CHAPTER 6

NEUROSCIENCE MARKETING

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Abstract

Neuroscience marketing is the application of neuroscience methods to marketing. It is a new field of marketing which applies medical technologies to examine the brain's responses to marketing stimuli. Neuroscience marketing is essentially a method that helps companies to explore customer buying decisions. Marketers utilize neuromarketing techniques to measure a consumer's preference based on the activities in parts of the brain and to explore why consumers make the decisions they do. Neuroscience marketing includes the direct use of brain imaging, scanning, or other brain activity measurement technology to measure a consumer's reaction to specific products, packaging, advertising, or other marketing stimuli. The brain responses measured by these techniques may not be consciously perceived by the respondents; hence, this information may be more revealing than self-reporting on surveys, in focus groups. With the help of neuroscience, marketers design products and create advertisements much more effectively. This chapter presents neuro-marketing techniques and how they enable marketers to pre-established emotional influence, the practice of neuromarketing methods in advertising and package design tactics.

Keywords: Neuroscience Marketing, Packaging, Advertising Effectiveness, Advertisement, Marketing Research.

1. Introduction

Neuroscience is a new technique that has been created to gauge the impact of marketing efforts on the consumer. Neuromarketing is a new discipline that applies neuroscience methods to understand consumer behavior. Research has shown that ever since scholars started using this tool, the interest levels in it have risen. In 2006 only three manuscripts were published. However, in 2016, this number reached 83 published articles. This quick acceleration of publications indicates neuromarketing is a flourishing discipline. Each year there is a growing community of academicians publishing their research in the field. According to Google Scholar, presently, there are over 15,000 neuromarketing papers published in different academic journals. When doing a Google word search on "neuromarketing," close to one million sources popped up in 2008 (Hubert & Kenning, 2008). In 2012, the same keyword, "neuromarketing," hit over 1.4 million matches, stressing the growing trend of this concept. Today this number reaches over 3 million matches for the vital word "neuromarketing." Currently, global companies that do research on neuromarketing and provide competitive advantages to the small and big companies are growing. Since neuromarketing receives increasing public awareness levels, it has become popular in both research and practice. Its attractiveness is also continuously growing.

By using a variety of different biometrics sensors and sophisticated software, neuroscience can precisely track what a person is looking at (attention), whether he is experiencing positive or negative emotional arousal, and what these emotions are. Neuromarketing is an emerging integrative field. Psychology, and marketing are significant components of this discipline due to the nature of the topic. Its emphasis on evaluating buyer's rational and emotional responses to marketing 4P's and other stimuli such as the economic, political, social, and technological situation of the market (Karmarkar, 2011). Neuromarketing is a description of the utilization of neuroscience and physiological exploration methods to gain a deeper understanding of people's behavior, preferences, and decision making (Stanton, Sinnott-Armstrong, & Huettel, 2017). Most of the time, marketing research data collection traditionally relies on self-report methods such as a questionnaire. Consumers use conscious thought as a way to post-rationalize their behaviors. Ninety-five percent of all cognitive process such as making a buying decision, paying attention to the advertisements, retention of the commercials, retrieval rate takes place in the subconscious mind. Surveys can only measure the customer's rational brain behaviors (Zaltman, 2003). Neuro-marketing addresses the analysis and utilization of unconscious or unexpressed consumer's buying processes. The use of neuromarketing is growing in popularity among big brands like Unilever and Coca Cola.

Neuromarketing is a growing field of interest for both researchers and businesses because it provides more detailed and valuable feedback than the usual marketing research techniques. It also provides much more efficient pieces of evidence in the interpretation of the consumer buying decision and rationality whenever they make the purchase decisions. Leading marketing research companies, including Gallup, Sand Research, Nielsen, and TNS, has increasingly used neuro-marketing techniques in their market researches (Camargo & Acero, 2016). Neuroscientists can explore the subconscious of consumer behaviour by evaluating the body's autonomic response to a marketing stimulus. For example, medical science has proven that an altered emotional state changes the heartbeat rate of the respondents (Yoshida & Sugaya, 2019) and initiate changes to the skin's electrodermal response as known earlier galvanic skin response (Cuesta, Niño, & Martinez, 2018). Patients with impaired emotional function care found to be utterly unable to make the most straightforward decisions (Bechara, H. Damasio, & Damasio, 2000). The study of neuroscience has permitted companies to gain insight for their brands into the way of the consumer's brain responds to certain stimuli.

While neuroscience is focusing more generally on the behaviour of the brain, neuromarketing examines how companies can modify their brand awareness strategies to influence customers on a psychological level. A simplistic explanation lies in the wiring of the human brain, where emotion plays a pivotal role in how the brain processes information. For every stimulus, we experience - the limbic system (which lies just under the cerebrum and is primarily responsible for emotion) —associates to each stimulus an intrinsic attractiveness (emotional valence): sound, harmful, or neutral. So, humans' brain does not only react to the facts of the information but also the psychological element of this stimulus (Bechara et al., 2000). Recalling the experience or event can explain the emotion associated with the stimulus. As a mechanism, the consumer makes buying decisions depend significantly on passion, recognizing your target market's affective response is essential. Salespeople are no strangers to take advantage of emotions to get in touch with their customers and influence them to purchase their offerings. In developing countries, markets and stores, or used car dealerships are full of "your best friend" inviting you for a cup of tea/coffee in their store or boutique to try to persuade you to buy several of their products such as carpets, gifts, shoes or their cars.

