, further research could be designed to initially seek the answer to the question of whether start-up companies that employ neuromarketing tools in their managerial decisions perform better than the ones that do only use traditional marketing tools. Conducting such research out of the developed world would also add geographical dimension into the current literature since currently, available neuromarketing research lacks geographical dimensions. Albeit it is expensive, fMRI could be picked as the neuroimaging techniques, or some other techniques could be inherited. Teamwork that would also include neuroscientists would be more helpful in dealing with the complicacy of neuroscience.

CONCLUSION

Neuromarketing is a new, but growingly popular field that aims to identify consumer mindset. True identification of the consumer decision-making process would help start-up companies give accurate decisions and, as a result, become successful (Falk et al., 2016). The traditional approach to consumer decisions is narrowly focused on functional and short-term benefits and they are mainly based on beliefs rather than scientific processes. Start-up companies tend to invest in products and services that they believe in becoming successful. However, even if this approach provides short-term success, if not at all, start-up companies could not overcome future problems and tend to fail. Employing a similar approach as the neuroscience approach for the consumer decision-making process would return as long-term benefits in the current severe competition environment across the globe.

Neuromarketing offers start-up companies to focus on the emotional needs of consumers rather than their functional needs for long-term success. This approach also requires a transformation in the decision-making processes. Companies that successfully apply neuromarketing techniques in their decisions are proven successful. For instance, German carmaker BMW focuses on emotional needs of men who are older than 40 and aims to help them overcome their midlife troubles with offering them a solution in the form of an elegant car while the US-based IT giant Apple plays on "fears of missing out" in its marketing strategies. Under these global competition conditions, start-up companies are required to beware of drivers behind their managerial decisions to develop successful businesses.

Past researchers agree that successful entrepreneurs have intuitive and natal abilities (Patriotta & Siegel, 2019; Banerji & Reimer, 2018). A talented adman or a successful marketer is able to understand consumer needs intuitively. However, neuromarketing techniques have recently been offering more scientific methodology in more appropriate and less hazardous methods for identifying consumer needs. Information on the consumer decision-making process as well as on how the brain of a consumer works and also how or whether the brains of consumers are different could be obtained through neuromarketing research and this information would be invaluable for start-ups.

In Turkey and also all-over the world, neuromarketing techniques have been gaining popularity at a growing phase. However, the consumer decision-making process remains as a black box. The neuromarketing approach would definitely help in shedding light on these unknown processes in question. The understanding consumer decision-making process is an urgent requirement in the current competition conditions. Every day many new brands pop up in all-over the world while consumers are exposed to many brand communication campaigns and communication techniques in their daily lives. The same chaotic environment also has a direct impact on managerial decisions at start-ups. Under these conditions, start-up companies are required to give the most efficient investment decisions that would satisfy

the emotional needs of consumers. Product or service differentiation does not provide desired results anymore, but brand differentiation is currently focused on emotional contact with the consumer. As a result, the identification of consumer decision making processes is crucial to help start-up companies create marginal benefits to improve the general welfare. As start-up companies promise fast development opportunities that would promote the general welfare, publicly supported start-up hubs could help entrepreneurs to access neuromarketing tools to overcome cost barriers.

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KEY TERMS AND DEFINITIONS

Brain-Driven Consumer Research: Employing neuroscience techniques with the aim of understanding consumer decision-making phenomena.

Consumer Behavior: Emotional, mental, and behavioral responses about purchasing, using and disposing goods and services.

Experimental Consumer Research: Employing psychological, empirical, and behavioral economics experiments in consumer research.

Neuroeconomics: A new approach to economics that retrieves connection among economics, psychology, and neuroscience.

Neuromarketing: Understanding emotional reactions of consumers and designing marketing strategy accordingly.

Neuroscience: A scientific field that aims to identify structure and functioning of human brain.

Start-Up: Newly launched companies that seek survival and development.

Chapter 10
Consumer Neuroscience:
Evolution and Commercial Applications

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ABSTRACT

Consumer neuroscience is a quickly growing discipline that harnesses both theoretical principles and applied measures from the decision and affective neurosciences, along with psychophysiology and vision research, in order to explain and predict consumption behaviors. This discipline links several subfields, including neuroeconomics, social and affective neuroscience, and neuromarketing. This emerging field comprises both direct and peripheral measures of neural processing related to consumption behaviors. Consumer neuroscience complements traditional commercial research measures such as self-report, which can often be inaccurate and biased by anticipated or recalled, but not actual, consumption behaviors. All told, consumer neuroscience represents a unique field focusing on the consumer and the innumerable factors that affect individual preferences and consumption behavior. This chapter will provide a comprehensive overview of the field's history, key measures used, case examples of academic and commercial work, and a discussion of the field's continued bright trajectory.

INTRODUCTION

In academic institutions as well as the private and government sectors, the term consumer neuroscience is quickly becoming a familiar term. While the measurements made within the field of consumer neuroscience have been used for decades, their application to address brain-based explanations of marketing choices and comsumer behavior has explains the rapid growth of this field.

Further, the decreased footprint of hardware, the processing speed and increase data storage capacity of computing, and the ability to execute sophisticated statistical modeling and prediction algorithms have created the perfect scenario for the field's proliferation. This chapter will provide a comprehensive overview of the field's history focusing on key models and measures used, examples of organizational

integration models in brand research, case examples of academic and commercial work, and a discussion of the field's future trajectory.

Many in academia study neuroeconomics, or decision neuroscience, which focuses primarily on determining neural processes that work to determine how humans determine the financial valuation of specific information. Consumer neuroscience is also considered the academic area of study which focuses on determining the neural processes that occur "up-stream" of consumer choice. Consumer neuroscience is unique because its main focus is on the consumer and how various factors affect individual preferences and purchasing behavior. The field of neuromarketing harnesses theory from both neuroeconomics and consumer neuroscience research to best architect consumer products and experiences. In other words, neuromarketing focuses on the study of various marketing techniques and attempts to integrate neuroscience knowledge to help improve the efficiency and effectiveness of said marketing strategies.

The tools used in neuroeconomics, consumer neuroscience and neuromarketing rely on capturing data in the moment, as consumers are experiencing consumer oriented choices. These tools will be further discussed within the body of this chapter. A key difference of these measures compared to those used in traditional market research is that they removed the bias that time factors into the consumer's self-reported recall or intentions regarding a past or future consumer choice.

Surveys and focus groups, for example, rely on the consumer's to accurately remember factors that may have influenced a past purchase. While the consumer can report what they recall are factors salient to making a consumption decision, they often don't account for subtle cues that worked below conscious threshhold to nudge their consumer choice. Further, self-reported recall or intention often assumes that consumer is defining choices based on rational information, weighing all decision utilities before making a logical choice. Consumers, however, are not rational decision makers while in the moment deciding on what to purchase. Their justifications of these purchases however are often rational, making self-report outcomes less sensitive to measuring the consumer. Measures of the brain and body largely resolve the bias of traditional self report measures, as they capture real time or near real time neural and physiological responses during consumption choices.

BACKGROUND

Early Commercial Measurement

In the United States in 1906, Daniel Starch launched the field of advertising research through his essay titled "Advertising: Its Principles, Practices & Techniques." This work was instrumental in developing the rationale that advertising had to be seen, read, believed, remembered, and most importantly, acted upon, to be considered effective. Building upon these ideas, polling icon George Gallup developed the concept of aided recall, in which researchers would assess memory for an ad without actually showing the ad to study participants. This technique has been adapted and continues to be used as a as a market research tool to measure the effectiveness of radio and television advertising.

Later, the 1940s through 1960s produced a different type of market research focusing on qualitative information to augment quantitative data captured from consumer recall. That is, market research in this era aimed to understand the individual consumer at a highly personal level. To this end, focus groups originated in the late 1930s at the US Bureau of Applied Social Research at Columbia University in an attempt to determine the social and mental effects of mass communications on the general public. Focus

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groups have a long and colorful history in assessing consumer attitudes and intentions. For example, they were used during the Second World War to examine the effectiveness of propaganda (Collis & Hussey, 2013). Even though focus groups were highly popular, researchers were keenly aware that the consumer's stated preferences often differed greatly from their actual behaviors.

The Irrational Consumer

The notion that individuals make rational decisions was a basic assumption that market researchers adhered to for decades. Indeed, traditional, deliberative self-report assessments of consumer preferences are still commonly used in market research today. That said, in the 1960's and 70's, academics Daniel Kahneman and Amos Tversky empirically challenged the assumption of rational human judgment and decision making. Their research collaboration was based on two distinct lines of inquiry, focusing on judgments (e.g. estimations of magnitudes and probabilities) and decision-making, centered around how individuals make choices, especially decisions made under conditions of uncertainty (Kahneman & Tversky, 1979). After hundreds of research studies, it became clear that human judgment and decision-making processes were anything but rationally based. Instead, humans demonstrate a number of "cognitive biases," systematic patterns of deviation from rational judgment that create efficiencies in choice by creating mental short cuts. These shortcuts often produce outcomes that are counter to outcomes that would be expected after rational consideration of all factors that impact a particular decision.

It is interesting to note that though this information was available within academia in the 1970's, the field of market research did not yet make the connection. Those in advertising were still reliant on data collected based upon the assumption of consumers making rational decisions. For this reason, there remained a disconnect between stated intentions of consumers and market-level sales. By and large, the self-reported measurements of consumer preference were not accurate indicators for advertisers to rely on in determining the efficacy of their advertising. David Ogilvy, widely hailed as the father of advertising, understood this disconnect saying "The trouble with market research is that people don't think how they feel, they don't say what they think, and they don't do what they say." The onus of creating effective advertising and marketing campaigns relies on the ability of the creative content generator to intuitively know what the consumer wants to see and feel. But the ability to quantify this intuition was lacking in the 1970's.

Empiricist Measurement

In the mid-1980s, a more empirical approach to market research was adopted to better understand consumers at the behavioral level. For example, environmental psychology firms such as Envirosell (New York, New York), Sorenson and Associates (Portland, Oregon) and Merchant Mechanics (Hanover, New Hampshire) emerged to measure behavioral data within urban planning, retail and other public environments. Environmental psychology is an interdisciplinary field that focuses on the interplay between individuals and their contextual surroundings. This field examines the way in which the natural environment together with our built environments shape us as individuals and as consumers (De Groot, 2019; Kopec, 2018). The field defines the term environment broadly, encompassing natural environments, social settings, built environments, learning environments, and informational environments.

Quantifiable measures of dwell times, incidents of location visits and revisits, product comparisons, path tracking, and other observable consumer behaviors are measured. These data are then systematically

compared within and across environments to determine points of global or local wayfinding issues in navigation, category engagement, shopper flow and other behaviors that map onto success in the consumer experience. As examples, in person experiments would surreptitiously watch and code consumer behaviors in real-world contexts, or video would be recorded and then coded remotely to determine extract client insights. This research removes the bias inherent in traditional market research techniques that rely on self-reported intentions and preferences. Instead, this research addresses the source of the consumer's in-store decisions: behavior at both the level of global wayfinding as well as at the local point of purchase.

Drawbacks exist with this empirical approach, in that there is no clear means to attach a rationale to why the consumer's behaved as they behaved. Documenting the environmental factors that drives a particular consumer's choices in a particular environment is important, but does not address the motivations and memories that preceded this behavior. That is, ultimately empirical research lacks a means for understanding how emotions drive purchase decisions in context. This type of research is also limited to shoppers and is not designed to address audience response to broadcast content or advertising.

The Age of Cognition

The 1990's was coined the "Decade of the Brain" by Michael Gazzaniga. During this decade, he and fellow neuroscience researchers grew the field of cognitive neuroscience, using sophisticated measures to assess changes in brain activation during cognitive processing tasks (M. Gazzaniga & Ivry, 2013; M. S. Gazzaniga, 2000, 2014). Cognition refers to the mental acquisition of knowledge and understanding through thought, experiences and the senses. Cognitive science began with the goal of addressing the "why's" of mental processes that underpinned behavior. Cognitive neuroscience extends this work to address the neural processes that underlie cognition. What was not actively addressed during this decade were how emotions, and not deliberative processing worked to drive behaviors.

Antonio Damasio worked with brain lesion patient populations to address the role that emotion had on choice behavior. After conducting extensive studies comparing decision-making abilities in both healthy and patient populations, he postulated that the brain lesions that affected the ability to experience emotions resulted in a severe impairment of rational decision-making (Eslinger & Damasio, 1985). Through this work, he developed what is known as the Somatic Marker Hypothesis, which posits that feedback (to the brain) from the somatic (bodily response) component of emotional reactions is crucial to all decision making, including rational decision making. Damasio's theory posits that emotions and feelings give rise to "somatic markers," which serve as beacons, or a type of weighting of one outcome over another, that work to guide decisions in an advantageous direction.

These reactions are based upon an individual's previous experiences with similar situations. These markers permit a comparatively fast preselection of the most relevant choice alternatives (differential), that are then processed further to generate a final decision. In this way, somatic makers increase the efficiency and accuracy of human decision making. Based on data from brain lesion patients, Damasio showed that decision-making processes depend upon activity in the ventromedial PFC, insula, anterior cingulate cortex, and amygdala. Activity in these regions influenced by marker signals purportedly generated within the somatosensory cortex that arise in response to bodily autonomic nervous system responses, such as the sympathetic skin conductance responses (Bechara, 2004; Bechara, Damasio, et al., 2000; Bechara, Tranel, et al., 2000; Reimann & Bechara, 2010). Indeed, patients with ventromedial PFC lesions fail to show an appropriate skin conductance responses and, in turn, tend to make risky decisions.

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Applied Emotion Research

As noted above, Kahneman and Tversky's supported the notion that humans often do not make rational or objective decisions. Taken together with Damasio's work, the field of cognitive neuroscience had a new way to consider the impact of social and affective experience on decision making. Indeed, if the 1990's were the Decade of the Brain, the 2000s became the decade of emotion and a desire to systematically understand the relationship between emotions and decisions. Several books cropped up at this time to popularize what were once esoteric theories on the subject. Descartes' Error (Damasio, 2006), Freakonomics (Levitt & Dubner, 2014), Thinking Fast and Slow (Kahneman, 2011), and Cialdini's Influence helped to disseminate the essential findings from of neuroscience to the masses.

During this era, a handful of academics and commercial research firms that were focused on brand research began connecting the dots to incorporate "implicit" or indirect querying techniques to measure the effect of emotional responses on consumer decision making. For example, Heath (2012) applied implicit techniques as a means to measure the extent to which emotions influence consumer responses to advertising campaigns, creating novel success metrics for measuring the success of a given campaign.

The First Consumer Neuroscience Firms

In marketing and advertising research, a handful of companies embraced this cognitive neuroscience approach. Global players Nielsen and IPSOS constructed neuroscience research divisions, establishing labs in various countries. Individual vendors appeared online offering commercial use of medical-grade hardware and software1. Small to midsize brand research consultancies employed neuroscientists and psychologists to help measure the implicit responses of consumers to branded content2. While some firms, such as Neurofocus (San Francisco, California) and Emsense (Chicago, Illinois) offered neuroscience-based solutions, other firms such as Merchant Mechanics, Sorensen and Associates. and Precision Research Services (Des Plaines, Illinois, United States) were the earliest to integrate brain and body measures into their original behavior-based research solutions.

For example, beginning the in mid-2000's Campbells Soup worked with Merchant Mechanics, Innerscope Research (Cambridge, Massachusetts) and Sands Research (El Paso, Texas) to conduct the first and largest consumer purchasing journey study - integrating brain, body and behavior data streams in order to systematically understand the emotional drivers linked with in-category choice behavior. Studies such as this launched these measurement technologies into the mainstream conversation supporting their utility in the marketing researcher's toolbox (Williams, 2010). Since then, numerous retailers and consumer goods manufacturers have incorporated these technologies into their research budgets. The advertising and broadcast content industries have also found a place for such measures in determining moment-to-moment variations in audience arousal, determining how the valence of arousal and motivation influences consumer engagement with content. At this time, circa 2015, the global market for neuromarketing technology reached $21.0 million. This market is expected to reach $50.3 million in 2021, increasing at a compound annual growth rate (CAGR) of 18.0% ("Neuromarketing Technologies, Trends and Market Research Report," 2016).