This chapter on Neuro-marketing presents an example of how neuroscience tools such as galvanic skin response measurement, facial expression analysis, eye tracking, and electroencephalography (EEG) enable marketers to pre-established emotional influence.

With this information, marketers can measure the effectiveness of advertising, the design of a package, webpage, or a product.

2. Neuro Marketing Tools

Unlike standard marketing research tools such as consumer surveys, focus group interviews, and in-depth interviews, neuromarketing utilizes several well-documented neuroscience techniques that measure the electrical and metabolic activity of consumers' brains. A few examples of these neuroimaging and neurophysiological methods include: computerized tomographic scanner (CT scan), magnetic resonance imaging (MRI)), Magnetoencephalography (MEG), Electroencephalography (EEG), Positron Emission Tomography (PET), Transcranial Magnetic Stimulation (TMS), Magnetoencephalography (MEG), Functional Magnetic Resonance Imaging (fMRI) and Positron Emission Tomography (PET). There are many techniques that neuro marketers use extensively as a measurement of the electrodermal and psychophysiological reactivity. These techniques include such activities as eye-tracking, evaluation of the heart attack, and respiratory rate and some of the other biometric tools Zurawicki (2010), Calvert, Spence, and Stein (2004), Kenning and Plassman (2005) organize the categories of tools utilized in neuromarketing research into three groups of recording methods in the brain: metabolic activity, electrical activity and non-brain activity (see Figure 1).

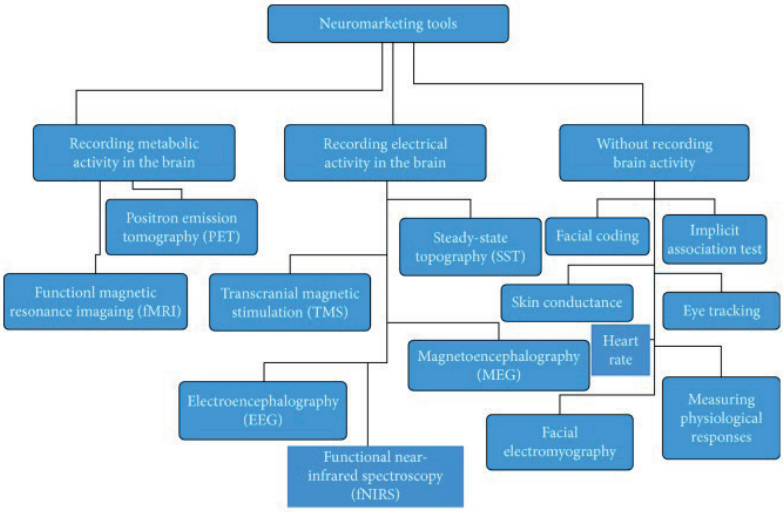


Figure 1: Categories of Tools Utilized in Neuromarketing Research
Source: "Consumer Behaviour through the Eyes of Neurophysiological Measures: State-of-the-Art and Future Trends", by P. Cherubino, A. C. Martinez-Levy, M. Caratu, G. Cartocci, G. Di Flumeri, E. Modica, ... , and A. Trettel, 2019, *Computational intelligence and neuroscience, 2019*, p. 7.

In Table 1, a flowchart presents the essential neuromarketing methods. Additionally, the table indicates what it assesses, when to use them, and their benefits and restrictions.

Table 1: Summary of Neuromarketing Methods

Neuromarketing Tools	Type of Methods	What is measured?	Business Application	Benefits	Restrictions
Electroencephalography (EEG)	Recording Electrical Activity in the Brain	Attention, engagement, excitement, emotional valence, cognition, memory encoding, recognition, approach withdrawal, and mental workload	It is used to test advertisements, movie trailers, website design and usability, app and socialmedia, in-store experiences, print and image design, new product, packaging design, pricing, sensory studies, outdoor advertisements, political debate, and other marketing stimuli.	High temporal resolution, relatively low equipment costs, noninvasiveness, valid measure for cognitive information processing, and portability	Low spatial resolution, Non-scalable, and susceptibility of the results to the influence of the moving artifacts
Eye Tracker	Without recording brand activity	Visual search, fixation position, eye movement patterns, spatial resolution, excitement, attention, and pupil dilation	It is used to test websites and usability, app and social media, in-store reactions, packaging designs, advertisements and video materials, print and image design, shelf layout, product placement, and aesthetic stimuli. It can test how a consumer filters information and determines the hierarchy of perceptions of the stimulus material.	Portability and noninvasiveness	Low flexibility since it does not work efficiently with glasses and contact lenses
Facial Coding	Without recording brand activity	Unconscious reactions and emotions	It is used to test advertisements (e.g., dynamic and static) and movie trailers.	Real-time data and noninvasiveness	Subjectivity

Functional magnetic resonance imaging (fMRI)	Recording Metabolic Activity in the Brain	Human memory encoding, sensory perception, craving, trust and brand engagement, loyalty, preference, and recall	It is used to test products, advertising campaigns, packaging, designs, and prices; to predict customers' choices or identify their needs; to reposition a brand; and to test sensory characteristics and a celebrity endorsement.	High spatial resolution, ability to localize neural processing during consumer choices and consumption experience, valid measure for cognitive and affective responses, and ability to detect changes in chemical composition or changes in the flow fluids in the brain	Low temporal resolution, expensive, immobility of participants during the experiments, non-scalable, and ethical barriers
Indirect measures: reaction time	Without recording brand activity	Reaction time and underlying attitudes/ evaluation	It is used to test consumer attitudes (for brands and categories), celebrity endorsement (choosing the right option), and salient packaging features/brand image.	Less biased	Responds depending on the subject collaboration
Magnetoencephalography (MEG)	Recording Electrical Activity in the Brain	Perception, attention, and memory	It is used to test new products, advertisements, packaging design, and sensory studies and identify needs.	Has good temporal resolution and spatial resolution better than that of EEG	Need for a room free from the earth's magnetic field, expensive, and ethical barriers
Physiological response: Heart Rate (HR) and Galvanic Skin Response (GSR)	Without recording brand activity	Emotional engagement, valence, arousal	It is used to test advertisements, movie trailers, website design, app and social media, product perception, aesthetic stimuli, and other marketing stimuli. It can measure reactions and consumer measures in both laboratory settings and the natural environment (i.e., store).	Portability and noninvasiveness	More informative if combined with other neurometric tools

Positron emission tomography (PET)	Recording Metabolic Activity in the Brain	Sensory perception and valence of emotions	It is used to test new products, advertisements, and packaging designs.	High spatial resolution, valid measure for cognitive and affective responses, and ability to detect changes in chemical composition or changes in the flow fluids in the brain	Poor temporal resolution, expensive, and invasiveness by the application of radioactive contrast
Steady-state topography (SST)	Recording Electrical Activity in the Brain	Memory encoding, engagement, emotional engagement, attention, and processing visual and olfactory input	It is used to test advertisements, movie trailers, prints and images, and brand communication.	High temporal resolution and tolerance for high levels of noise or interferences	Low spatial resolution
Transcranial magnetic stimulation (TMS)	Recording Electrical Activity in the Brain	Attention, cognition, and changes in behaviour	It is used to test new products, advertisements, packaging design, and other marketing stimuli.	Portability and possibility of studying specific brain areas	Expensive and ethical barriers manipulating brain activity

Source: Adapted from "Consumer Behaviour through the Eyes of Neurophysiological Measures: State-of-the-Art and Future Trends" by P. Cherubino, A. C. Martinez-Levy, M. Caratu, G. Cartocci, G. Di Flumeri, E. Modica, ..., and A. Trettel, 2019, *Computational Intelligence and Neuroscience, 2019*, p. 11.

3. Neuro Marketing and Advertising

In the US, total advertising spending is more and more increasing. In 2014, US companies paid over $180.12B for advertising expenses (Emarketer, 2015), and all over the world, companies invested over $540 billion in 2015, with an increase of almost five percent overspending from the prior year (Adage, 2015) while in 2018, US companies paid $223.7 for advertising expenses (Statista, n. d.), and all over the world, it is estimated that advertising spending worldwide will surpass 560 billion U.S. dollars in 2020 (Statista, n. d.) The target markets experienced a growing number of commercials and advertisements. The urban Americans saw roughly 2,000 ads per day in 1985, and this number more than doubled with people viewing 5,000 ads per day in 2016 (New York Times, 2015). Nevertheless, among a sample of 350 ads exposed in a day, only 153 advertisements were found to received attention and were valid for more than a few seconds (SJ insight, 2014).

Investigating the effects of a television ad is easy by locating data about the points listed using neuroscience models for:

i. Appraising the value of an advertisement by neuromarketing indexes as a whole or for particular frame segments

ii. Assessment of various influences on the perception of the TV commercial by two or more subgroups (girl, boy, adult, child, etc.)

iii. Explaining the reduction principles associated with TV commercials in time, based on neuro-indicators and producing a shorter but also valid version (i.e., 30″ to 20″ or 15″)

iv. Preliminary review of an advertisement

v. Study of the effect of recurring exposure (to test the optimal grossing rating point (GRP))

vi. What and where people look at on a screen can be measured. Marketers can measure the visual elements and how long consumers fixation lasts when certain advertising elements appear in front of them.

Advertising effectiveness on the target audience can be dependent on numerous reasons namely the product category, the emphasis of the decision-making process, and the nature of the target market (Glowa, 2002).

Basically there are two different approach to measure advertising effectiveness; first technique is to focus on evaluating indicative marketing metrics like loyalty, consumer satisfaction, product awareness and product preference; secondly, evaluating concrete marketing metrics like increase in the sales, profits, company market value, return in investment and cash flow, satisfaction and loyalty (McAlister, Srinivasan, Jinda, & Cannella, 2016). Whatever the chosen method, observing the efficacy of advertising campaigns remains a challenge for most businesses. However, cognitive neuroscience techniques and some other innovative research techniques can be applied to achieve the necessary effectiveness for proper scholarly documentation.

Good advertisements influence consumers' tendency and liking towards the product and positive attitudes and behaviors (S. Lee, Y. Lee, J. Lee, & Park, 2015; Meyers-Levy & Malaviya, 1999; Smit, Lex Van, & Neijens, 2006). Marketers can assess the effectiveness of an advertisement by numerous factors such as the consumer's attitude toward the commercial, for instance if they like it or not, the consumers' attitude toward the brand, product or company (Lewinski, den Uyl, & Butler, 2014; Mitchell & Olson, 1981) the target market's buying intention, the actual purchase

of the product (Lewinski et al., 2014) and the recall for the advertised company, brand or product (Turley & Shannon, 2000). A viewpoint toward the commercials and the product brand communicates the preference, fun, liking, pleasure, enjoyment, happiness and valence of feelings of consumers about the commercial and the brand, respectively (Chattopadhyay & Basu, 1990; Phillips, 2000). The consumers buying objective considers the subjective probability dimension of a person that associates him or her to a specific behaviour (Ajzen & Fishbein, 1980). This intention indicates to a behavioural plan or the subjective probability of a given response (Lewinski et al., 2014). Recall impacts the buying decision and is therefore known as a central feature of advertising effectiveness (Turley & Shannon, 2000).