Organizations Focused on Consumer Neuroscience and Neuromarketing

Early academic work in consumer neuroscience occurred in 2003 with a now famous study regarding soda preference (McClure et al., 2004). In this study, researchers wanted to understand whether neural processsessing of two sodas, nearly identical in chemical composition, are associated with strong subjective preferences for one or the other by consumers. The researchers wanted to understand how cultural messages such as branded logos and advertisements combine with content to shape perceptions that influence behavioral preferences for a reward. Coca-Cola® (Coke®) and Pepsi® were delivered to human subjects in behavioral taste tests and also in passive experiments carried out during functional magnetic resonance imaging (fMRI). Two conditions were examined: (1) anonymous delivery of Coke and Pepsi and (2) brand-cued delivery of Coke and Pepsi. For the anonymous task, consistent neural response in the ventromedial prefrontal cortex was found to correlate with subjects' behavioral preferences for these beverages. In the brand-cued experiment, brand knowledge for one of the drinks had a strong influence on self reported behavioral preferences as well as on the measured brain responses.

This study launched an era of academic interest, especially across business schools, which were once siloed from the arts and sciences. Business school professors studying economics through traditional consumer assessments understood the increased efficacy of measures captured in the moment. Among the first business schools in the United States to embrace applied measures of brain and body were The University of Pennsylvania's Fox School of business, Stanford University, Harvard Business School, The University of Michgan and Duke University's Fuqua School of business. Other insitutions began to teach consumer neuroscience within the Arts and Sciences. Dartmouth College's Psychological and Brain Sciences Program (Hanover, NH U.S.A.) was the first Ivy League to offer an undergraduate level course in Consumer Neuroscience and Neuromarketing to majors in neuroscience, psychology and economics.

Beyond theory-based academic pursuits in undestanding consumer decision making, those in the commercial and government sectors understood a more pragmatic application of brain and body measures and united around the term Neuromarketing to define this new type of research. In early 2012, The global Neuromarketing Science and Business Association (NMSBA) was officially formed3 with a mission to promote "global interaction between business and science for a solid and practically valuable neuromarketing profession" ("Neuromarketing Science & Business Association," 2012). Each year, this organization features the Neuromarketing World Forum at various locations across the globe to bring together vendors and clients who convene and showcase the latest technologies and trends in the industry. On the academic front, several U.S. based business schools have an annual meeting called the Interdisciplinary Symposia on Decision Neuroscience which blends the latest academic, theoretical research trends with vendors who share client-oriented research solutions ("ISDN,"2019). It is through these types of interdisciplinary organizations that the growth of consumer neuroscience continues to grow in importance.

Two Affective Models of Choice

Two classic models help to explain the effect of emotion on consumer choice. From classic psychological literature, the James- Lange model provides a foundational science-based rationale for how humans create an emotional interpretation of an experience:

EVENT ® PHYSIOLOGIC RESPONSE®INTERPRETATION ® EMOTION.

That is, they posited that human beings experience an event in the world, their body responds, and it is that physiological response that is then interpreted, and an emotion is linked to the experience. The classic attention-interest-desire-action (AIDA) model from the field of advertising (Lewis, 1899), has a synergistic relationship with the James-Lange model, also describing the series of events that must occur to determine the success of an advertisement. If an advertisement is not successful, it is likely that the consumer experienced a failure somewhere along the attention, interest and/or desire processes. Given that, in this case, the event is the advertisement itself, the goal of the creative is to elicit a strong enough physiologic response to an advertisement that will then be interpreted as a desire for the promoted product.

NEUROSCIENCE Tools

fMRI

Functional magnetic resonance imaging (fMRI) is commonly used in academic neuroscience research to uncover the neural processing dynamics that may arise from different consumption experiences (U. Karmarkar et al., 2015). For example, recent fMRI work showed that buying decisions depended on the order in which price and product information is presented to the consumer.

When price is presented before viewing a related product, consumers are to pay less for the product compared to a condition where the product is presented before the price. Interestingly, fMRI data showed that greater neural activity in the medial prefrontal cortex (mPFC), was observed in the "price primacy" scenario (when the price was shown first), compatred to when the product was shown first (U. R. Karmarkar et al., 2015). The implication is the greater neural processing based on the price information led to a devalueing of the product itself. Academic findings such as this can be commercially applied to pricing and visual merchandising to increase the probability of purchase behavior. Specifically, showing the product before the price, acts to diminish the importance consumer's place on price-focused purchase decisions.

EEG

Electroencephalography, or EEG, a measurement of electrical signals from the scalp that underpin neural activity, has the advantage of providing a temporal record of brain activity during a purchase decision. This quick binomial-like response also has the advantage of being closely time-locked to product presentation. EEG maintains high temporal acuity in measuring stimulus responses, at the millisecond level (Hammond, 1981). This level of sensitivity allows for fine-grain measures of quickly changing stimuli, such as video-based advertisements and music. Further, frontal alpha asymmetry (FAA), a difference in the amount of alpha wave activity between the two hemispheres, captured via EEG has been shown to reflect one's motivation in attending to or avoiding a stimulus. Greater activation in the left or right hemispheres has been shown to indicate a draw towards or away from a stimulus, respectively (Harmon-Jones, Gable, & Peterson, 2010). Neuromarketers often use the FAA metric to study "approach" motivation toward and an "avoidance" motivation to draw back from branded content. FAA is becoming an

important implicit measure involved in temporally sensitive assessment of the consumer's willingness to engage with branded commercial content (Çakar & Gez, 2018).

Some researchers have correlated components of ongoing EEG to assess "engagement" with a presented event (e.g., product) (Dmochowski, Sajda, Dias, & Parra, 2012). In this research, engagement is defined as "emotionally laden attention" and can be used to predict market-level success of presented products. There are distinct advantages to having the means to understand the neural substrates of engagement in one consumer or in a specific population of interest. Quantitative assessments of entertainment are possible with this measurement (Gunter, 2000). Thus, prediction of future sales successes are possible by harnessing EEG data.

Biometrics Heart Rate and Skin Conductance

Biometrics provide in-moment responses to branded information. Biometrics provide a method of measuring activity in the rest of the body, such as skin conductance (ER-SCR) responses used to measure arousal or interest (Groeppel-Klein, 2005)., and heart rate variability (HRV), changes in the inter-beat interval of the cardiac signal. Once used as a measure to assess driver fatigue (Egelund, 1982; O'Hanlon, 1972), HRV is commonly used to assess changes in mental workload, or cognitive effort. Finally, eye position information is also used in conjunction with biometrics in order to identify specific information being attended to during varying levels of arousal and cognitive effort (Clark et al., 2018).

Facial Affect Through FACET

Emotion detection technologies employ two techniques: computer vision, to identify facial expressions, and machine learning algorithms to analyze, interpret and then classify the emotional content of those facial features. Facial affect algorithms have historically been created using supervised learning, which is an artificial intelligence approach that learns by being trained to recognize content it has already experienced. Software used in neuromarketing to measure and classify consumer emotions relies on databases that contain thousands of faces that have been classified by a system based on Paul Ekman's classic work in facial affect identification (Ekman, 1992, 1992; Ekman & Friesen, 2003). When a novel face is presented, specific muscle groupings are identified (e.g. the *corrugator supercilii* muscles near eye) based on shadow or point detection and then compared against the groupings of faces in the seven emotions Ekman identified as universal. The algorithm then computes an evidence value, which is the probability that the novel face is eliciting a discrete emotion based on its comparison with faces in the database.

The assumption that there exist seven discrete and universal emotions has been challenged (Barrett, 1997, 2006, 2017). In his initial study, Ekman had participants sort images of faces eliciting different emotions into pre-defined categories of emotions joy, anger, disgust, contempt, sadness, surprise, fear. Barret's follow-up studies, however, removed the pre-defined emotions. This resulted in participants sorting emotions into more categories than the initial seven from Ekman's classic study. Barrett does not feel that it is tractable to attempt to map facial expressions directly on to emotions across cultures and across contexts. Moreover, consumer contexts (such as shopping) are simply not emotional, and as such, consumers often do not elicit frequent emotional responses. One benefit of FACET however, is that is can demonstrably assess basic positive and negative affect from the face. In the future, the algorithms

used to classify facial affect will become better at classifying more nuanced emotional expressions with the assistance of training models that can expose specific baselines of interest in weighting classifiers.

fNIRS

Functional Near-Infrared Spectroscopy, or fNIRS, is the most recent and promising tool to test consumers' neurological responses to branded stimuli. Using optodes instead of electrodes, brain activity is measured through hemodynamic responses through light refraction associated with changes in neuronal behavior. This technology takes advantage of the transparent properties of human tissue to the near-infrared spectrum. Differences in the absorption spectra of deoxygenated and oxygenated hemoglobin allow the measurement of relative changes in hemoglobin concentration via light attenuation at multiple wavelengths. fNIRS has resolved previously existing specificity issues inherent in data capture. For example, EEG can only capture electrical signals at the surface (cortical) level of the brain. fMRI has poor temporal resolution; in that it is difficult to time lock changes in signal responses to a dynamic (e.g., video) stimulus. fNIRS, on the oether hand, maintains high spatial and temporal sensitivity. In the first published use of fNIRs within a shopping context, results suggested that merchandising communication strategies were processed and evaluated in two different brain regions, demonstrating the importance of different areas of the frontal lobe in evaluating merchandising strategies (Krampe et al., 2018). This study supports the use of fNIRs as a promising new tool to explore consumer behavior from a neuroscientific perspective in naturalistic environmental settings. A second study using a small sample of 32 participants demonstrated that fNIRS can monitor activations in the prefrontal cortex during purchasing decisions - informing predictive models of consumer behavior, such as the decision to buy a particular product (Cakir et al., 2018).

Implicit Association Tests

Implicit Association Tests (IATs) measure the strength of associations between concepts and evaluations. For example, an IAT may measure a consumer's association with a particular brand attribute such as quality or the emotions the brand elicits. Implicit responses (e.g., a positive association with a particular brand) typically influence an explicit response (e.g., button press), impacting the time it takes consumers to make the explicit response (Brunel et al., 2004). Myriad implicit and fast explicit response time measures exist and are in use in consumer research.

They vary in their implementation and the algorithms used to create meaningful differences in the associative relationship. Many firms have sprung up utilizing various forms of implicit responses, as the technique lends itself to desired scalable solutions for client-based research objectives. Gerald Zaltmann, an Emeritus Professor at Harvard University, is considered a pioneer in probing the unconscious, patenting the Zaltma Metaphor Elicitation Technique (ZMet) in 2001. ZMet is a method used to delve into the unconscious processes that drive behavior.

Other Measures

Along with the measures discussed in this chapter, others exist that have not yet become mainstream, including pupillometric response and posture change. Sentiment analysis from text scraped from internet websites, social media in particular, is widely used at present. Specific emotions are assessed and quanti-

fied to determine various expressed feelings surrounding branded content. While important and on the rise in brand research, these measures are not commonly used in consumer neuroscience.

Case Examples

The following examples are provided to showcase a small sample of research studies using the tools of applied neuroscience. A multitude of other studies have been published academically and in the NMSBA's InSights quarterly journal that covers both commercial and academic research ("INsights Magazine, NMSBA, 2019).

Advertising Delivery and Placement

The Advertising Research Foundation commissioned original research to understand, in a quantifiable manner, the extent to which in-moment brain and body responses change as a function of the type of placement and delivery vehicle used in advertising presentations (Clark et al., 2018). Using multiple measures, including heart rate variability, EEG's frontal alpha asymmetry, event-related skin conductance, facial affect and posture to assess the relative user response to varying advertisement placement and delivery vehicles on mobile devices, the researcher's goal was to provide the advertising industry with an objective and statistically driven means by which to reduce the most negative advertising experiences. Their work found that in-moment brain and body measures predicted what participants were willing to pay for ad-blocking software in a post-task recall of consumption experience. Interestingly, this research also showed that the most annoying and disruptive placement and delivery vehicles for ads actually negatively impacted the user's recall of the editorial content in which the advertisements were placed. This has meaningful implications for the value of editorial content in which the advertisements are embedded.

Crowd Emotion

In 2019, global research firm IPSOS teamed up with Shimmer Sensing (Dublin, Ireland & Boston, Massachusetts) to record simultaneous emotion-based responses from a crowd for each of the Super Bowl football game advertisements which are historically the most-watched advertisement spots in the United States (Venkatraman et al., 2015). Shimmer's NeuroLynQ® system had to process more than 300 million data points, and continually transmit the data from 37 sensors in real-time as the participants enjoyed a Super Bowl party for more than four hours. This passive evaluation of the audience provided affective crowdsourced rankings for each advertisement. This real-time assessment of multiple participants ushers in a new area of consumer neuroscience with an unprecedented ability in measurement capabilities. Typical applied neuroscience studies rely on serial processing of one participant at a time, which can be time-consuming if there are few research resources. Shimmer's NeuroLynQ technology is the first to break this serial testing, and it sets a new standard for vendors in a world where clients demand sufficient sample and fast turn-around times for research studies.

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Efficacy of Measures

Temple University researchers examined six different market research technologies in an attempt to validate their predictive ability for market-level data (Venkatraman et al., 2015). A systematic comparison of traditional self-report, implicit association testing, eye tracking, biometrics, EEG and fMRI was done to determine which measure performed better than self-report. fMRI was found that have the best ability to predict advertising effectiveness. Changes in activity in the ventral striatum were the strongest predictor of real-world, market-level response to advertising. Many in the neuromarketing industry took issue with this study, as each measure had its own optimal sample size and trial design. Many in the industry felt that the generalizations made across each measure's predictive abilities was not a fair assessment. One study using neuromeasures to predict one type of market-level outcome is simply not a sensitive means to generalize methodological efficacy, which the authors address. As many in the industry feel, there is no one silver bullet market research solution, and the best research begins with addressing the client's objective and working backward from there to determine which tools may best be used to meet that need.

Prediction

Prediction of future sales successes is made possible by harnessing EEG data. Novel computational approaches for extracting neurophysiological data from EEG, along with eye-gaze based metrics have been shown to predict population-wide behavior of moviegoers (Christoforou et al., 2017). This neural metrics modeling was performed on a small audience prior to an official movie launch and was shown to predict close to 72% of the variance of a films' performance at its premiere. This technique carries predictive information about a broader audience's decisions to watch a movie, above and beyond traditional methods.

In a different EEG experiment, researchers investigated whether different EEG neural activity signatures could predict future product preference (Telpaz et al., 2015). In this study, participants viewed individual consumer products in isolation, without making any actual choices, while their neural activity was measured with EEG. Following the EEG part of the experiment, participants were offered choices between pairs of the same products. Neural activity measured from a midfrontal electrode displayed an increase in the N200 component and a weaker theta band power, which were found to correlate with a more preferred product. The accuracy of EEG prediction in this study was dependent on both the ordinal and cardinal distance of the EEG data; the larger the difference in EEG activity between two products, the higher the predictive accuracy for participant's product choice.

Future Directions of The Field

"The Decade of the Brain" gave rise to faster neuroscience hardware and greater storage. Cognitively oriented neuroscience-based insights began to occur more rapidly and comprehensively than in any prior decade. Since then, the turn of the millennium has seen a proliferation of that early foundational work, and spawned not only advancements in research tools, but in the subfields and applications within neuroscience. Now, there is a strong foundation of integrated knowledge that combines cognitive, social and affective neurosciences, along with psychonomics.

The perfect storm of hardware, software and the growing acceptance of interdisciplinary discovery have culminated in the rise and strong future trajectory of consumer neuroscience as a field. With ever-

changing federal funding, private commercial sector grants are being sought out by those in academics to test commercially oriented products or advertising communications. The taboo that once existed in taking private funding has largely subsided, and in this age of transparency, data sets are often expected as a matter of course by the clients in order to append their own confidential data and create new comparisons in conjunction with the brain and body measures collected by consumer neuroscientists.

Where Standards and Ethics Meet

The future of consumer neuroscience in market research will continue to proliferate in applications and utility. Where once only the largest corporate conglomerates took the plunge in using academic and medical-grade tools that tap into the consumer's nonconscious, the value of consumer neuroscience has continued to grow, trickling down to smaller brands and across different verticals, such as hospitality, health care decisions and political communications. Methodology that was cost-prohibitive for market research budgets and was slow in turnaround times compared to client needs, consumer neuroscience research has become ever more attainable and on par with cost and turnaround times of traditional market research projects that use explicit measures of self-report. This speed and accessibility will continue to increase with use of automated web services and standardized I/O devices for data collection.

A means of vetting providers of consumer neuroscience will continue to be a critical challenge. Though the field is largely mainstream in the marketing and advertising research industries, there exists a spectrum of abilities across vendors of this research. Some vendors are reliant on one tool to answer all client questions, while other firms are more client-centered and have the means to integrate data capture solutions that will work best to meet client objectives. 'Off the shelf' technology will continue to improve, ever lowering the barrier to entry for collecting and processing nonconscious data. As such, quality control for companies offering neuroscience-based technologies will be measured not only for the quality of their data collection, analysis and interpretation, but also for their ethical practices and ability to relate findings across research paradigms.

The Neuroscience Marketing and Business Association (NMSBA) has already begun to take steps toward unified standards and ethics on the provider front (*NMSBA Code of Ethics—NMSBA*, 2019). In this Code, practitioners agree to adhere to several core principles, including assurance that no misrepresentation of insights be delivered to clients that cannot be backed by science and statistical evidence, that practitioners not act in any way that negatively impacts the neuromarketing research profession and that practitioners comply with the highest research standards and accepted scientific principles. Moreover, this code outlays aspects of practitioner credibility and accounts for a need to disclose protocols for dealing with incidental findings during fMRI data capture. That said, there is still great variability in the protocols used across industry with differing benefits to participant and neuromarketing firm.

In addition to core principles and credibility assurances, the NMSBA's code of ethics outlays the rights of individuals who actively consent to neuromarketing research participation. During the consent process, practitioners agreeing to the NMSBA's Code explain the tools to participants using lay terminology, assure participants are able to parrot back an understanding of the procedures and rationale of the research, are that participants are fully informed about the intention of the study. Participants are also assured that they have a right to withdraw their study participation at any time. The NMSBA's code requires consenting practitioners to maintain a privacy policy which is easily assessable to participants of a study, that participant's identities will be anonymous unless explicit consent is provided to wave that

right, and that personal information not be kept by the practitioner longer than is required to complete the research.

Those in academics focused on neuroscience, computational modeling or psychology are highly skilled in the theoretical underpinnings required to approach client-side initiatives. However, many lack the practical "boots on the ground" experience in industry work to generate pragmatic principles from the research, nor the tactical strategies that fall out of such principles, which are desired by the client. Further, academic turn-around times for the consent protocols in testing human subjects often come with unknown timelines, which clients are wary of in their research relationships. Finally, academics working on commercial ventures in neuroscience and across the sciences must be careful in their understanding of institutional conflicts of interest in who owns the data and the technical discoveries from the research.

The validation of non-conscious measurement techniques will continue to link lab-based findings to real-world and virtual contexts. Now, and into the future, adopters of neuromarketing must keep in mind that nonconscious measures are not free of bias or confounds; they are simply novel measurements compared to consciously derived measures traditionally relied upon in marketing research. Fortunately, the biases of conscious and nonconscious measures are complementary and can often work in synergistic ways to create a whole greater than the sum of its parts. Understanding how and why relationships vary between implicit measures of the brain and body and explicit responses from traditional self-report will allow for more accurate industry success metrics.

Future Technological Uses in Consumer Neuroscience

'Neuro' and 'Bio' software dashboards will increase in utility and function to generate insights based on a cohesive understanding gained only through the integration of data from multiple nonconscious streams. Dashboard style visualizations of success metrics will be generated from the processed signals of multiple measures. These measures will include: scalp potentials from EEG, heart rate variability from electrocardiograms, event-related skin conductance (ER-SCR) from galvanic skin conductance, the valence from facial affect, motivation proxies found in posture and pupillometric responses. Additional data sources will be included in the weighting of these success metrics, including genetic markers for predisposed traits and current emotional states.

These combined streams will allow for real-time, time-series analysis that will best predict an advertisement's ability to direct attention, arousal and engagement. Dashboards will encourage remote data analysis, allowing clients to upload prototypes of test materials such as package designs, television and web video-based content and narratives. "Stand-off" measures, or passive methods of data capture, will rapidly be developed and utilized for covert data collection of bio-measures from a large consumer body in real-world contexts (Clark, 2017). Developers of novel data capture techniques, such as thermal imaging and fNIRS or "functional Near-Infrared Spectroscopy," will advance the reliability and footprint of their tools. This will allow them to collect emotionally derived, nonconscious measures from a large subject pool at key moments in test environments (Balconi et al., 2015; Nishizawa et al., 2019; Zhang et al., 2017). Crowdsourced stand-off technologies such as thermal imaging will quite literally be able to assess the proportion of consumers who are "hot" for a product or message (Cardone et al., 2015).

Moreover, data will be linked in time to market level assessments of consumer behaviors. These combined data streams will work synergistically by measuring small consumer segments to extrapolate statistical correlational models linking to market level consumer behaviors. Small sample predictions for advertisement ratings, social shares, sentiment analyses, sales data, and even for the number of votes

focused on policy and politics, are now possible, but such algorithms continue to advance in their accuracy and reliability. With the integration of hold-out models and neural network artificial intelligence, we will continue to be able to extrapolate findings with more precision than historically possible.

Multisensory Persuasion

Advances in multisensory marketing and advertising communications will integrate theoretical neuroscience research focused on sensory perception and persuasion. Application of these theories will optimize the impact of polymodal sensory inputs on consumer choice. The modes of sensory communication will necessarily diversify traditionally visual and auditory-only modes of marketing and promotional content toward more diverse processing. Olfactory and haptic cues will grow in their importance to connect to the consumer. As the "Internet of Things" erases distance between the consumer and the point of purchase, choice drivers in the consumer's physical space will be facilitated by multiple routes of sensory persuasion. Within the right contexts, nonvisual sensory cues will enhance the level of processing for target products.

Smell

Olfaction, or "smell," is the only sense with a direct connection to the brain's limbic system and hippocampus; areas of the brain that have long been known to be involved in emotion and memory (Holmes et al., 2002; Rouby et al., 2002). Specific odors have been linked to brand preference and perceived quality (Bone & Jantrania, 1992; Labbe et al., 2006; Ramirez, 1993). A wealth of academic research has shown that the presence of specific olfactory cues effectively persuades consumers. Aromas that conjure the recall of childhood memories have been shown to facilitate the intention to adopt new or novel products (Ibrahim, 2015). Ambient scents have been shown to effectively impact consumers' spatial perceptions in retail environments, which in turn influence customers' feelings of power and, thus, product preference and purchasing behavior (Krishna et al., 2010; Madzharov et al., 2015; Morrin, 2018).

Haptics

Haptics refers to the use of technology that stimulates the senses of touch and motion, especially to reproduce in remote operation or computer simulation the sensations that would be felt by a user interacting directly with physical objects. Research pairing congruent visual and haptic information elicits stronger positive brand evaluations than low congruence conditions (Littel & Orth, 2013). Consumers have been shown to have preference for a "Need for Touch" (Jin, 2011). Tactile inputs in the consumer's interface with branded content plays a key role in consumer's evaluation of a product's substance properties. It has been shown that the weight of some consumer packaged goods is positively correlated with perceived price (Horsky et al., 2004; Piqueras-Fiszman & Spence, 2012). Vibrations, weight, relative hardness, and other touch-related cues remain to be explored by brands in their ability to persuade consumer choice. Brands first must understand where this sense can align with brand attributes to maximize the benefits of this sensory input. With the growth of mobile advertising, synchronizing the appropriate haptic responses breaks through the audio/visual barrier in the capacity to elicit the mobile user's attention. Aligning this technology in retail spaces through RFID has the capacity to communicate with consumers in this fashion at key geographical locations of interest.

The Right People in the Right Place at the Right Time

Collaboration will be a key to success for clients and consumer neuroscience vendors. There will be a growing need for intermediary firms that will serve as a conduit for understanding holistic and specific business objectives. These firms will work as translators, working at a consulting level, to assist the client in asking the appropriate questions of such measures. They will be able to identify and apply suitable methodological combinations and research designs to address such issues. These firms will serve as a conduit, having the ability to integrate data from a variety of suppliers. They will be able to meaningfully synthesize existing data from client-side with these original neuro-driven sources.

Adopters of applied neuroscience and psychophysiological methods will increasingly require interpretation of new data types, not merely collections of indices or report cards of statistical differences. To that end, a new breed of client-side consumer insights professional will be required. These specialists will have the technical competency to access and apply nonconscious data beyond the reporting of a consumer neuroscience suppliers. They will identify insights that are relevant in advancing company initiatives and client's return on research investments. Such trained personnel will be necessary in-house, or through access to consulting partners, who can take control of the massive amounts of data into meaningful storylines and actionable insights. They will act as interpreters and integrators of bio-measures with traditional measures to uncover nuggets of insight that marketing and advertising industry executives can easily digest and apply. These individuals will be charged with creating meaningful connections between two crucial ROIs: 'Regions of Interest' as it pertains to neuroscience-based research and 'Return on Investment' as it relates to holistic research initiatives.

Currently, the availability of such subject matter specialists is scarce and may come at a premium for the near term. Most existing candidates are already engaged on the supplier side or entrenched in academia. However, with the continued proliferation of training and certification opportunities through accredited undergraduate degree programs, business schools and industry-sponsored initiatives, the burgeoning interest of students in consumer neuroscience will translate into a healthy supply of neuro-insight specialists.

SOLUTIONS AND RECOMMENDATIONS

Most critical to the success of the field of neuromarketing is the necessary generation of empiricist-driven links between brain and body measures and consumer behaviors. As these links become more evident, our understanding unconscious emotional arousal, motivation and valence will be able to predict behavioral outcomes more precisely and reliably than ever before. Bridging this gap between bottom-up neural and physiological responses to accurate top-down market level predictions will require more data points along the path. Now with more wearable and stand-off measures present on the consumer and within the consumer environments, these connections and their causal chains will only strengthen.

As brands grow in their ability to communicate with neuroscientists and statisticians, a greater pragmatic efficacy of brain and body measures will be possible. Advertising creatives will integrate their learnings from neuromarketing and consumer neuroscience to generate more persuasive visual and sensory content as well as to create more effective framing of messaging to best communicate with target consumer segments.

Applying knowledge learned from data streams collected in the moment during an experience will continue to allow brands an ability to tighten communications for better audience engagement with content. Further, use of implicit response time measures will continue to grow in utility to aid brands in understanding their iconic brand assets at a new level of sensitivity.

The author of this chapter recommends the increased use of mixed methods research designs to advance statistical models related to behavioral outcomes. Convergent and divergent patterns of activity will occur across data captured through different methods, resulting in more robust classifiers of consumer responses to branded content. As these meta-metric relationships are learned, a greater sensitivity in our understanding of the processes that precede behaviors will grow. As these processes are better understood, strategies, principles and related rule-based tactics will be defined to influence those priors that occur upstream of consumer behaviors.

FUTURE RESEARCH DIRECTIONS

Several advancements in information processing, data capture and scientific theory have created the perfect storm to advance the fields of neuromarketing and consumer neuroscience beyond what was once thought possible. Moving forward, data streams captured from the brain and body will not require tethered equipment such as sensors attached to consumers to monitor their central and periperal nervous system responses to branded content. Stand off measures such as video-based facial identification and thermal imaging will be used as measures to assess consumer responses at a crowed level. Further, more sophisticated analysis abilities, such as a growing understanding of measures of neural synchrony, will redefine current definitions of attention and engagement. And with the growing pervasiveness of wearables, such as activity trackers, a vast amount of continually collected data will provide enough sample for deep machine learning algorthims unprecedented classifications and predictions of consumer behavior. The renowned science fiction author, Arthur C. Clarke famously posited that: "Any sufficiently advanced technology is indistinguishable from magic." In the coming years, practitioners and clients using neuroscientific techniques will most certainly demonstrate that what looks like magic in the industry today, will be considered the indispensable conventions of tomorrow.

CONCLUSION

While consumers have the ability to actively and rationally deliberate on every consumption decision made during each waking moment, they simply do not have the cognitive resources required to do so. Consumers are predisposed to conserve their mental resources. Instead, they use automated decisions, such as cognitive biases, or psychological nudges, for cognitive efficiency to highlight specific characteristics of the choices to be deliberated on. Consumer decisions are predominantly driven by feature-based information that garners their attention and emotions that drive their engagement with branded content or products. Consumer memory of past consumption behaviors is weak and often biased by recall of experiences and emotions at the time that they are queried. Consumer's anticipated consumption behaviors are idealistic and optimistic but frequently succumb to other factors at the point of purchase, even if they are not able to articulate why their behaviors didn't align with their intentions. What's more, consumers are not very good or specific at reviewing past decisions with great detail.

The neural processes that accpmpany consumer decisions changes as a function of how information is presented, by personality and affective states, by time and space and by social interactions. Consumer neuroscientists have an unprecedented ability to quantify and categorize in-moment, attention and engagement towards branded content that can then be connected to predictions of consumption behaviors at a market level. While there are no silver bullets in assessing branded content, the application of theories borrowed from neuroscience, decision making, vision, and emotion together with the data streams of consumer neuroscience, provide a powerful tool to understand consumer's judgments and decisions surrounding consumption behaviors. As the futuristic author William Gibson famously and frequently said, "The future is already here — it's just not very evenly distributed." This can clearly be said about the use of applied neuroscience tools to measure the consumer.

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KEY TERMS AND DEFINITIONS

Cognitive Neuroscience: The scientific field that is concerned with the study of the biological processes and aspects that underlie cognition, with a specific focus on the neural connections in the brain which are involved in mental processes.

Consumer Neuroscience: Is the combination of consumer research with modern neuroscience. The goal of the field is to find neural explanations for consumer behaviors. Unlike traditional market measures which rely on conscious recall of past experience or deliberative beliefs regarding future behaviors, consumer neuroscience relies on in-moment measures of central and peripheral nervous system processes that often occur outside of conscious awareness.

Crowd Sourced Data: Data simultaneously collected across a group of individuals.

Decision Making: The ability to make choices in certain and uncertain conditions.

Electroencephalography (EEG): EEG is a test used to evaluate the electrical activity in the brain. An EEG tracks and records brain wave patterns that are highly time locked to a stimulus

Emotion: A natural instinctive state of mind deriving from one's circumstances, mood, or relationships with others.

Empiricism: The theory that all knowledge is derived from sense-experience. Stimulated by the rise of experimental science, it developed in the 17th and 18th centuries, expounded in particular by John Locke, George Berkeley, and David Hume.

Environmental Psychology: An interdisciplinary field that focuses on the interplay between individuals and their surroundings.

Facial Action Coding System (FACS): Refers to a set of facial muscle movements that correspond to a displayed emotion.

Facial Electromyography (fEMG): Facial EMG refers to an electromyography (EMG) technique that measures muscle activity by detecting and amplifying the tiny electrical impulses that are generated by muscle fibers on the face when they contract and relax.

Focus Groups: A demographically diverse group of people assembled to participate in a guided discussion about a particular product before it is launched, or to provide ongoing feedback on a political campaign, television series, etc.

Functional Magnetic Resonance Imaging (fMRI): Functional magnetic resonance imaging or functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow. This technique relies on the fact that cerebral blood flow and neuronal activation are coupled. When an area of the brain is in use, blood flow to that region also increases.

Functional Near Infrared Spectroscopy (fNIRS): Is a non-invasive imaging method involving the quantification of chromophore concentration resolved from the measurement of near infrared (NIR) light attenuation or temporal or phasic changes.

Haptics: The use of technology that stimulates the senses of touch and motion, especially to reproduce in remote operation or computer simulation the sensations that would be felt by a user interacting directly with physical objects.

ISDN: Interdisciplinary symposia for decision neuroscience.

Judgements: The ability to generate estimates (guesses) regarding magnitudes and probabilities.

Neuromarketing Science and Business Association: Global organization aimed to increase awareness and utility of applied neuroscience across various commercial sectors.

NMSBA: Neuromarketing Science and Business Organization.

Olfactory Cues: Chemical signals received by the olfactory system that represents an incoming signal received through the nose. This allows humans and animals to smell the chemical signal given off by a physical object.

Psychonomics: The science of the laws relating the mind to the organism's internal and external environment.

Sentiment Analysis: The process of computationally identifying and categorizing opinions expressed in a piece of text, especially in order to determine positive, negative, or neutral attitudes associated with test element.

Skin Conductance: The psychophysiological phenomenon that the skin momentarily becomes a better conductor of electricity when either external or internal stimuli occur that are physiologically arousing.

Somatic Marker Hypothesis: Feelings in the body that are associated with emotions, such as the association of rapid heartbeat with anxiety or of nausea with disgust that strongly influence subsequent decision-making.

Stand-Off Measures: Measures captured from the consumer without having to physically touch the individual's person. Examples of stand-off measures include video and thermal cameras.

Thermal Imaging: the technique of using the heat given off by an object to produce an image of it, or to locate it, or to detect changes in health or emotion associated with a given stimulus.