The evaluation of advertisement effectiveness is problematic for several reasons. Individual responses to an advertisement are affected by factors besides the ad itself. Such items as cultural, economics, socio-demographics, and psychosocial stimuli also affects a consumer's response (Corvi & Bonera, 2010). Moreover, advertising results fluctuate and do not always translate into precise quantitative terms, such as sales revenues. In addition to these challenges, the advertising effect also does not directly ensure the introduction of a campaign with outcomes changing over time (Corvi & Bonera, 2010).

The fundamentals of advertising's efficacy are a person's opinions about the advertisement the brand, its intentions, and, in the long run, the actual person's behaviour (Lewinski et al., 2014) and memory recollection (Turley & Shannon, 2000). As a driver of behaviour, opinions toward advertising impact advertising effectiveness (Ling, Piew, & Chai, 2010; Mehta, 2000; Ting & de Run, 2015). Ajzen and Fishbein (1980) define a person's opinion about an object, as both a cognitive and affective evaluation of this object. It is also an indicator for behavioural intent. Successively, the behavioural intent is information to support the consumer's inclination to act in a specific way (Ajzen, 1991). Nevertheless, belief is the innermost dimension for opinion about advertising (Tan & Chia, 2007). Any adjustment or shift in views about commercials head towards a replacement or shift in attitude toward the commercial. This change therefore impacts the purchase intention (Ting & de Run, 2015; Wang, Sun, Lei, & Toncar, 2009). Whereas a positive belief about the outcome emerges, the plan enacts a behaviour increases (Shook & Bratianu, 2010). Research on commercial recall was an interest of researchers for a long time, and even before the involvement of neuroscience researchers, Bozinoff and Dacin (1985) determined that long-term recall was possible, with specific advertisements being recalled over a decade later. Specifically, highly creative ads are more straightforward to recall than control advertisements, making creativity an essential component of advertising recall (Lehnert, Till, & Carlson, 2013).

Measuring advertising effectiveness rises as the variable "emotion" is launched to the field (Corvi & Bonera, 2010). Emotion considerably impacts individual response messages (Lewinski et al., 2014; Mai & Schoeller, 2009), and it is an indicator of effectiveness of the advertisement (Poels & Dewitte, 2006). Consumer's awareness about the advertisement message and product is amplified with emotional advertisements. Such commercials enhance the product's appeal and increase the brand recall rate. For example, sensitive announcements are prone to be remembered than informative commercials (Page, Thornson, & Heide, 1990). Assessing a consumer's emotional response provides a robust understanding of the advertisement's bearing on consumer attitude, behaviour, and recall. Emotions are responses to stimuli that impact one's immediate physical environment (Kiehl, Laurens, Duty, Forster, & Liddle, 2001; Petrides, Pérez-González, & Furnham, 2007; Ramsøy, Friis-Olivarius, Jacobsen, Jensen, & Skov, 2012). LeBlanc, McConnell, and Monteiro (2014) demonstrate that emotions are essential for consumer responses and connected to attention, decision making, and memory. Emotion effects the distribution of resources to the visual structure (Algom, Chajut, & Lev, 2004; Estes & Verges, 2008; Öhman & Mineka, 2001) moreover, negative stimuli allocate more attentional resources than neutral stimuli.

Emotions, such as sexual excitement or hunger, be able to influence a person's decision-making process (Loewenstein, 1996). Moreover, emotions in both individual's attitudes and judgments, affect a consumer decision making (Gutnik, Hakimzada, Yoskowitz, & Patel, 2006). Emotions are potent, persistent, predictable, and can be, occasionally, harmful. Emotions are also the driving force of decision making (Lerner et al., 2015). Depending on the situation, emotions influence peoples' judgments and decisions (Lerner, Li, Valdesolo, & Kassam, 2015).

Wiles and Cornwell's (1991) study explores a systematic assessment of different methods used to evaluate emotion in advertising research that applies autonomic measure or self-report. Lewinski et al. (2014), in order to examine self-report, used cartoon characters and required respondents to choose the cartoon character that corresponded to their emotional state to rank their emotional state on a Likert scale and answer an open-ended question. While this type of reporting is the simplest way to measure emotion, hidden or manipulated answers, and socially awkward feelings can be the result of this reporting. The emotion forces the consumers into a conscious, self-awareness process (Pryor, Gibbons, Wicklund, Fazio, & Hood, 1977) and increasing the possibility of "cognitive bias" occurrences (Poels & Dewitte, 2006). It is reported that, most of the cases, respondents have a tendency to respond what the interviewee feels to be in accordance with the moral code of the interviewer (Benstead, 2014).

In contrast to self-reporting, autonomic measures provide an evaluation of the respondent's emotional responses because these responses are beyond of the respondent's consciousness

(Poels & Dewitte, 2006). This approach assesses respondents' heart rate fluctuations (EEG), brain activity (fMRI), facial expression, eye movements and skin conductance variations (Cook, Warren, Pajot, Schairer, & Leuchter, 2011; Langleben et al., 2009; Lewinski et al., 2014). Except for facial recognition software, these techniques require the use of invasive tools to measure responses. For example, to monitor brain activity, a participant must have numerous electrodes positioned his or her scalp. In addition to this invasive procedure, the explanation of the EEG data continues to be complicated. Conversely, automated facial expression methods do not require the wiring of the participant to a machine in order to provide a proper evaluation of the individual's emotional level; the outcomes are also rather instinctive and the assessment more comprehensible (Dieckmann & Unfried, 2014).Autonomic measures found to be more efficient than self-reports whether or not the measurement tools are invasive. The main reason of this is that autonomic measures repeatedly capture responses that are beyond the conscious control of the individual (Lewiski el al., 2014).