ENDNOTES

[1]   Sands Research, El Paso TX, Shimmer Sensing, Dublin Ireland & Boston, MA, Innerscope Research, Boston MA, Olson Zaltman, Pittsburgh, PA, The Brighthouse Institute (defunct) Atlanta, GA

[2]   Perception Research Services, Teaneck, NJ Merchant Mechanics, Hanover, NH, Emsense Chicago, IL (defunct), Neurofocus, NY, NY

[3]   Headquarters Utrecht, The Netherlands.

Chapter 11

A Neuromarketing Perspective for Assessing the Role and Impact of Typefaces on Consumer Purchase Decision

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ABSTRACT

Given increasing knowledge about how consumers communicate with texts, our understanding of how brain processes information remains relatively limited. Besides that, in today's world, advancing neuroscience-related technology and developments have changed the understanding of consumer behavior. In this regard, in the 1990s, consumer neuroscience and neuromarketing concepts were revealed. This new concept has brought a multi-disciplinary approach and new perceptions of human cognition and behavior. For measuring consumer behaviors through a new alternative method, research has started combining traditional marketing researches with these new methods. This chapter explores how typeface knowledge from the brain functions using neuroscience technology and the importance neurosciences methodologies have for readability research. Moreover, this chapter will evaluate how typefaces affect the purchase decision of the consumers and offer an integrative literature review.

INTRODUCTION

The reflections on the impact of the globalization process on social life and the rapid development of technological change have affected marketing efforts and forced them to develop. Conscious consumers, intense competition environment, and market dynamics among businesses cause inadequate marketing strategies and traditional research techniques and unsuitable marketing strategies.

In today's world, neuroscience has advanced conventional marketing research, increasingly providing indications that emotions and subconscious responses can strongly impact perceptions and decision-making of consumers (Mileti et al. 2016). Consumers almost make their purchasing decisions in line with their perceptions. The real perceptions of consumers are formed as a result of their needs, wishes, values, and personal experiences. For this reason, it is thought that it will be better for companies developing in recent years to pay more attention to consumers' perceptions in strong marketing departments. It is also essential for marketers to understand the concept of "perception" because consumers make decisions and act in line with their perception of reality (Rani, 2014).

Researchers have been using neuroscience techniques to facilitate their product development and marketing/advertising endeavors for decades (As cited in Spence 2016, Krugman, 1971; Weinstein, 1981; Weinstein, Drozdenko, & Weinstein, 1984). It became difficult to understand human behavior and purchasing decisions with traditional methods and analysis. The hypothesis, which assumes that consumer behavior is rational, has lost its applicability. Consumers are irrational while giving decisions (Kahneman, 2011).

In this context, to have a better idea of the consumer's mind plays an essential role in designing marketing strategies. Furthermore, using neurological tools in marketing makes it easier to predict consumer behavior. Some researches provide evidence that typefaces convey meanings that influence important marketing constructs, and they influence how consumers perceive brands and also what they remember about brands (Childers & Jass, 2002). Some other researches also prove that people tend to match tastes with shapes (Velasco et al., 2014a, 2015), such as angular shapes with bitter-tasting foods, round shapes with sweet-tasting foods (Deroy & Spence, 2013). Moreover, others show that consumers can get affected by the graphic design of the product easily. Brands show a unique personality on the product that they represent.

The advertising industry is growing day by day, and it increases its importance in individuals' lives by feeding on different fields. "Creativity" and "difference" came to the fore with the diversification of channels and enrichment of advertising application areas. (Göksu, 2016). So that, they differ from each other by their strategies in the market (Genç &Arslanbaş, 2018). The designer of the brand logos focuses on the population that they appeal to and their needs and desires to be able to attract their attention and persuade them. Font types can convey various feelings to consumers, such as peace, trust, cheapness, luxury, etc. For example, tourism logos of the countries are generally designed using Sans Serif font types, because they represent the modernity, timelessness, and naturality (Ersan&Çeken, 2017). However, the main problem is, despite all these opportunities and technologies, neurotechnological studies are not turned to good account. Besides the cost, another reason can be seen as the lack of awareness of its effects.

This chapter offers a literature review of the effects of typefaces on consumers' purchase decisions from a neuromarketing perspective and emphasizes the importance of this field. On the other hand, the aim of the research to prove that neuromarketing tools can be essential for analyzing customer's reactions in order to apply sustainable and more analytical marketing assessments. Initially, under the literature review, neuromarketing and typeface notions have been evaluated, and then the impacts of typefaces on consumer purchase decision has been expressed with anent samplings.

NEUROMARKETING PERSPECTIVE

The marketing approach that takes/covers intellectual processes of the customer more extensively with the help of biology and neuromarketing disciplines gain marketing researches a new dimension and enables us to capture more realistic insight into buyer's mind, to optimize marketing communication practices considering this data and lastly to feature our product and brand on the market with more efficient strategies. The emotional and reasonable perception systems convey purchasing behavior. For this reason, Platon's philosophy forms the concept of neuromarketing. Neuromarketing's development as an independent science covers a long process.

With the developments in brain scanning technologies, the number of studies to discover the human brain is increased. All these developments contributed to neuroscience and cognitive psychology disciplines to explain the meaning of the consumer's black box. These two disciplines came together to contribute a paradigm (Gordon, 2002). This paradigm has generated neuromarketing, which is known as consumer neuroscience. Neuroscience tries to understand the effects of the unconscious on behavior. Neuromarketing, which uses the principles of neuroscience on marketing researches, became an important and fast-developing area of the marketing research industry (Treutler et. al, 2010).

Traditional marketing researches cannot provide results good enough in analyzing consumer purchase decisions along with economic progress. The reason behind this is the fact that individuals make their decisions when auto-pilot is engaged, which applies to 99% of their everyday lives. In other words, 99% of the decisions made are unconscious (Özkardeşler, 2018). Neuromarketing aims to understand how the consumer decides to buy in daily life rather than according to which reason they decide to buy (Çubuk, 2012). The most important characteristic of our subconscious is that it records every event, process, or fact that our consciousness is unaware of it. The neuromarketing approach aims to send a message to our subconscious, and it is measured how the purchasing process is affected by using the data that have been sent (Ceylan & Ceylan, 2015). Subliminal stimuli that influence purchase decisions by affecting our primitive brain are classified as follows: self-centered approach, opposition, concrete finding, beginning and ending, and lastly, emotions.

Neuromarketing, as interdisciplinary studies focus on the part of the human brain or center, becomes active, and the chemical change in the human body while the consumer faces marketing stimulus. Neuromarketing makes it possible to measure three critical parameters that have vital importance in neuromarketing in terms of consumer behavior: attention, emotional commitment, and retention. The measurement of the attention of a consumer to advertising that he/she is watching or the attention that he/she is attaching to a shelf while walking in the supermarket, the facts that the consumers are afraid of or love, a part of an advertisement or a picture remembered by the consumer are the examples of these parameters (Aytekin&Kahraman, 2014).

Brain scan analyzing methods have been used since the 1990s to measure product choice, advertising effectiveness, brand loyalty, etc. It is considered to be more effective since it is easier for consumers to explain their feelings and experiences rather than they can where the psychophysiological and linguistic stimuli are being used (Utkutuğ&Alkıbay, 2013). If we see through the whole process from the beginning to the end, we can say that typography has become to lessen its artistic side and begun to be used in our daily life and with the neuromarketing researches, it has increasingly become a customer-oriented mass media. The wide range of analysis and opportunities for neuromarketing have allowed researchers to expand their typeface research.

MEASUREMENTS IN NEUROMARKETING

Neuromarketing which is a very useful tool to use in typeface researches, with its definition as "a way of the understanding consumer," It makes possible to analyze the consumers' reactions to the brands and their font types used for logos to be able to understand their thoughts and sensations accordingly (Valencia, 2016). Considering the belief that the consumers' names represent their personalities, the companies' names and logos are designed with the purpose of representation, as well. Creating a connection between consumer and brand is determined, and the brands are generally successful in achieving it because generally, consumers can relate the product that they use (Zurawicki,2010). Since neuromarketing has a vast analyzing field and opportunity, the researchers can benefit from it to extend the typeface researches.

In order to explain the concept of neuromarketing more clearly, it is useful to know what brain scanning methods are used in neuromarketing. In addition, neurometric measurements should be supported by biometric measurements to determine the specific meanings of emotional data. The most commonly used techniques in the field of neuromarketing can be grouped into two main groups. These techniques are; physiologically based biometric measurements that record the physiological responses of the person against stimuli such as facial reading and facial expression (eye coding), eye tracking (eye-tracking), galvanic skin permeability, and fMRI (Functional Magnetic Resonance Imaging), EEG (Electroencephalogram) against stimuli such as it can be expressed as neuroscience-based neuroimaging techniques that record neural movements in the brain (Valiyeva, 2015). Neuromarketing studies include studies in which physical reactions of subject groups are measured using various technological tools in a laboratory setting. In these studies; With the Skin Conductance Response (SCR), Galvanic Skin Response (GSR), Pupil Dilation Response (PDR), Electroencephalographic (EEG), and Functional Magnetic Resonance Imaging (fMRI) technique, it is observed which consumer reacts to which creative through their brains (Salman & Perker, 2017).

One of the main advantages of EEG for marketers is its relative inability and portability (Düzgün, 2016). With the portability feature, EEG will eventually open the way to take measurements without being noticed by people. PET and fMRI methods provide better spatial resolution than EEG, but have poor temporal solubility.

CONCEPT OF TYPEFACE

Before explaining the concept of typeface, it is necessary to define the differences between typography, font, and typeface. According to Merriam Webster Dictionary font is described as an assortment or set of type or characters all of one style and sometimes one size. "The typeface was defined as the face of printing type." Typography was explained as 'the style, arrangement, or appearance of typeset matter.'

Typography is a technic that provides us to communicate via visual media, which are the words combined with the letters and the visual combinations of those words' sequences (Yıldırım, 2012). Scholars apply it via font type, point size, line gaps and lengths, and other variables. It can convert any message into effective forms by pepping them up. Typography is everywhere at any time. There are more than one hundred thousand fonts around the world (Garfield, 2010). The researchers continuously encounter with typography not only on the publishings such as books, newspapers, and magazines but also on bills, price labels on foods, also on the signboards on streets and T.V. and the internet. Consumers ignore or do not realize them (Samara, 2004).

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Promotion activities through sales started increasing at this time. In the 1950s, the "marketing" approach to consumers' needs and wants was dominant. According to this approach, the "quality" of goods and services was at the forefront. From the 1990s until today, the "customer-based" approach is ruling the marketing world. We can come across with the customer-oriented approach in every field from global companies such as Ikea to Obama's election campaign. During this process, customer databases are formed, researches about consumers' desires and needs are made. (Demirtürk, 2016).

Cave or rock paintings are paintings painted on cave or rock walls and ceilings, usually dating to prehistoric times. When we analyze the history of visual media, we come across with cave drawings. Cave drawings are one of the most primitive communication media for humans who need to be social instinctively. By those drawings, our ancestors left a historical legacy to us, communicated with each other and us, at the same time, they took the first step for the history of writing. So that they permanently narrated the information about their daily life and their experiences. (Gümüşhan, 2018).

Thereafter, the drawings on the cave walls started to evolve to the symbols that are called pictograms when little tribes expended to communities. At this stage, the pictures of the object were being drawn, and the thoughts were being symbolized. We see the first examples of the pictograms in Mesopotamia and Egypt in 3500 B.C. (Gümüşhan, 2018). Total symbolization of the writing started with Sumerians' invention, cuneiform scripts. In the following process of this history, the characteristic forms of writing traced to typography examples which were improved thanks to calligraphy to be able to get the Latin alphabet more esthetic look and exercise power ower the readers.

Typography, which has 568 years of history, had first emerged in 1450 when Gutenberg converted a grape wringing machine into a printing machine, and this multiplying method has developed and survived until today (Metin, 2008). The books have become cheaper and more available thanks to Gutenberg. It is believed that Gutenberg applied approximately 300 different shapes of letters for 1282 papers of Babel that he published between 1454 and 1455. The texture is the first font of the world that Gutenberg has invented (Garfield, 2010). The first font of the world is seen in Figure 1. below.

Figure 1. The First Font of the World
Source: Garfield, 2010.

The handwriting books before printing were generally written in Gothic or Blackletter forms. These illegible texts did not have oval-shaped forms, and the characters were written by an edged pen. Consequently, first vertical forms were noticed on a general page layout. For instance, "m" occurred when "n" and "i" became side by side. During the renaissance period, which lasted in the 14th and 15th centuries, instead of using Gothic font, more oval and larger font types were developed, and they were named Humanist (Metin, 2008).

During the transition process from handwriting to printing, print house owners were providing spaces for illumination and printing the text seen as if it was handwriting to be able to compete with the calligraphers (Metin, 2008). In the 1470s, people showed a tendency to the Roman alphabet by getting inspired from Italian calligraphers.

Blackletter or Gothic letters lost their popularity when the Roman alphabet became widespread. These kinds of letters are used only on some buildings and newspapers (The New York Times), signboards in the glorious and flashy places where the tourists visited mostly, and by heavy metal bands (Garfield, 2010).

Both social and political actions and economic causes have led to developments in font types. In the 20th century, radical changes can be seen in the design and accordingly in typography. One of the most crucial change is the Sans Serif font type. Although the first Sans Serif font types were designed at the beginning of the 19th century, they became widespread in the 1920s and '30s. It is thought that Caslon Egyptian, designed in 1816, is the oldest Sans Serif font type. In the 20th century, the German Nazi Party was using Blackletter against Roman letters. In January 1941, Gothic and Blackletter's usings were prohibited by the law. These fonts were started to associate with Jewish people (Dabner et al. 2010).

Many trends that started in the Modern era developed their own font types, which reflect their utilitarian approaches to the design (like German Bauhaus School). These trends were generally interpreting the thing's beauty to its practical function. Designing the font type as Sans Serif meant that getting rid of unnecessary calligraphy because it made the font's geometric form more noticeable (Usta, 2005). On the other hand, Francesco Griffo invented Italic font in the 1500s while he was looking for a method to write the book's pages condensed. In another resource, the owner's name of this invention is Aldus Manutius (Hyndman, 2015).

The functionality of the typefaces appeared within the scope of legibility increased in the 21st century (Yıldız & Keş, 2017). It is provided by the users to read and detect fonts in various usage areas effectively. Accordingly, an environment of easy transmission of the message was born. Thanks to the arrangements that reveal both the aesthetic value and functionality of the typefaces, the use of fonts has increased. Thus, it is seen that millennium fonts are among the best-selling, fonts such as Helvetica and Univers.

When we analyze the history of typography in the technology field, we realize that the designers focus on drawing consumers' attention. The most famous example of that is Steve Job's Machintosh. He used calligraphy on a computer having aesthetic concerns. He got the chance to use the information on Machintosh that he learned thanks to calligraphy lessons that took after dropping out of the university while he was designing it. By that, he was the first one who designed the computer that has impressive typography. Consumers demand that the electronic product that they use to be fully equipped; however, at the same time, they care about its esthetic form. Steve Jobs presented the first computer with typography to us by considering those aesthetic concerns (Kopuz, 2018). Therefore, the development of typography has started to proceed in history with computers of one of the most innovative companies and spread all around the world. People, especially the young population, began to convey their messages by using font types via technological channels.

Personality of Typeface

Typeface plays a considerable role in our daily lives, and all of them have different characteristic features. Some of them indicate simplicity, elegance, solemnity, etc. while some show extravagance, enthusiasm, and passion. Some are subtle with their meanings; some are very overt. We can categorize them as serif, which is designed with decks at the end of a stroke of the letter and signalize conservativeness and traditionality, opposite to that sans serif, which does not have decks and signalize modernity and contemporaneity (Belluso, 2015). The examples of typeface do an amazing job of showing their character and defining their font personality. Although there are some incompatibilities in past studies and researches, show that typeface has different personalities, and it is undeniable that they play a role in our lives about making decisions.

Different researchers studied the personality of typeface and defined them in different ways. In early times, Poffenberger and Franken described twenty-nine typefaces during their research as dignity, cheapness, luxury, economy, strength, etc. Following that, Spencer treated in his book that typefaces might be grouped as luxury/refinement, economy/precision, and strength. Besides, some researchers worked on typefaces specifically instead of categorizing them like Kostelnick and Dragga. They defined Times

Figure 2. The Book Cover of Men Are From Mars
Source: https://www.amazon.co.uk/Mars-Women-Venus-Communication-Relationships-ebook/dp/B006UN3K4O

New Roman as "bookish and traditional while defining Bodoni as "dramatic and sophisticated." Additionally, some of the typographers suggested the specific typefaces contributed to cultural and national characteristics such as Caslon for England, Garamond for France (Li, 2009).

"The perfect thing in Helvetica is its gap opportunities between the letters – and this provides a flowless form. However, it is generally unprincipled, just like a beautiful human being." Keith Godard (Usta, 2005). John Gray chose the font type in his bestseller book Men are From Mars, Women are from Venus considering the gender.

As can be seen in the image, for men Architecture font, for women Centaur font have been chosen. The reason is that Architecture font has a tough, ruthless with a little space era styled character while Centaur font is extremely attractive and elegant with its delicate and attentive calligraphic shape. It is thought that well-rounded and prominent fonts are generally masculine; fanciful, thinner, more curved fonts are feminine (Grafield, 2010).

The Sense of Typeface

The human brain is a mechanism that tries to sense the visual things and categorizes them and then keeps the information as the experience so that it can use them afterward. The way of sensing and attributing a meaning to the typefaces is a conclusion to that process. Researches show that it is not only the meaning of a word that reacts in our brain to sense it but also the character of the typeface.

In the study that they conducted, they showed some words written by using specific fonts to the people to pair them with "heavy, light, slow, fast" terms. They were supposed to use right and left keys to pair them and press the right key when they feel the word was light and fast. If the word was heavy and slow, they had to press the left key. This experiment presented that people sensed Palatino Italic as "fast" and Cooper Black as "slow" (Doyle & Bottomley, 2004). With this study, it is proven that the font type also has behavioral traits in the sense of the human brain. Thus, it cannot be denied that the sense of typeface has a negative or positive impact on the consumer and their behaviors. Thanks to the researches in this field, it is possible to say that the companies are aware of this, and the relationship between the sense of consumer and purchasing will increase.

Font type designer Sarah Hyndman (2016) who describes us as "type consumers" narrated in her "Why Fonts Matter" book that consumers encounter with hundreds of font types on a day and "consume" them in some way. The author indicated that we perceive the font types instinctively with the effect of our experiences in the past and act by their reference points. Font types play a huge role in our lives. They keep us "safe" with warning signs on streets, "direct" us with the signboards, "teach" us with the books and articles. They provide us with understanding if a product is sour, hot, or sweet without overthinking. Besides, they automatically inform us about features of elements in the physical world – "expensiveness-cheapness," "fastness-slowness," "heaviness-lightness." Most of the brands are working on sticking in the consumer's mind easily by being simplified. We can observe this change by analyzing the logos of the brands such as Facebook, Twitter, Instagram and Google from the past to the present.

Ikea was overreacted when they changed the font type from Futura to Verdana, in 2009. Consumers reproached Ikea because of using Verdana, which was, used everywhere. However, the brand's point was taking advantage of "everywhereness." As it is commentated in the document, directed by Gary Hustwit, about Helvetica font type, which designed by Max Miedinger in 1976, the world spread Helvetica font using trend from, started to use it in New York metro, has made it "trustworthy, honest, objective and friendly." It was designed so flawlessly that the designers find a new Helvetica font type member in every

other design as if it is not possible to design the better one. Ascribing an emotional meaning to the font types may make a person feel that the text written with that font is honest and fair.

Researches have shown that people think that the texts written using Serif font types have more "serious, important and correct information." They are identified mostly in the academy. Such that Phil Renaud got "A" when he used Georgia font in his articles while he got "B-" when he used Trebucket in his school years. Times New Roman was designed for inserting more texts in narrow columns. The reason might be that it is Georgia's Serif font and has a better readability score (Hyndman, 2015).

Sans serifs are accepted that more neutral. The study conducted by psychologists Samuel Juni and Julie Gross in New York University with 102 students has shown that Times New Roman has a negative impression when the students have rated as a satirical article happy or angry written with both Times New Roman and Arial fonts (Hyndman, 2015).

Geometric shapes involved font types that are identified with the subjects such as science fiction, and space (Hyndman, 2015). According to the researches in the past, we accept the traditional and familiar one more "reliable" while we "suspect" from the different and sharp typefaces. We also "dislike" the font types that are more dominant than the brand or the product (Garfield, 2010). It is determined with a study in 2015, making with 45.000 participants that the Baskerville is the most efficient font type (Hyndman, 2015).

THE IMPACT OF TYPEFACES ON CONSUMER PURCHASE DECISION

According to one of the first studies about the effects of typeface characteristics on consumer responses by Tantillo, Lorenzo-Aiss, and Mathisen (1995), Serif typeface is perceived as "more elegant, charming, emotional, distinct, beautiful, interesting, extraordinary, rich, happy, valuable, new, gentle, young, calm, and less traditional than sans serif typestyles. Serif styles have more personality, freshness, high quality, vitality, and legibility but the sans serif group is more manly, powerful, smart, upper-class, readable, and louder."

Childers and Jass's (2002) research shows that using a luxurious typeface used in advertisements increases consumers' perceptions of the luxuriousness of the advertised brands. According to Mackiewicz and Moeller 's (2004) study that focuses on the effects of typeface characteristics on typeface personalities, Bradley Hand is perceived as friendly and individual. Another research by Mackiewicz (2005) about the effects of typeface characteristics on perceptions of friendliness and professionalism, friendly typefaces are simple and imperfect and straightforward, on the other hand, professional typefaces show moderation and balance.

Similarly, Koch's (Koch, 2012) Paired T-test results as typefaces can affect the emotions. The participants significantly interested Helvetica Ultra Light (lightweight) in the sense of desire; Helvetica Bold (heavyweight) with fear; Helvetica Condensed Bold (narrow/condensed character width) with joy; and Helvetica Bold Extended (wide/extended character width) with fear and sadness. The typeface Helvetica Bold Condensed (narrow/condensed character width) was associated with fascination.

The interest can be undoubtedly increased by choosing a suitable typeface for a particular purpose. Some people have associated moods such as 'dreamlike' and 'ascending' with the curved, light, and possibly sans-serif type; Moods such as 'sad', 'dignified' and 'dramatic' are often matched to the angular, bold, and possibly serif type (Kastl &Child, 1968).

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The research shows that semantic associations can create perception through consumers' product evaluation (Fligner, 2013). 'The natural Typefaces' preferred in the product packaging creates a 'healthy' product perception and makes a desire for consumers accordingly. Thus, it is indicated that marketing departments for products with natural health benefits can strategically use natural fonts in their product packages to strengthen communication and persuasion. In all four studies, they showed that consumers are able to consistently determine the semantic qualities associated with a particular type of writing, and the connotations derived from the packaging fonts pass to the product perception and evaluation of consumers. For example, healthy products have been associated with 'naturalness'. Studies have shown that the typefaces produce connotations in the receiver. These findings suggest to marketers that packaging fonts should be chosen carefully so that the meaning of the font and the message to be delivered is aligned. In terms of creating marketing communication, the health-focused companies should consider 'locally grown' 'organic' and 'superfood' with simple writing (Liu et al. 2019).

The results obtained in the (Childers & Jass, 2002) study are stated to contribute to the development of information in marketing in various ways. Research has shown that typefaces should be considered as more than a design. Through semantically focused, the applicability of typefaces was examined indirectly. The result has suggested that these meanings are particularly beneficial in terms of marketing in delivering product benefits. Through consistent use, brand logos create meaning. Through steady utilize a typeface highlighted religiously in publicizing campaigns, a strategy favored by effective firms such as McDonald's and Volkswagen creates meaning. Through affiliations with real-world objects, the typefaces utilized on item bundling, in print advertisements, and tv commercials communicate really valuable advantage messages to customers. Typeface semantic hints have been shown to affect topics characterized by a high level of participation. Given the effects of a brand message on its content, it seems likely that conceptualization of typeface semantics as non-content clues can be questioned. Typeface semantics has been shown to affect consumer memory for brand benefits significantly.

According to the article that is called "The Colorful World of Marketing", people perceive the objects 3% by touching, 3% by smelling, 3% by tasting, 13% by hearing, 78% by seeing and the most critical factor that affects the purchasing decision in 9 seconds is the color." (Eti İçli, 2008, p.25). The color has a universal language around the world—for instance, red means attention all over the world (Çubuk, 2012).

According to the typography designer Sarah Hyndman's book, Why Fonts Matter and the results of her online typeface analysis on typetasting.com website, one of the most important visual factors that affect the decision mechanism of the consumer is a typeface. By changing our perception, they can make us think differently about a brand or product. All symbols, typefaces, and texts, which the consumers face from morning until evening, direct their decisions. People give meaning to shapes and typefaces according to their social and cultural standards. In this context, like Poffenberger and Barrows mention in their study in 1993; while sharp figures are associated with negative concepts such as anger, pain, and violence, the soft contoured figures are associated with positive concepts such as happiness, joy and sociable (Hyndman, 2016).

In a study called "The Type Taste," 12 typefaces are written both on carton cups and alone. In this study, the relation between the shape and the taste. Tastes are "sweet, sour, salty and bitter," The result of the study shows that the soft contoured typefaces are associated with "sweet," the angled ones are associated with "bitter, salty and sour." The second experimental group liked the cartoons more, which has soft contoured typefaces on, and they found them more accessible to be read. According to this study, there is a strong connection between shapes and tastes (Hyndman, 2015).

Figure 3. The Taste of Typefaces
Source: Hyndman, 2015: p.108

In another study conducted by psychologist Samuel Juni and Julie Gross, two articles written with Arial and Times New Roman were given randomly to 102 students of New York University, and they were asked to evaluate them. The articles which were written with Times New Roman were evaluated critically and aggressively. On the other hand, the articles written with Arial were found funny (Hyndman, 2016) Previous researches also prove that people tend to match tastes with shapes (Velasco et al., 2014) such as angular shapes with bitter-tasting foods, round shapes with sweet-tasting foods (Spence&Deroy, 2013). The latest research conducted by Schroll, Schnurr, and Grewal (2018) shows that using a handwritten (vs. machine-written) typeface on product packaging positively affects purchase behavior.

In the research (Skender, 2015), when the luxury brands' typefaces are evaluated, it is seen that typeface reveals a subtle emotional response to the viewer, who does not know the abstract connection between the font used and his positive emotions. Whether modern, retro, futuristic, gothic, or avant-garde, everyone has a choice. The use of Helvetica and Futura is remarkable in the advertising industry. The reason is that the writing looks clean, readable, and versatile. For Saint Laurent's logo, Helvetica NeueBold is selected. Nike's oblique Futura typeface verifies the quality of a pair of running shoes and classic hoodies. Thus, research impresses the marketing departments should take into account the importance of typeface and logo design in order to fit into the audience persona.

In the marketing world, one of the most important points in creating brands was to distinguish the brand and increase its recognition. O'neill (2016) argues that although many companies insist on using the 'Helvetica' font, and it caused feeling boring. So, many companies look at Futura logos to increase recognition. Due to the launch of Futura as one of the first geometric sans-serif typefaces, it also in-spired multiple repetitions in the font industry. As a logo, the font contains most of the features that make Helvetica so attractive for many brands - it is compatible with large-scale printing material and small mobile device reading. Futura seems to be used by many advanced organizations as well. It is an important opportunity for big companies like Google to choose Futura recently.

Eventually, consumers react to a product by checking the brand's logo and the shape of the letters on it at first. That means the representatives of the brands are their logos, which characterize the motto. As an undeniable consequence, it is clear that the first impression is always important when all the research-ers are considered. Typefaces affect the purchasing decision of consumers.

Figure 4. The Luxury Brands Typefaces
Source: (Skender, 2015). Typography In Fashion Design

TYPEFACES						
SERIF			SANS SERIF			
DIDOT	TIMES NEW ROMAN	CUSTOM	HELVETICA	FUTURA	ENGRAVERS GOTHIC	CUSTOM
BURBERRY	GUESS	ChristianDior	colette:	Calvin Klein	CHANEL	GIVENCHY
CAROLINA HERRERA	LANVIN PARIS	GUCCI	COMME des GARÇONS	CÉLINE	DEREK LAM	LACOSTE
EMPORIO ARMANI	Maison Martin Margiela	JIMMY CHOO	ELIE SAAB	DOLCE & GABBANA	MARC JACOBS	TOMMY HILFIGER
TIFFANY & CO.	MaxMara	PRADA	FENDI	ESCADA	PROENZA SCHOULER	
VALENTINO		ZARA	GIAMBATTISTA VALLI	JIL SANDER		
DVF		RALPH LAUREN	HBA	LOUIS VUITTON		
			ISABEL MARANT	NIKE		
			laura mercier	Supreme		
			MICHAEL KORS			
			NARS			
			SAINT LAURENT PARIS			
			TOM FORD			

A NEUROMARKETING PERSPECTIVE ON TYPEFACES

The world of marketing has recently started to use neurological tests more frequently to understand consumers better (Aytekin & Kahraman, 2014). Neuromarketing is the key to unlocking the subconscious thoughts, analyze the feelings, and observe the desires to drive the purchasing decisions we make each and every day of our lives (Lindstorm, 2008). Neuromarketing, which is described as the application of techniques used in neuroscience to understand consumer behavior in the field of marketing, has opened new ground for marketers. With Neuromarketing, it can be determined how the consumers react to a product or brand they see, an advertisement they watch, or in which region of their brains they act. This information can shed light on market developers, brand determination, pricing, promotion mix design, shop atmosphere, and effective sales. Thus, it is aimed to increase the chance of success by developing more effective marketing strategies. Also, the eyes are constantly in motion. Although some of these movements are conscious, most of them are unconscious movements. These scanning processes, which our eyes do not realize, offer some data (Toker & Sulak, 2018).

The first scientific Neuromarketing based study about the role and impact of typefaces on consumer purchase decision has been done by Özkardeşler (2018), specifies the role of typefaces used by individuals having enough purchasing power that is referred to as consumers in acting on purchase and to provide brand owners data regarding the use of typefaces. In the first study of Özkardeşler (2018), the typeface may be useful in the consumer's purchase decision according to specific consumer profiles. It

is thought that it will be inadequate to affect the consumer profile, which attaches importance to brand loyalty and does not take into account the issues such as packaging. The effectiveness of the typeface in the purchase decision is evaluated by determining the emotional responses and cognitive responses created by the stimuli prepared with the characters of Serif, Sans Serif, Handwriting / Script, and Other / Fun categories. Participants were asked to mark the product suitable for a particular adjective for each product in order to observe their preference. The result of th GSR data, Pearson's Chi-squared test, and Survey studies have been analyzed a whole; it is seen that data consistent with the research data for the previous writing character are obtained. For example, issues such as the expensive perception of handwriting typefaces and more preference and more reliable perception of a serif typeface, cheaper perception of sans serif remained valid. Despite repeating perceptual findings, certain judgments about purchasing behavior have not been reached. Thus, the study showed the importance of neuromarketing tools in order to analyze the vision of attendance.

One other study (Doğusoy. et al., 2016), examines proofreading fast in two different typefaces written text. One text was written in Serif typeface (Times New Roman), and other in San Serif (Arial) typeface. The main task of the study is to look for speed and accuracy of texts with previously added misspelled words. In the experiment, articles have no digital numbers or symbols, and each one includes 24 lines with double space, 12 font size. The experiment applied with measuring eye movements by using the Tobii 1750 eye tracker device in a laboratory setting. However, the result provided no significant result as considered the reason is limited participants. However, they have stated that, regarding the accuracy, participants found more dispelled words in sans-serif rather than serif typeface and completed in a shorter time.

Today, other traditional marketing techniques do not adequately respond to market demands (Abadiha, 2018); many trusted global brands have demonstrated the use of modern marketing tools and advertising to thrive in existing competitive environments. Regarding the high advertising volume that people deal with directly or indirectly daily, neuroscience and Neuromarketing techniques can be a powerful tool to help them better understand how to stay and stay in this hugely competitive market. According to his research Hyundai, Pepsi, and Yahoo is from the companies that start an experiment with EEG test to measure consumer awareness before productions. For example, Yahoo (www.yahoo.com) prefers san serif typefaces as "Helvetica" for macOS users and "Arial" for Windows users on the web portal. It allows a lot of content both in the legibility and in the text fields (Musayev, 2013).

In his study examining passive visual behavior modifiers and consumer psychophysiology, (Gault, 2012) indicates that the Red Bull logo's primary color is red, and it creates positive brand attitudes. Nevertheless, it is observed higher levels of activity in the frontal cortex when the logo switched into the gray colors. The reason is impressed the brand logo contains a bold san serif typeface.