The Facial Action Coding System, EEG, facial electromyography (EMG), skin conductance, and heart monitoring are tools used to record autonomic measures, and each device has its limitations. The Facial Action Coding System is widely used to expose the visible movement of the facial muscles (Ekman & Friesen, 1978; Ekman, Friesen, & Hager, 2002). This method does not perform high achievement in measuring the emotional responses toward commercial and print advertising (Derbaix, 1995). Although EEG is a physiological measurement technique, it can only be able to control stimulation and not emotional valences (e.g., Cook et al., 2011). On the other hand, EMG shows better results than EEG in capturing respondent's emotional valences.

In addition, although EMG works alongside with self-report measures (Lang, Greenwald, Bradley, & Hamm, 1993) the EMG procedure is unpleasant, with the placing of electrodes on the respondent's face, and has a lower ecological validity (Lewinski el al., 2014). Skin conductance captures nervous system activation by measuring the level of sweat emission (Poels & Dewitte, 2006), with a higher level of skin conductance associating to higher physiological arousal (Ravaja, 2004). Since both positive and negative stimuli lead to the same level of nervous system activation skin conductance outcomes are restricted (Hopkins & Fletcher, 1994). Finally, measuring heart rate changes cannot be with a direct stimulus, and therefore heart rate monitoring must be done as an accompaniment to one of the earlier mentioned autonomic measures (Hopkins & Fletcher, 1994). It is important to take into consideration that, most of the time, the body reactions like changes in skin acidity or heart rate fluctuation are beyond the conscious control of the respondents' while the methods to measure autonomic reactions have limitations (Lewinski et al., 2014).

Individual faces can display many different emotions (Jack, Garrod, Yu, Caldara, & Schyns, 2012), and facial muscles. Facial expression techniques are perfect supplement to traditional surveys with the purpose to recognize emotional reactions that respondents cannot or do not want to communicate, are not consciously aware of, or do not remember at all. The cerebral cortex, through the corticobulbar tract, links both emotions and facial muscle interactions (Martinez & Du, 2012). More specifically, all potential values of facial expressions can be explained by amygdala (Whalen et al., 2013) and is generally regarded as an essential factor in emotion, social behavior, and emotion inhibition and regulation (Phelps & LeDoux, 2005). As previously discussed, while self-reports explore the conscious situation of the individual, the autonomic methods explore the body's reactions; therefore, autonomic techniques measure directly assess the unconscious appraisal of a subject and overcome the restrictions of self-report techniques (Lewinski et al., 2014; Poels & Dewitte, 2006).

Tools like facial readers or facial recognition software have been prevalent between scientists (Lewinski et al., 2014). McDuff, El Kaliouby, Cohn, and Picard (2015) analysed over one thousand facial responses from among twelve hundred individuals. The researchers presented people 170 advertisements. Their findings indicate that ads with higher emotions were higher possibility to be recalled than commercials with less strong feelings. Bakalash and Riemer (2013) applied fMRI imaging technique and they found that emotional advertisements stimulated greater amygdala stimulation. Consequently, these advertisements became the most memorable.

With the purpose of to explore the possible correlation between emotion and public service advertising effectiveness (Hamelin, El Moujahide, & Thaichon, 2017), used facial recognition software (GfK-EMO Scans). GfK-EMO Scans use webcam technology to capture in real time with automatic and non-invasive emotional reactions to different marketing stimuli (Garbas, Ruf, Unfried, & Dieckmann, 2013). GfK-EMO Scans does not have any disturbing cables and can record over 20 frames per second, empowering an accurate measure of real-time emotional responses (Garbas et al., 2013). Applying the GfK EMO Scan technology the creative process of producing a commercial can be objectively evaluated, facilitated and optimized.

In this study, 60 students were used as test subjects, the subjects observed two different safe driving commercial and their emotional reactions were recorded. First group of 30 students watched high emotional commercials, and the other group of 30 students seen low emotional commercials. Both public service advertisements conveyed similar messages about the dangers of speeding and the importance of road safety. The high emotional commercial presented a thrilling car accident with fatalities and expressed a great degree of negative

feelings, including nervousness, panic and distress. The low moving commercial provided systematic data and the law of physics to explain how a rider may have prevented a fatal accident by driving under the speed limit. After seeing the commercials, the participants answered a survey adapted from the National Survey of Speeding Attitudes and Behavior (NSSAB) and focused on measuring the impact of emotions on recall and attitude change. (The survey of the National Survey of Speeding first conducted in the US in 2011 and findings of the surveys show drivers segmented into three distinct groups: speeders, sometimes speeders, and non-speeders. Demographically speaking, speeders (30% of the total population) were more likely to be higher-income young males in comparison to sometime-speeders (40% of the total population) and non-speeders (30% of the total population). The result of this survey published by the US Department of Transportation, National Highway Traffic Safety Administration (NHTSA). The findings of the research also analysed cell phone habit (calling and text messaging) while driving, demonstrating speeders used their phones more while driving when compared to sometimes speeders and non-speeders) (Schroeder, Kostyniuk, & Mack, 2013). Hamelin and colleagues (Hamelin et al., 2017)administered the survey again two weeks after the initial study. The reason of the two weeks delay for the second survey, was depending on the fact that people seems forget roughly 48% of meaningful material within two weeks of exposure (Di Vesta & Smith, 1979). The median values of the group who was shown the high emotional video can be seen below (see Figure 2).