Neuromarketing offers companies to find out how much the consumers focus on any image, how it connects with it, and how much it keeps in mind, even without asking a single question to the subjects. Think Neuro company, which conducts neuromarketing studies, analyzed the old and new logos of Star TV and Turkcell companies using the EEG device. Sixteen volunteers participated in the research, and 27 logos were shown, 3 seconds each, 4 of which are old and new logos of the companies. After analyzing the collected EEG data; It is observed that the new logo, which has little difference in terms of emotional interest among the old and new logos of Turkcell, has attracted the attention of consumers more. When the results of analyzing the old and new logos of Star TV are examined, it is revealed that the old logo is better than the new logo in terms of emotional interest and attention. This situation shows whether

consumers have suddenly removed the old logo, which has been emotionally connected with them for years (Aytekin& Kahraman, 2014)

In an experiment with using eye-tracking technique and overall speed, the metric has shown that (Beymer et al. 2008) serif vs. san serif detected no significant differences in the eye. Yet, the result is statistically insufficient. Eighty-two volunteers participated in the experiment. Three font sizes were applied as small (10 pt) medium (12 pt) and large (14 pt), and as a Typefaces Helvetica for the san-serif category, Georgia for serif category are preferred. Compared to the san-serif font Helvetica, the serif font, Georgia, was read 7.9% faster, but the difference was found insignificant.

Another eye-tracking study (Josephson, 2008) offers a different analysis of measured on-screen readability of four typefaces as Times New Roman, Arial, Georgia, and Verdana. Six participants are selected from university students in the USA. The eye-movement data were measured by using an ISCAN RK-426PC Pupil/Corneal Reflection Tracking System (ISCAN, Inc., Burlington, MA). The news story in Times New Roman, which has popularity in printed materials, was read within the same speed with the story in Verdana, including its legibility features.

Even though the research analyses the relationship between the topic and its typeface, interest with the participant, Verdana had the best result in faster reading speed and less regression.

Kravutske is also one of the proponents within the scope of typeface interest. The researches seek that typeface influences the reader's perception. The result of the Nelson- Denny Reading Test, it is indicated that typeface, serif or sans serif, does not directly affect reading comprehension and speed of reading. Rather than a typeface, the length of the text is a factor (Kravutske, 1996).

Another factor is, if a person is experienced in one typeface, finds the most congenial and comfortable (like newspapers, magazines, etc.). As Kravutske's cited: Poulton, 1965) shows that the highest comprehension rate is seen in sans serif Gill Medium typeface. What is essential in reading is its length and characteristic form rather than its constituent parts. As a particular parameter, serifs contribute to the shape of the word and can assist the slower reader.

SOLUTIONS, RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

When neuromarketing studies were examined, it was observed that reactions that cannot be revealed by methods in which advertisement activity is dealt with a traditional approach could be detected. If the evaluation is done during the exposure to an advertisement, it helps to detect what element is adequate to what extent. Depending on the qualifications of the device to be used in the study, the full version of consumer behavior in the brain can be accessed. For instance, brain monitoring researches conducted using FMRI provides more detailed results compared to researches towards vascular activity analysis on the grounds that it is a sensitive device.

Moreover, other tools such as electroencephalography (EEG) evaluates the brain wave motions using electricity, Eye Tracking which determines the duration, the place and the sequence of staring at a visual object, Galvanic Skin Response (GSR) which detects the alterations on the skin while a person is imposed upon stimuli and Positron Emission Tomography Device (Pet) that measures the blood pressure in cortex area to be able to evaluate the neural activities while fulfilling different tasks (Atlı, 2015). Evaluations carried out by verbal criteria cannot provide such data because research is done after being exposed to stimuli.

On the other hand, for problems in psychophysiological techniques to be solved, and consistency among data to be achieved, experimental designs where verbal criteria and psychophysiological criteria are used together are suggested. In this way, more efficient surveys can be developed, and more effective evaluations can be made (Utkutuğ & Alkıbay, 2013). Besides, the typographic characters have a direct impact on the memory of brands and perception. For this reason, the selected font should be chosen in accordance with the brand and the product, and its effect on the company should be measured. While making these measurements, it should be especially focused on the age group, sectoral integrity, target audience, and the sense in the brand.

For further researches, it is suggested that the importance of neuromarketing methods will increase, and they will provide detailed information about the consumers' insight by conducting a more comprehensive examination; researching only one gender, or a single product will provide a more detailed and action-oriented conclusion about consumer insight. As the one, another recommendation is the typefaces/characters used in the research can be enriched as a family of letters by trying many different combinations in different sizes and uppercase and lowercase shapes.

CONCLUSION

In this research, a review of scholarly literature on the typeface and neuromarketing was undertaken together with case studies. When the researches results are holistically analyzed, it could not be reached to a definite conclusion on the impact of typefaces on a consumer purchase decision. In the survey questions (Özkardeşler, 2018), individuals who do not prefer the same brand each time stated that they attach importance to the packaging and the typeface when purchasing the product. Considering the effect of typefaces on reading speed, retention and brand integration, it has been understood the place of the typeface in the mind of the consumer is very important. With the help of tools used in neuroscience, neuromarketing measures the consumers' brainwaves and reveals how consumers react to the messages given by marketers.

It is in question that an emotional bond between consumer and product/brand is tried to be formed, which is evident especially today. For this relationship to be described, there need to be methods that detect intellectual processes with all of its dimensions. Besides that, it is not known whether emotional reactions and cognitive reactions are formed independently from each other. It is advised to use psychophysiological techniques that can reflect both intellectual processes to gain insight into these types of reactions.

As a result of the researches, the physiological and neurological data of the consumers are recorded, and marketing activities are shaped in line with these data. While Helvetica font can be mentioned that luxury brands have been used predominantly in recent years, it has not been proved which neurologic effects they preferred as a result. However, it has been observed that eye-tracking programs can use effectively in this area, and more tests can be performed in the field of brain scanning. In consumers' purchasing decisions, the visual impression intensity once again emerged.

Neuromarketing research can be described as a strategic approach that will offer important advantages in strategic issues such as consumer purchasing behavior, product effectiveness, brand equity, brand value, degree of preference. The Eye Tracking technique, which started with a fixed system since it is a portable and wearable device, is more advantageous than other neuromarketing techniques with its wide usage area, low cost, and working system suitable for use with other techniques. If it is used during

the typeface preferences of the brands, with the correct, suitable, and variable parameters, this will let the brands have a head start on this competition. It should be noted that besides these neuromarketing tools, factors such as age, gender, society, cultural values, economic status are also effective. It is necessary to consider all the parameters as a whole, measure the brain waves of consumers, and observe how consumers react to the messages given by marketers.

This chapter is based on literature review and researches on typefaces that once have been approved. No single case of neuromarketing based study on typefaces made in Turkey found within the scope of detailed literature reviews. The findings of this study pose importance in that it contributes to Turkish literature in respect of neuromarketing, typefaces, and purchasing. This research shows that neuromarketing tools can be essential to understand consumer behavior better, and they generate more effective results when combined with the traditional marketing research techniques for providing complete information concerning consumers' decision making.

An essential path for the scientific community in neuromarketing studies will be to validate researches that have already presented exciting results because there are still no studies that systematically seek to replicate the results obtained, making it impossible to identify the qualitative accuracy of these studies. It is clear that neuromarketing methods are important to understand consumer purchase decisions, and they generate an important role concerning consumers' decision-making process. They should be used to help to advance the understanding of consumer behavior.

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KEY TERMS AND DEFINITIONS

Consumer Behavior: Consumer behaviour is the study of individuals', groups' and organizations' decisions with regard to the selection, purchase, use, and disposal of goods, services, ideas, or experiences to satisfy their needs and wants.

EEG: An electroencephalogram (EEG) is a test used to evaluate the electrical activity in the brain. Brain cells communicate with each other through electrical impulses. It can be used to help detect potential problems associated with this activity. An EEG tracks and records brain wave patterns.

GSR: GSR is a mobile device intended for measurement of Galvanic Skin Response using alternating current, and pulse measurement using reflectance method.

MRI: Magnetic resonance imaging (MRI) is a medical imaging technique that uses a magnetic field and computer-generated radio waves to create detailed images of the organs and tissues in your body.

Neuromarketing: Is a commercial marketing communication field that applies neuropsychology to marketing research.

Purchase Decision: Purchase decision is the thought process that leads a consumer from identifying a need, generating options, and choosing a specific product and brand.

T-Test: A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features. It is mostly used when the data sets, like the data set recorded as the outcome from flipping a coin 100 times, would follow a normal distribution and may have unknown variances. A t-test is used as a hypothesis testing tool, which allows testing of an assumption applicable to a population.

Typefaces: Letters, numbers and symbols in consistent type-weight and typestyle that make up a complete set or a distinctive design of a printing type such as Ariel, Helvetica, Times Roman and thousands of others.

Typography: Typography is the art and technique of arranging typefaces to make written language legible, readable, and appealing when displayed.

Chapter 12
Applying Neuroscience to Talent Management:
The Neuro Talent Management

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ABSTRACT

This chapter discusses the opportunities and challenges involved in combining the two fields of neuroscience and talent management (often abbreviated as TM), starting from the assumption that the need to merge them is justified by their complementarities, rather than by the level of analysis they focus on. The authors discuss potential benefits and drawbacks for management research using methods obtained from cognitive neuroscience. Firstly, they discuss distinct advantages in applying techniques allowing researchers to track processes that are essential to the talent management field, warning that neuroscientific approaches and technologies are not commonly used. Secondly, they define main problems, which describe the limits within which management scientists can usefully apply these approaches. Thirdly, they suggest a new perspective that incorporates the complementary capacities of managers and neuroscientists to generate useful information and perspective for both disciplines.

INTRODUCTION

Neuroscience can be defined as an investigation of the functioning of the nervous system and the brain. In other words, neuroscience is scientific research into functions of the nervous system (brain, spinal cord, and peripheral nervous system) (Gage, 2015). During the 20th century in the neurosciences, the individual was mostly treated as the fundamental unit of analysis, and the brain was thought to be a solitary information-processing organ. This is a starting point that is entirely understandable. In this period, the brain, the organ of the mind, is housed deep within the skull protected and isolated from others, as are the neural, genetic, and hormonal processes of interest to most biological scholars (Cacioppo, Berntson, & Decety, 2010).

Over the last few decades, technological and conceptual advances in neuroscience have begun to expose the internal functioning of the human brain (Boulder, Becker, Cropanzano, & Sanfey, 2011). In these years, the neurosciences have seen a dramatic increase in popularity across different social science disciplines, influencing social psychology, economics, organizational behavior, and marketing in particular (Holmes, 2014). Innumerous conferences, symposiums and publications of all sorts have been produced regarding the relationship between the brain and the human subject (Kraus, Panese, & Pidoux, 2013).

Enhancements in the neural processes accelerated by quantum leaps in imaging technology have enabled scientists to provide additional insight into the neurological dynamics of human interaction. From this point of view, theoretical foundations underlying organizational phenomena advanced through the incorporation of themes, methods, and findings emerging from neuroscience (McDonald & Tang, 2014).

Today, we are living in an increasingly 'neurocentric' world, a world in which knowledge and insights regarding our brain and its processes are expanding fast and have an increasing impact (University of Amsterdam, 2016).

Management scholars have realized the significance of neuroscience and human biology. Although empirical studies are sometimes limited, existing applications tend to fall into three categories: evolutionary psychology, behavioral genetics, and neurological and physiological changes. Every one of those concepts has presented scholars with a unique insight into the interaction between social neurobiology and work behavior. Organizational scientists recognize the importance of the social environment. Phenomena such as working climates and other aspects of the social environment have well-documented effects on employee attitudes and behaviors (Boulder et al., 2011).

In this regard starting from the late 1990s, for companies all over the world, talent management has been defined in broad terms as an organization's endeavors to attract, select, develop and retain key talented employees (Scullion, Collings, & Caligiuri, 2010). Thus, talent attraction, development, deployment, and retention became a crucial task in global business (Schuler, Jackson, & Tarique, 2011).

Neuroscience today provides powerful insight into cognitive and behavioral processes, the relationship between mind and body, and transforms the way we think (Vorhauser-Smith, 2010). Moreover, neuroscience offers the potential to advance our understanding of talent attraction, management development, and talent retention (McDonald & Tang, 2014). Applying Neuroscience to the practice of talent management can help companies do their human resources or talent management practices more effectively (Hills, 2012).

In this section, research questions that could be asked include; How can insights from neuroscience shape future theory and models in talent management? How should neuroscience methods be integrated into the research methodology of talent management? Can neuroscience and talent management help to evolve the discipline of neuro talent management with precision and reliability? Thus, how do neuroscientific tools help address practical talent management issues are a paramount question.

OVERVIEW OF NEUROSCIENCES

The term neurology is a specialized area of medicine that concerns disorders and diseases of the nervous system date back from 1681, and many neuro disciplines were coined in the 19th century, as did neuroanatomy, neurophysiology, neurosurgery, and others. However, the widespread interest in neurosciences and the emergence of new neuro-disciplines is comparatively new (University of Amsterdam, 2016).

In 1890, when Spanish pathologist applied a method developed by Italian doctor Camillo Golgi to stain nerve tissues, Santiago Ramón y Cajal to visualize the neuronal structures and morphology and its relation. Cajal, his students, and their followers produced a detailed description of the neurons and their connections, which suggested that the neuron is the functional unit of the nervous system (Gage, 2015).

In the mid-1960s, the term neuroscience was emerged to signal the start of an era in an interdisciplinary understanding of the structure and function of the normal and abnormal brain (Squire et al., 2008).

The modern era of neuroscience began with the development of tools and techniques used to measure in more detail the structure and function of the nervous system. In this context, an important development occurred in the field; in 1977, Dr. Raymond Damadian and his team invented the first MRI machine in a small laboratory in Brooklyn, New York. This was the birth of modern neurosciences (Vorhauser-Smith, 2010).

Neuroscience has traditionally been defined as a biology subdivision. It is an interdisciplinary field mainly related to several other disciplines, including mathematics, linguistics, engineering, computer science, chemistry, philosophy, psychology, and medicine. Many researchers believe that neuroscience means the same thing as neurobiology. Neurobiology, however, looks at the biology of the nervous system, while neuroscience alludes to anything that has to do with the nervous system. Today, neuroscientists are involved in a more comprehensive range of fields than before (Nordqvist, 2020). Neuroscience today spans a broad spectrum of research endeavors from the molecular biology of nerve cells to the biological basis of normal and disordered behavior, emotion, and cognition. Moreover, neuroscience is one of the most growing fields in science nowadays (Squire et al., 2008).

The emergence of neuroscience can be considered a significant scientific, social, political, cultural phenomenon in Western society since the 1990s, called "Decade of the Brain" by former US president George Bush. In 2014, former President Barack Barack Obama initiated the BRAIN (Brain Research through Advancing Innovative Neuroethologies) Initiative, connecting medical development with brain mapping, and a year later, he proposed a publicly funded research plan for the "Century of the Brain" (Kraus et al., 2013).

In 2013, the Human Brain Project (HBP) which strives to accelerate the fields of neuroscience, computing and brain-related medicine in the EU and similar endeavors in Japan, Brain/MINDS (Brain Mapping by Integrated Neurotechnologies for Disease Studies) is a national brain project started in 2014, the China Brain Project approved by the Chinese National People's Congress in March 2016 and in South Korea, the Korean Brain Research Institute was established in 2011 (University of Amsterdam, 2016). In 2014, Japan started a brain-mapping project called Brain Mapping by Integrated Neurotechnologies for Disease Studies (Brain/MINDS) (Okano, Miyawaki, & Kasai, 2015). Many symposiums and publications of all sorts have been produced regarding the relationship between the brain and the human subject (Kraus et al., 2013). All these examples show an emerging interest in neuroscience projects in countries across the developed countries in the world. While neuroscience is a major scientific undertaking in the 21st century, advances in basic research have not yet translated into benefits for society (Markram, 2013).

The neuroscience branches can be broadly categorized in the following disciplines, based on research areas and study topics below:

TALENT MANAGEMENT

The term "talent" has a long history, beginning with ancient Greeks and the biblical times (Farndale & Atli, 2016; Michaels, Handfield-Jones, & Axelrod, 2001) first dictionary definition of "talent" refers to "a denomination of weight, used by the Assyrians, Babylonians, Greek, Romans, and other ancient peoples." A talent became a monetary unit when the value was attributed to one talent of silver. The word "talent" entered English via the Bible. New English Bible translates the Greek word "talent" with the word "capital." Today, human resources experts also use the term "human capital," which, in some contexts, could be seen as synonymous to "talent" (Tansley, 2011). Talent takes a critical role as a part of the human resources (HR) function to manage all the employees into the organization to high performance (Tetik, 2017).

The term 'The War for Talent' was coined by the United States management consultancy group McKinsey & Company, and Talent management emerged in 1998 (Michaels, Handfield, & Axelrod, 2001). McKinsey & Company authors published their report stating that "better talent is worth fighting for" (Chamber, Foulon, Handfield-Jones, Hankin, & Michaels, 1998, p. 45). After that, many practitioners and academics were solicitous about talent management (Axelrod, B., Handfield-Jones, H., & Michaels, 2002; Collings & Mellahi, 2009). The following years became the dominant human capital theme of the early twenty-first century (Cappelli & Keller, 2014; Cascio & Aguinis, 2008).

In the United States, talent management is regarded as an essential criterion for corporate success. As with the 'management of human resources,' talent management is another term originally from the United States, and mainly from consulting firms and practitioners (Farndale & Atli, 2016). There has been some agreement that is having strong talent in the Company has a positive impact on business outcomes (Lawler III, 2008; Michaels et al., 2001). Talent Management is an emerging business concept and one of the most critical strategic goals of organizations today. Today, doing business in the new economy demands the recruitment, development, and retainment of talent (Kermally, 2004). In every respect, talent is required and is often regarded as a critical strategy in maintaining a competitive advantage. Talent management is needed for consistency, success, and efficiency (Phillips & Edwards, 2009).

Many companies use the term talent when referring to their 'A-players' who rank among the top 10 to 20 percent (Beechler & Woodward, 2009; Michaels et al., 2001) Since then, its definition has developed to the present focus on the value of a person to the organization and its distinctive abilities and abilities (Michaels et al., 2001). 'Talent'' may also mean a particular person or group within an organization who has strategic skills to help a firm achieve its short-term and long-term objectives (Silzer & Dowell, 2010). In organizational studies, talent has been described as "those individuals who can make the greatest difference to organizational performance, either through their immediate contribution or in the longer term by demonstrating the highest levels of potential" (Tansley, Kirk, & Tietze, 2013).

Lewis and Heckman (2006) state that three streams of thinking concerning with the term talent management. The scholars associated with the first stream simply substitute talent management. The second stream sees talent management as a set of processes to ensure an adequate flow of employees into jobs throughout the organization (i.e., succession planning). The third group concerns itself with the management of 'talented' people. A fourth stream focuses on identifying core strategic positions and the development of a talent pool to fill these positions (Collings & Mellahi, 2009; Krishnan & Scullion, 2016).

Although it is becoming increasingly used, there is no clear agreement on the definitions of talent management. There is a wide variation in how talent management is defined in academic literature (Cap-

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Table 1. The Major Branches of Modern Neuroscience

Affective Neuroscience	Mostly, researches on laboratory animals are conducted and looks at how neurons act with emotions.
Behavioral Neuroscience	The research of the Biological basis of behavior. Looking into how the brain was affected by behavior.
Cellular Neuroscience	The study of neurons, including their form and physiological properties at the cellular level.
Clinical Neuroscience	Looks at nervous system disorders while psychiatry, for instance, looks at mental disorders.
Cognitive Neuroscience	Study of higher cognitive functions and their underlying neural bases that exist in humans. Linguistics, neuroscience, psychology, and cognitive science draw cognitive neuroscience. Cognitive neuroscientists can take two broad directions; behavioral/ experimental or computational / modeling, with the aim of understanding from a neural point of view the nature of cognition.
Computational Neuroscience	Trying to understand the computation of brains, using computers to simulate and model the function of the brain and to use math, physics and other computational techniques to study the function of the brain.
Cultural Neuroscience	Examines the form and shaping of the brain, minds and genes during the different periods of beliefs, practices and cultural values.
Developmental Neuroscience	Examines how the cellular development of the nervous system takes place: what underlying neural development mechanisms are available.
Molecular Neuroscience	Investigates the functions of the nervous system molecules.
Neuroengineering	Using the technology of engineering to understanding, replace, repair or improve neural systems more effectively.
Neuroimaging	A medical imagery branch that focuses on the brain. Neuroimaging is used to diagnose and evaluate brain health. The study of the brain, how it works and how the different activity affects the brain.
Neuroinformatics	Combines data across all neuroscience areas, helping to understand the brain and treat diseases. Neuroinformatics involves data acquisition, information sharing, publishing and storage, analysis, modeling, and simulation.
Neurolinguistics	Studying which neural mechanisms control language acquisition, comprehension and utterance of language.
Neurophysiology	Examines the relationship and functions of the brain with the sums and interrelationship of the parts of the body. The study on the functioning of the nerve system usually using physiological techniques such as electrode stimulation, light-sensitive channels, ion, or voltage-sensitive dyes.
Paleoneurology	A fossil-based brain study.
Systems Neuroscience	Follows the data flow pathways within the CNS and attempt to define the processing types that are taking place. This information is used to explain behavioral functions.
Social Neuroscience	An interdisciplinary area dedicated to understanding the application of social processes and behavior by biological systems. Social neuroscience brings together biological concepts and methods for informing and improving social behavior theories.

Source: Table created by the author. The content retrieved from Nordqvist, 2020

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pelli & Keller, 2014; Collings & Mellahi, 2009; Collings, Scullion, & Vaiman, 2011; De Vos & Dries, 2013; Krishnan & Scullion, 2016; Lewis & Heckman, 2006; Scullion et al., 2010).

Some scholars are using talent management as a synonym for human resources. All the traditional human resources processes include recruitment, selection, development, human resources planning, performance and retention. There are suggestions that some organizations consider renaming the human resources department as the department of talent management. The title of ''talent Management Director'' or ''Vice President'' is becoming common in large organizations. Talent management has been used more narrowly either as a new term for an existing human resources role as a substitute for succession planning, human resource planning, or leadership development or to focus on an exceptionally talented group of employees (Silzer & Dowell, 2010). In its basic form, talent management is simply about anticipating and then developing a plan to meet the requirement for human capital (Cappelli, 2008). In a holistic approach to defining talent, Ulrich (2006) identifies three criteria for talent: competence, commitment, and contribution. By taking into account the above explanations. Talent management might be defined as ''an integrated set of processes, programs, and cultural norms in an organization designed and implemented to attract, develop, deploy, and retain talent to achieve strategic objectives and meet future business needs''(Silzer & Dowell, 2010). On the other hand, Cappelli and Keller, 2014 define talent management as '' the process through which organizations anticipate and meet their needs for talent in strategic positions.''

Building a "most desirable work environment" image through branding is viewed by companies as an "ideal" means of attracting and retaining super keepers. Companies realize that, in order to remain competitive, comparable marketing and branding practices used to market products and/or services, recruitment and retention programs have to be applied (Lance A. Berger & R.Berger, 2004).

Silzer & Dowel, (2010) suggest that organizations use five main processes to ensure that the necessary talent is available to achieve their business strategies, and most human resources programs, systems, and processes are related to these five talent processes:

1. Attract and select talent for the organization.
2. Assess competencies and skills in talent.
3. Review talent and plan talent actions.
4. Develop and deploy talent.
5. Engage and retain talent.

There is some emerging agreement on which HR activities should be included under the umbrella of talent management as can be seen below in *Table 2. Talent Management Components included, sometimes included, and Usually not included.*

NEUROSCIENTIFIC TOOLS

Several methods are available to study and understand neurological and physiological mechanisms of potential interest to social science in general, and management science. They include fMRI, EEG, Eye Trekking, Galvanic Skin Response (GSR), Magnetoencephalography (MEG) Facial Coding (Atlı, 2015; Martinez, Venkatraman, Cappa, Zollo, & Brusoni, 2015)

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Table 2. Talent Management Components

Included Under Talent Management	Human Resource Activities and Functions
Usually included	Recruiting
	Selection, promotion
	Assignments, placement
	Onboarding, assimilation
	Retention initiatives
	Reward and recognition programs (other than compensation)
	Training, development, learning opportunities
	Coaching, mentoring
	Leadership and executive education and development
	Performance management
	Career planning and development
	High potential identification and development
	Employee diversity efforts
	Succession management and planning Organizational
	Organizational talent reviews
	Measurement and evaluation of talent management efforts
Sometimes included	Compensation systems, recognition programs
	Organizational culture initiatives
	Organizational values initiatives
	Organizational capability development efforts
	Organizational structure changes
	Workforce planning
	Employee engagement
	Employee surveys
	Work and job design
Usually not included	Labor relations strategies
	Employee and labor negotiations
	Organizational development
	Organizational change efforts
	Organizational design
	Employee benefits
	Lifestyle initiatives (such as flextime)
	Termination and severance processes human resorces
	Human resoruces information systems

Source: (Silzer & Dowell, 2010) p.19-20.

The following devices mostly used in neuroimaging are utilized in this examination: (1) fMRI device enables investigators to localize and track changes in blood oxygenation during ongoing cognitive tasks. Another words, device which shows what parts of the brain are activated when exposed to different stimuli, in other words, scans the brain by spatial mapping; (2) electroencephalography (EEG) which measures the intensity of brain wave activity by electrical methods; (3) Eye Tracking which detects where, in what sequence, and how long a person looks at a visual object; (4) Galvanic Skin Response (GSR) Device which measures the changes on the skin when exposed to stimuli; (5) Magnetoencephalography (MEG) is a non - invasive tool used to analyze human brain activity. It allows continued brain activity to be measured the millisecond by millisecond and shows where brain activity is obtained (6) Facial Coding tool uses automated software and webcam capture and is one of the most widely used methods to quantify emotional reaction in commercials and digital videos (Atlı, 2015; Institute for Learning & Brain Sciences, 2020; Ipsos Encyclopedia, 2016).

NEUROSCIENTIFIC BASIS OF NEURO TALENT MANAGEMENT

Applying neuroscience to talent management requires a robust neuroscientific base. In this context, *social neuroscience, social cognitive neuroscience, behavioral neuroscience, organizational neuroscience, Organizational Cognitive Neuroscience and Personality Neuroscience* **concepts are closely relevant to the neuroscience of talent management. Therefore, these neuroscientific approaches will be tackled below.**

Social Neuroscience (SN)

As an interdisciplinary field, social neuroscience dedicates itself to understanding how biological systems implement social processes and behavior. Social neuroscience collects biological concepts and methods for informing and refining social behavior theories. It uses concepts and data of social and behavior to refine neural organizations and theories of functions (Nordqvist, 2017). Most of all, we can think of social neuroscience as an interdisciplinary field using a range of neuroscience measures to understand how other people influence our thoughts, feelings and behaviors (Ito & Kubota, 2020).

Cacioppo and Berntson coined the term "social neuroscience" to describe the large enterprise of studying the interplay between the social and physiological levels of study. The approach to social neuroscience began to appear increasingly in the laboratories with social psychologists, cognitive neuroscientists, developmentalists, and neurologists in the 1990s (Amodio & Ratner, n.d.). Social neuroscience is used in a variety of neural, physiological, and endocrine measures to explain social behavior. (Scheepers & Derks, 2016). As such, social neuroscience is investigating the same subjects as social psychology, but it is studying the brain and body from a multilevel perspective (Ito & Kubota, 2020).

Social Cognitive Neuroscience

Social cognitive neuroscience uses research instruments like neuroimaging and neuropsychology to examine social phenomena and processes (Lieberman, 2007). Ochsner and Lieberman (2001) have described social cognitive neuroscience as an emerging, interdisciplinary field that pursues to understand human interactions at the intersection of the social, cognitive and neural spheres of science. Besides that, it is

the study of processes in the human brain that enables people to understand others, understand themselves and effectively navigate the social World. The pursuit of social cognitive neuroscience research has increased exponentially (Lieberman, 2007; Waldman, Balthazard, & Peterson, 2011).

Behavioral Neuroscience

The area of behavioral neuroscience is the wider evolution of the previous area of physiological psychology, the original field of psychology as in Wilhelm Wundt's and William James' writings. (Thompson, 2001). Behavioral neuroscience, also known as biological psychology, psychobiology or biopsychology, applies the principles of biology to the study of physiological, genetic and developmental behavioral tools in animals and humans (Wikipedia, 2020). Behavioral neuroscience is that aspect of the broad, interdisciplinary field of neuroscience concerned with the biological bases of behavior. Today, behavioral Neuroscience deals with the neural and biological bases of behavior which include lesion effects and electric stimulation, electrical activity recording, genetic factors, hormone influences, neurotransmitters and chemical factors, neuroanatomical substrates, drug-related effects, processes and environmental factors (Thompson, 2001).

Organizational Neuroscience

Organizational behavior (OB) is an academic field of study that investigates how employees, groups, and systems influence within organizations. Behavior refers to what people do, how they act, and what their behaviors are in the organization. Since the organizations examined are mostly business organizations, OB is also applied for workplace concerns such as turnover, absenteeism, productivity, motivation, working in groups, and satisfaction. Managers also use the information gained from OB research to help them to manage their organization (Langton & Robbins, 2006).

Applying neuroscience to organizational behavior establishes the scientific foundations of organizational neuroscience, a nascent discipline that explores the neural correlates of human behavior in organizations. Concerning organizational neuroscience, the topics covered include the neural foundations of organizational phenomena, such as work climates, organizational cultures, employee attitudes and behaviors, social settings, decision making, leadership, fairness, trust and cooperation, emotions, ethics and morality, unconscious bias and workplace diversity. Organizational neuroscience can provide critical insights for organizational academics to improve new theories, refine existing theories, reformulate old questions or asking new questions (Beugré, 2018; Becker, Cropanzano, & Sanfey, 2011) Besides that, ON represents a natural progression of thinking and research under the larger umbrella of social cognitive neuroscience (Lieberman 2007, Ochsner&Lieberman 2001). Therefore, (ON) is one of the crucial disciplines which supports talent management.

Organizational Cognitive Neuroscience

Butler and Senior (2007) stated that "cognitive organizational neuroscience" may be an applied type of social cognitive neuroscience aimed at examining and recognizing human behavior in organizations. While there has been some theoretical work in organizational cognitive neuroscience related to managerial decision-making. It is undoubtedly an emerging field (Cited in Waldman et al., 2011).

Personality Neuroscience

Personality neuroscience deals with the neural correlates' Individual differences in cognition, emotion, motivation, and behavior. At the intersection of two fields, personality neuroscience combines the perspectives and methodologies of personality psychology and neuroscience (Abram & DeYoung, 2017).

Using neuroscientific approaches, it is becoming ever easier to research psychologically important human differences. Neuroscience endeavors to understand proximal sources of personality in the brain. In complex interactions among the genes and the environment, these processes are traced back to distal sources. The model Big Five offers a useful classification scheme for personality neuroscience and can organize an assessment of this young field effectively (Deyoung & Gray, 2012).

NEURO TALENT MANAGEMENT

In recent years, social sciences and humanities have been transformed by the growth and multiplication of new neuro fields (Ariffin, 2010). Within that period, several disciplines of social science also have adopted neuroscience (Camerer, Lowenstein, & Prelec, 2005; Dijksterhuis, Smith, Van Baaren, & Wigboldus, 2005; cited in Boulder et al., 2011). Such convergence has given rise to a plethora of new interdisciplinary neuro pronounced areas of business such as neuroeconomics, neuromarketing, neuro-accounting, neuroethics and neuroleadership (Ariffin, 2010). Scientific areas such as brain science advance, we are looking at a real change as human resources/talent management becomes ready to adopt a new model of managing people to suit a new era (Sloman, Simmons, & Cantrell, 2015). In this neuroscience era, the contemporary leaders who adopt the new developments will quickly take advantage of these new insights into what really drives attracting of talent, development and retention. These developments now also affect how we will tap and will manage workplace talent (Vorhauser-Smith, 2010).

When we look at the present, neuroscience is new to talent management not because it was not seen before relevant. It is only now that this science is being also utilized for organizational contexts rather than the utterly clinical field (Vorhauser-Smith, 2010). Now currently emerging around applying neuroscience to human behavior in the workplace as well (Sloman et al., 2015). Neuroscience findings will provide insights from which will emerge new and powerful strategies to unleash and develop the capabilities of our emerging leaders and unlock the potential of all our employees. Today, scientific advances are allowing us to understand human talent better, and how to manage it in new ways (Vorhauser-Smith, 2010). Hence, neuro talent management could be defined as the application of neuroscientific methods to analyze and understand human behavior in relation to talent management. Neuro talent management can be defined as "the application of neuroscientific methodologies for the enhancement of talent-related areas. Neuro talent management propounds beneficial insights into unleashing workplace potential.

Talent Management is one of the essential tools for organizations. To adapt with rapid changes in the volatile, uncertain, complex and ambiguous (VUCA) corporate environment, Talent Management practices need to be progressed. In this regard, neuroscience research on talent management is still in its infancy, but some of the areas where neuroscience is already making an impact on talent management will be discussed below.