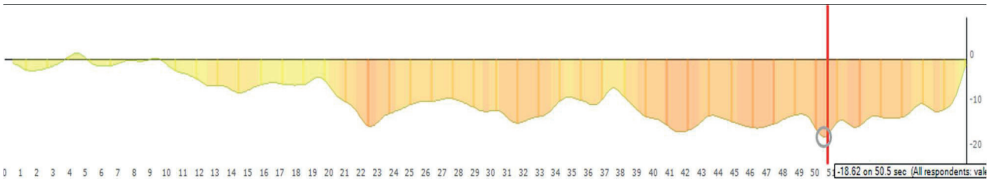


Figure 2: The Median Values of the Group Who Was Shown the High Emotional Video (HEV).

The first few seconds of the high emotional commercial records and show a young couple kissing and positive feelings. Instantly following the scene, a car smashes into the couple. At this point, the emotional valence turns negative and remains negative until the conclusion of the commercial. A score of 55.5" was the highest score registered by any one of the participants with a relative value of −18.62. Although the scene marked at 50.5 s does not display any strong emotional cues (see Figure. 2), The recorded negative emotion is strong because there is an "accumulation" of emotions from the participants. Participants register highly negative emotions after being shown the female victim on the operating table. The crying relatives next to the corpse of the boy at the mortuary, the overturned car on the side of the road, and the driver's expression while he loses control of his vehicle (see Figure 3).



Figure 3: HEV High Emotional Scenes

In contrast to the reactions to the HEV, subjects who have watched the low emotional video (LEV) demonstrate a lower level of emotional valence (see Figure 4 and 5).

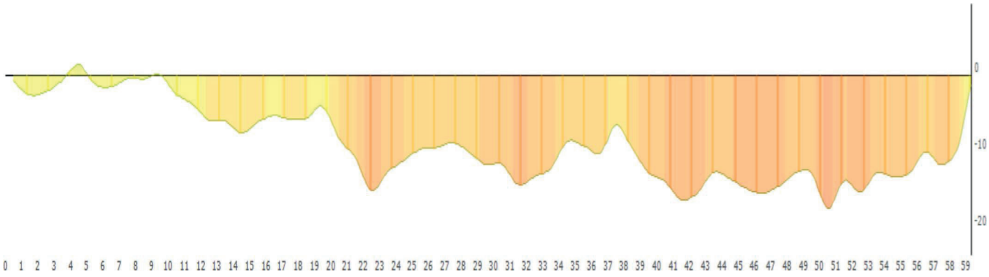


Figure 4: HEV All-Respondents Emotional Valance Graph

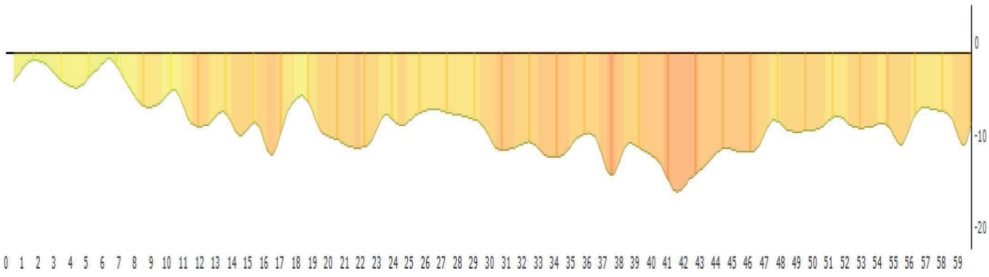


Figure 5: LEV All respondent Emotional Valance Graph

For LEV participants, the highest emotional instant is captured at 41.6 s with a relative value of −17.07 (see Figure 6). The scene does not contain any emotional cues; instead, it shows a quick variation of the speedometer. This change caused participants to lower their gaze and eyebrows, subsequently causing the system to interpret the action as a shock or negative emotion.

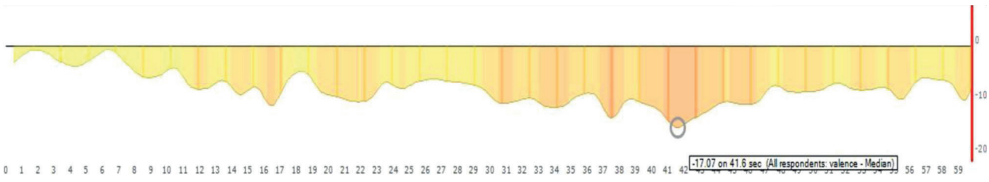


Figure 6: LEV All-Participants Emotional Valence Peak Value

The study suggested that response to a commercial advertisement is constant across a given population because the test population had an identical emotional reaction to a given stimulus, despite noting a variation between genders. This result was corresponding with the findings of Hasson, Nir, Levy, Fuhrmann, and Malach (2004), who used fMRI to demonstrate that much of the cortical response was typical.