Building Talent Strategy

The Academy of Management defines the business strategy as the field concerned with the roles and problems of general managers and managers of multi-business or multi-functional business units (Powell, 2011). Firstly, the best talent strategy in rapidly changing global markets should address changing conditions on the ground and cultural differences across the globe. There are many definitions of talent strategy. From essentially succession plans through the high potential program to including all employees and aligning all talent levers to ensure the business goals are achieved through people. The definition includes three key areas to get right in your talent strategy:

1. Identify the features that allow people to implement the company strategy and build the right talent culture to use these features.
2. Ensure that managers can help employees make the most of it.
3. Management of the changes resulting from the implementation, via the talent strategy of the company.

In order to execute a business strategy through people, you need to identify those who are already performing in a way that delivers the business goals. Thus, neuroscience, the science of how the brain works, can help organizations execute their talent needs more effectively. (Hills, 2012).

Employer Branding for Talent Acquisition

The increasing importance of employer branding has its roots in the increase, labor market shortages due to demographic developments increasing global personnel competition and higher voluntary fluctuations in employment (Rampl, Opitz, Welpe, & Kenning, 2016). Today, branding is an essential modern marketing concept, for which extensive research has provided invaluable insights into how customers can be attracted and retained. Moreover, the neuromarketing field deals with this field. However, far less is known about branding to attract and retain employees (Rampl et al., 2016). Whereas, employer branding can help to increase the productivity, profitability, retention of employees and employer attractiveness of the organization, as well as reduce recruitment costs and timeframe by hiring a new employee (Stariņeca, 2016). Kucherov and Zavyalova (2012), states that companies with a strong employer brand enjoy a positive image on the labor market, some promises of the psychological contract, and economic and symbolic characteristics that are important to their employees a specific differentiation as an employer.

Today, a high salary is not solely adequate for attracting talent. Talent Management/Human Ressources departments also begin to consider collaborating closely with marketing departments to built and boosting employer branding and image why this company is a great place to work (ICEMD, 2015).

In this regard, considering that about 95 percent of the thoughts and feelings that influence our decisions are subconscious, as we act almost without realizing it (Kotler and Armstrong, 2008), neuroscience can be a complementary way of penetrating the human behavioral area. This enables more precise identification of the motivational factors influencing employee decisions. Besides that, neuroscience makes it possible to test the attractiveness of jobs, choose the right employees, measure branding activities, and study labor market trends or the loyalty phenomenon (Rampl et al., 2016). Employees compare perceived functionality, economic and psychological benefits expressed or implied in the promise of a brand with their own needs to see to what extent they are satisfied (Foster, Khanyapuss and Cheng, 2010;

(Grajdieru, 2017). As a result, neuroscience might increases our awareness of insight and intuition for building employer branding and attracting talent. Moreover, neuroscience tools might be propounded to measure current and prospective employees' perceptions and preferences.

Talent Recruitment and Acquisition

Recruitment is a subset of talent acquisition. Today, many companies are seeking competitive advantage through recruitment and selection of the best employees (Yockey, 2019). However, in today's tight market for top talent, recruitment policies provide opportunity practices that support what neuroscience suggests about managing the talents use equitable, merit-based selection methods (Vorhauser-Smith, 2011). In this direction, personality neuroscience is a rapidly expanding field of research, incorporating not only structural and functional neuroimaging but also molecular genetics, psychophysiology, and psychopharmacological research (DeYoung et al., 2010). A key aim of the evolving field of personality neuroscience is to connect the great variety of enduring human behavioral dispositions with accurate brain function markers. It can be achieved by analyzing massive data sets using methods that model communication trends across the brain (Toschi, Riccelli, Indovina, Terracciano, & Passamonti, 2018).

Regarding recruitment tests, Big Five Personality traits factors are significant predictors of outcomes in mental and physical health, well-being, education, work, and relationships (Ozer & Benet-Martinez, 2006), and the theory of their biological roots is an important step towards the integration of individual research differences in psychology and neuroscience. The results of these studies support such a theory that demonstrates that human psychology can be understood using personality neuroscience (DeYoung et al., 2010). Thus, neuroscience has an opportunity to offer neuroscience-based models and personality measurements in order to assess talented employees' abilities.

Rewarding and Talent Motivation

Reward plays a vital role in the organization, as it is the driving force behind the human resources strategy, the business strategy, and the organization of culture. The reward system is traditionally made up of financial rewards and non-financial rewards. Financial rewards consist of basic salary, incentives to pay, and benefits to employees. On the other hand, non-financial rewards; consisting of intrinsic work-reward centers, praise, recognition, time off, and other rewards given by peers or superiors to the employees. The reward is closely linked to the various subsystems of the organization, such as training, culture, performance management, employment, and relations (Deb, 2005). Moreover, multiple studies have shown that, even without further monetary gain, fairness or cooperation leads to self-reported, behavioral, and neural evidence of reward (Tabibnia & Lieberman, 2007).

Thus, new neuroscientific research results might be given new insights and contributions it especially regarding non-financial rewards. Besides that, researchers are taking insights for everything from how we think to what motivates us to control our emotions (Sloman et al., 2015). For example, one of the neuroscience devices producer EMOTIV company develops credible and cost-effective mobile EEG devices in the market. The company also launched an adaptable neurotech ecosystem that fits company talent needs. The model called MN8 is a first-of-its-kind Bluetooth stereo headset with integrated 2-channel EEG buds. This device is discreet, easy to use, and comfortable to wear throughout the day. It helps to measure and analyze the changes in your employees' levels of stress and attention using EEG and machine learning algorithms. The device cannot read thoughts or feelings, but it can provide easy-

to-understand feedback on the level of stress and distraction to inform workplace wellness, safety, and productivity (Emotiv, 2020).

Another interesting neuroscience field neuroergonomics is an emerging field that investigates the human brain in relation to behavioral performance in natural environments and everyday settings (Curtin & Ayaz, 2018). New methodologies have been developed in conjunction with recent stress research that focuses on enabling staff to become better resilient to stress. These are based on strong science in the brain and are used to train staff in their ability to better control their cognitive and emotional areas of the brain (Ghadiri, Habermacher, & Peters, 2012). Given the fact that emerging neuroscience developments have great potential to improve employee motivation and enable practical, rewarding approaches in the workplace for talent management experts, these tools are derived suitable bases for neuro talent management.

Learning and Development Programs

Neuroscience techniques might help to gain opportunities to expand on and improve companies' current behavioral approaches to training and learning by incorporating recent or emerging advances in neuroscience. Some of the research topics for talent learning and development programs can be seen below.

- Evaluating the efficiency of training regimes and learning paradigms,
- Individual capability and response to training/ training status of employees
- Monitoring and predicting changes in individual performance efficiency,
- Prospective or current talented employee selection and assessment
- Monitoring and predicting social and group interactions (Bloom et al., 2009).
- Assessing training and trainer effectiveness
- Shorten training cycles

The application of neuroscience to management and leadership is somewhat newer but is gaining momentum as researchers gain a deeper understanding of how the brain can influence character, personality, and behavior (Peterson, Waldman, Balthazard, & Thatcher, 2008).

Research from social cognitive neuroscience's interdisciplinary field provides insights into how executives learn and develop, resulting in theoretical proposals and practical implications. Neuroscience aims to offer the potential to increase our understanding of managerial development practical and theoretical (McDonald & Tang, 2014).

Besides, a relevant concept of Learning and Development Programs is a phenomenon of leadership development (Waldman et al., 2011). A newly emerging area regarding leadership. Neuroscience makes some valuable contributions to leadership as "Neuro Leadership," concept who labeled by the term leadership consultant David Rock in 2006. Neuroleadership is the study of leadership through the neuroscience lens and explores key leadership elements. Neuroleadership brings neuroscientific knowledge into leadership development, management training, education, consulting, coaching, and change management as a new field of study (Ariffin, 2010; Gibaldi & Gibaldi, 2008) These developments, although in the early stages of development, are exciting and would seem to hold real potential to advance our understanding of leadership and learning and development programs for talent management.

Succession Management

Talent management aims to get the right person in the right job at the right time. These require planning, development of employees, career management, succession planning. In this process, one crucial question in talent management in which employees should be the focus of scarce development resources. This group is often referred to as the organizational talent pool and is usually viewed as senior figures in strategic positions and high potential candidates who could occupy these strategic jobs in the future (Cappelli & Keller, 2014). In other words, The succession planning process identifies and prepares talented employees to take on key positions and leadership roles and ensures that they have the skills, experience, and knowledge to meet changing work requirements (Jobsandskills.wa.gov.au, 2020).

In this regard, neuroscience can expand and improve the company's behavioral science approaches to succession planning. Neuroscience, for example, offers new ways of assessing how well current paradigms of selection, training, and career and performance management accept assumptions about achieving their goals. Neuropsychological indicators can help in assessing how well a matrix of talents could be created. These assessment tools will allow the company to assess individual variability and tailor talent regimes (Bloom et al., 2009). Succession planning in talent management provides companies with an intentional strategy to rely on and continue critical skills and show a genuine commitment to the development of existing employees. (Jobsandskills.wa.gov.au, 2020).

CAREER AND PERFORMANCE MANAGEMENT

Career and performance management is one of the most important Talent/HR strategy factors (Ahmed & Kaushik, 2011). Career management is the active planning and implementation of strategies and actions that are likely to help further employee career. Career planning is a term that an organization more commonly uses to describe plans for employees (Forsyth, 2002). Performance management is a methodical process to improve organizational performance by developing the performance of people and groups. It is a means of achieving better results by understanding and managing performance within the accepted framework of the objectives, standards and competency necessities (Armstrong, 2009)

Neuroscience now adds additional strength to the understanding of people (Cheese & Hills, 2016). Just like neuroscience techniques used in neuromarketing or consumer neuroscience help us understand our customers, similarly, in neuro talent management, the same techniques help us understand our employees (Ölçekciler, 2017). Most particularly, functional MRI enables us to better understand how the brain works, how we learn, respond to stress and encouragement, threaten and reward. According to recent neuroscience researches, especially neuroscience-based measurement techniques help us to understand talented employees' career classifications and developing their career learning and development plans. Today organizational neuroscience-based researches show us that reducing threat, maximizing reward, and enhancing social connection is might enhance performance, create more engagement with the firm, and greater trust between company and employees (Cheese & Hills, 2016). Moreover, neuroscience researches findings can overcome low levels of performance and can help companies significantly. Using neuroscientific techniques, it is easy to identify the true level of employee satisfaction, the real performance effectors, and the underperforming managers (Ölçekciler, 2017).

Talent Engagement and Retention

Talent engagement and retention is an important dimension in managing talents in order to maintain a competitive advantage for companies (Alias, Noor, & Hassan, 2014). Social connections are an essential motivator for working. People communicate with people. Fortifying social connections at work creates a sense of belonging, a relationship network. Commitment is the result of strong connections in the workplace (Vorhauser-Smith, 2010). The manager role is a crucial component of employee engagement. Their supports enable employee engagement in the job and the organization (Alias et al., 2014).

There are many factors in order to build employee engagement in organizations. Factors may include: strategic and operational talent planning, compensation and benefits, developing talent policies, employment legislation and standards, job descriptions, performance management, learning, training and development, workplace diversity, teams and group dynamics, conflict resolution, workplace wellness initiatives, employee recognition, staff-volunteer relations etc. (Canadian Child Care Human Resources Sector Council, 2020).

Employees mostly conceal their opinions on employee engagement surveys or 360-degree performance evaluations. The major reason for this relates to the fear of losing their jobs. Indeed, many employees believe that these surveys are management tricks and are willing to identify whom to fire next through those surveys. Instead of complaining through these surveys, they prefer to support leadership (Ölçekciler, 2017). As mentioned, the contribution of neuroscience towards neuro talent management above, as a measurement tool neuroscience, might explain the employees' real opinions. Thus, an employee-friendly workplace might be created through neuroscientific researches. Talent management professionals should encourage and train leaders to develop positive working relationships with their peers and employees to increase employee engagement.

SOLUTIONS AND RECOMMENDATIONS

Over the last few decades, the boundaries of behavioral sciences have expanded to incorporate advances in our knowledge of psychology, neuroscience, and economics, marketing, and some other business-related fields. These advances transcend the hierarchical levels of neuroscience, offering powerful new tools for understanding and making decisions better.

The decision-making approach differs among people. Human decisions are ineffective and often inefficient, especially when risk assessments are required for decisions, and when they are taken under pressure. From the corporate perspective, different styles of decisions can be tailored for different tasks, and even different tasks for individuals with different styles of decision-making can require or be better performed. These differences in decision-making are distinguishable from neuroscience instruments. These instruments can discern the neural correlates of differences with sufficient research.

Today, neuroscience researches on talent management are at a very early stage. Lack of neuro talent management data in the field requires many new kinds of research, such as neuroergonomy and personality neuroscience, talent assessment, employer branding related researches that may contribute to neuro talent management.

FUTURE RESEARCH DIRECTIONS

Measuring brain activity in certain areas of the brain during exposure to various stimuli makes it possible to investigate how employees make decisions and the link between decision-making and human brain areas. Neuroscientific approaches allow us to anticipate other employees' decisions through evaluation of the company's emotional commitment, the desire to leave the organization, and the efficacy and drive of internal marketing strategies. Hence, Neuroscience techniques allow achieving results unattainable by any other research method.

Today, neuroscience researches on talent management are still in its infancy. Accordingly, we lack neuro talent management data about how employers are handling the challenges of talent management through neuroscientific methods. After the increasing usage of neuroscientific methodologies on talent management, there may be potential to use neuroscience to understand people at an individual level better and better manage the workplace.

CONCLUSION

Neuroscience projects on a large scale have been launched or are being planned today in multiple continents such as America, Europe, Asia, Australia, and many countries. Now that scientists worldwide have gained new insights into neuroscience and human behavior on unprecedented scales. As analytics, organizations finally have the opportunity to test hypotheses and draw conclusions by analyzing a newly available treasure trove of neuroscience and big data analytics. Although the term Neuro Talent Management (NTM) is very new, during organizational change, it adds new ideas on how to build and maintain high levels of talent management programs. Hence, neuroscience provides organizational science as an emerging research option. New developments in the field of neuroscience can indeed help us to unravel the new talent management approaches.

Some of the advancements in neuroscience research have revealed underlying nerve patterns possibly associated with specific components of leadership. These findings help companies recruit the right talent and put in them to the right talent grids and differentiating their career paths. On the other hand, Mostly, classical employee surveys do not give us the correct data to understand real employee opinions, so companies can not reach a good result. Neuroscience studies can resolve this and help companies significantly. Neuroscience technology could, however, be used to better understand our employees and thus helps companies to manage themselves, just as it is helpful to understand our internal customers. With these methodologies, real satisfaction, real efficiencies, and underperforming managers can be easily identified.

Besides that, human beings thinking processes mostly take place in the subconscious mind. Thus, neuroscientific methods allow us to understand certain decisions of the employees by measuring the emotional commitment to the company, the intention to leave the organization, the effectiveness of internal marketing strategies, and motivation methods.

Consequently, attracting, developing, and retaining the best talent is critical for companies to gain in the competitive market. Modern neuroscience offers an incredible advantage in the competitive corporate world to sustain and exponentially develop and achieve success. Neuroscience in structuring talent management practices can serve as a catalyst. It offers valuable insights into the different areas of talent management, including attracting, developing, and retaining talented employees. Techniques used in

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neuroscience help us to understand employees as internal customers. Because of these reasons, talent management professionals need to pay attention more to neuroscience in the following years.

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KEY TERMS AND DEFINITIONS

Behavioral Neuroscience: Is that aspect of the broad, interdisciplinary neuroscience that concerns biological behavioral bases.

Organizational Cognitive Neuroscience: Is the cognitive neuroscientific study of organizational behavior field.

Organizational Neuroscience: The application of neuroscience to organizational behavior sets the scientific foundations of organizational neuroscience, a nascent discipline that explores the neural correlations of human behavior in organizations.

Personality Neuroscience: Involves the use of neuroscience methods to study individual personality related behavioral, motivational, emotional, and cognitive differences.

Social Cognitive Neuroscience: Social neuroscience as an interdisciplinary field dedicates itself to understanding how biological systems implement social processes and behaviour.

Social Neuroscience: As an interdisciplinary field, social neuroscience dedicates itself to understanding how biological systems implement social processes and behaviour.

Talent Management: Attracting, developing, and retaining talents to achieve long-term goals at the organization

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