Another crucial result of this research affects to the influence of both high and low emotional commercials on initial attitude and its change after some time. Test subjects exposed to the HEV have reported a better safe driving attitude score than the participants who watched the LEV. Concerning memory impact, this research also shows that high emotional commercials direct to a more stable attitude change than low emotional commercials. The safe driving attitude score of test subjects who had watched the LEV declined considerably after two weeks, while subjects who had seen the HEV had retained the similar high rating following the same two-week period. The message expressed within a highly emotional approach increases storage and retrieval potential over the same message demonstrated in a low emotion strategy. The result of this research indicates that emotions impact respondents' understanding and retention of the word in a commercial. Although both ads were concerned with driver safety, the specific message about the danger of speeding has only significantly influenced participants' attitudes towards speed, has had no effect on other hazardous driving reactions, such as texting and phoning while driving.

fMRI imaging offers an insightful understanding of human behaviour and consumer habits. These two traits are essential aspects in neuromarketing (Farnsworth, 2019). Neuromarketing employs fMRI to assess advertising campaigns before sending them out to the general public.

A participant study observed three different advertisements for the National Cancer Institute's telephone hotline. Thirty-one right-handed participants (15 females, 16 males) were recruited from a quit-smoking program located in the Los Angeles area of the United States. The partakers were paid $80 after they completed the fMRI study (Falk, Berkman, & Lieberman, 2012). Every one of the contributors were intense smokers with a real determination to quit smoking (Biener & Abrams, 1991). As such the reference point for intentions to quit smoking were held reasonably constant across this sample. The age range varied from 28 to 69 years (M = 44.4 years, SD = 10.1), with ethnically and socioeconomically diverse backgrounds.

This novel approach is a unique way for identifying advertisement campaigns that will invite public attention. The ten advertisements ending, with the phone number, are the focus of the current study. The advertisements were distributed as follow: three of these advertisements appeared in Campaign A, three ads appeared in Campaign B, and four ads appeared in Campaign C.

Participants watched expertly built television advertisements designed to assist smokers quit smoking during the fMRI session. Researchers concentrated on three advertisement campaigns (designated here as Campaigns A, B, and C). All advertisements were selected to target smokers who had decided to quit. All campaigns included a total of 90 seconds of advertisement time. The duration for each ad was 30 seconds, apart from two advertisements lasting only 15 seconds. All participants viewed a series of 16 ads, 10 of which ended by displaying the National Cancer Institute's Smoking Quitline phone number (1-800-QUIT-NOW). The advertisement campaign that supplied the highest amount of brain activity in a particular region and prompted significantly higher calls to the hotline.

4. Neuroscience and Effective Packaging Design

The importance of packaging strategies is increasing exponentially. As one of the essential attributes of the product, marketers employ packaging strategies to single out a company's product from the opposition's products. They differentiate their offerings by creating attractive and recognizable packaging, that is easily recognized in a store. Packaging's quality image is an essential carrier of a specially programmed market communication system. As part of the integrated marketing communication strategy, the appearance of the package is a necessary carrier of the quality of the product to the target consumers. In this communication, process packaging is a form of language. This language ought to attract the consumer's attention about the product, thereby creating interest, a consumer's purchase decision. This effort may generate a long-lasting favorable implication (Cholewa-Wójcik & Kawecka, 2015).

Brand packaging provides information on innovation and new design strategies to the company's brand managers, package designers, packaging material suppliers, and marketers by exploring new topics, trends, and news about consumer-packaged goods to successfully create strategic branding through package design. Through packaging design, brands move from merely being commodities and become expressions of lifestyles. Traditional package design requires hours of research and creative work. For impulsive-decision-based products, package design is critical for success. Attractive package designs which stand out are mostly designed to be emotional; however, assessing if a design of package is emotionally compelling or not is a difficult task. The reason for this is that traditional survey questions have a tendency to signify a customer's accurate emotional response poorly. These surveys measure a customer's feeling, i.e., the conscious interpretation of an emotional state rather than the emotion state itself. And, conscious understanding leads to bias. For example, respondents may attempt to please the surveyor, resulting in the well-known social desirability bias.

Visualize consumers evaluating a single food packaging in a noncomparative context. In this scenario, objective and factual cues that offer detailed quantitative information lead to better evaluations and higher purchase intentions than do evaluative nutrition cues. However, consumers are not examining products in a noncomparative environment. In a more realistic situation, consumers evaluate multiple products simultaneously, and those evaluative nutrition cues now reduce the cognitive load on the shopper, making them more useful. Front-of-packaging nutrition labeling is intended to educate consumers and aid them in making healthier food choices.; however, the best practices for marketing on the packaging are unclear.

The consumer forms a perception of a product from the cues and product information present on the packaging. Still, these cues that engage and influence consumers' product evaluations and decision-making processes are barely understood (Andrews, Burton, & Kees, 2011). Consumers form attitudes by several factors, such as the packaging's ability to communicate nutritional and health perception (health), enjoyment, convenience (attractiveness), safety, transparency, and environmental motives (trust), and product perception (Von Alvensleben, 2001).

In one fMRI experiment, the researchers can examine the brain activity of subjects who had to make decisions about the attractiveness of specific fast-moving consumer excellent packages. The results show that brain activity is triggered when art subjects are presented appealing and unappealing package designs, showing different cortical events (Stoll, Baecke, & Kenning, 2008). The same study discovered significant cortical activity changes in visual areas of the regions associated with the processing of visual stimuli and attention

for the two distinct types of package designs. While researchers show subjects unattractive packages, the researchers found out increased activity in areas of the regions of the respondents' brain related with processing unpleasant stimuli. An example of a trigger of this increased activity are unattractive offers or abhorrent images in the print ads. Based on these, the researchers were able to understand and document why physically attractive packaging is given more attention, which leads to high sales of convenient consumer products (Gang, Lin, Qi, & Yan, 2012).

Appealing package designs considerably increased the response time of customers in buying choices: among a set of offered products, respondents chose the bags with well-known brands in traditional package design, and even though the bags had a higher price (Reimann, Zaichkowsky, Neuhaus, Bender, & Weber, 2010). Functional magnetic resonance imaging (fMRI) showed that this preference resulted in increased activation of certain parts of the brain. These findings propose that reward value presents a critical role in aesthetic product experiences.

Neuromarketing brain scans tools can predict customer buying behaviour significantly better than a survey method (Baldo, Parikh, Piu, & Muller, 2015). Baldo et al.'s (2015) study demonstrated that survey methods couldn't precisely predict consumer behaviour, whereas employing neuromarketing tools provided by brain scans data, the prediction precision achieved to 80%. Additionally, the researchers examined how these surveys and brain data methods could impact the gross profit of a company. A simulation created with sales data proved that survey-based planning might increase profit among 12.1%, while neuromarketing tools with brain scans may increase profit by as high as 36.4%. Brain data analysis is an advanced neuroscientific method that considerably improves product image and creates substantial competitive advantages and value for companies. Employing the preference index developed by Davidson, Ekman, Saron, Senulis, and Friesen (1990), a researcher can see on the computer screen the brain data analysis. This computer display shows the emotional response time of the brain while viewing a picture of a product's advertisement is merely one second.

Modica, Cartocci, and Rossi (2018) studied the emotional and cognitive reactions of the mind to the cross-sensory interaction (sight and touch) with products belonging to different categories. The results showed that respondents are more likely to approach situations more logically in reply to comfort food during the optical exploration and the visible and perceptible exploration stages and towards different food commodities in comparison with local ones. For this concluding interaction, A higher mental effort index (measured as the increment of the theta band in the frontal lobe) for the later interactions

After realizing innovations in visual neuroscience regarding the reaction of consumers to various types of packaging, businesses such as Campbells started to reconsider their packaging strategies. Campbell was among one the big companies that used neuroscience to improve their packaging strategy. Campbell's marketing branch was flustered by a few issues. First of all, soup wasn't viewed as an important product by consumers, causing marketing research to be much more challenging; conventional marketing research methods such as ad recall and intent to purchase do not have a high linkage with actual consumer behavior. Campbell knew the fact that customers did have an emotional soft spot for their soup products (When you were sick or cold, your mother fed you soup. Maybe even Campbell's soup). The customer confronted with a shelf with almost identical red and white packages, the Biometric monitoring methodology showed that the warmth faded in the grocery store soup aisle as Campbell began to observe in what way customers were reacting to a string of design adjustments.

In 2005, Campbell company utilized neuromarketing methods to identify which components lead customers to decide to buy soup and if a fresh label design on the package would increase the sales of their soup. After almost two years of research on the emotional and cognitive reactions in response to pictures of bowls of soup in logo design, Campbell found that customers are more favorable to "matte" packaging than shiny textures (Couchman, 2017). Campbell redesigned its label according to these results (Kumar, 2015). According to their biometric analyses, Campbell implemented new displays and packaging to seek a better link with customers' feelings. The key attributes of the original packaging strategy were distinct colour packaging for various lines of soups. Additionally, they included a smaller logo, excluded spoon pictures, and included more vibrant and steamy images (Dooley, n.d.).

Another giant company was the Nabisco corporation, which produced substantial alterations to their package design of one of their popular foods, "Chips Ahoy!" Nabisco remodelled Chips Ahoy packages to boost sales and speed repurchases. The packages have a resealable-lift-here-flap that removes the past barrier of eating the entire package. Resealability is an important feature of the box. Simultaneously, the resealability assertion was driving adverse emotional reactions; it was too upsetting for the existing packages and too difficult to read on the proposed packages. The cookie appearance on the recommended packaging was also of concern. It was attracting only neutral reactions, despite its fame, and thus didn't appear to be effective. These results motivated the company to consider changes to both designs before making available the new packages. The resealability flap is more readable. The cookie pictures, on the other hand, gained more energy using the flying cookie visuals.

Hamelin, Kishore, and Harcar (2017) studied the importance of packaging for the organic food industry in India and the consumer's decision-making process that influenced purchase intention concerning organic packaged food. Hamelin, El Moujahide, and Thaichon (2017) recommended effective packaging design strategies for organic firms' brand managers based on factors identified in the study. Moreover, prior studies have demonstrated that evaluative cues (imagery, icons, color, etc.) drive more purchase intent than external signals (factual statements about the product). The study aimed to identify if different cues on the package can impact the attitude of the consumer develops towards the product. Neuroscience methods, like eye-tracking and skin conductance, were used to evaluate the impact of these cues on consumer decision making. Ultimately, the study used five brands of organik cereal (see Figure 7) to test which signals had an effect on the product's health, price, attractiveness, and trust measures, as well as how those factors impacted purchase intention. The researchers selected The Australian cereal brands to prevent brand recognition on purchase purpose among the students. A wide range of cue types present on each package motivated the selection process. The packaging ranged from *Lean on Me*—which provided the most subjective and evaluative cues, including information like a human face and a weighing scale—to the more objective cue-based packaging of *Australia's Own Organic*. Each signal constituted a three-second duration interval. Various studies (Hare, Camerer, & Rangel, 2009; Krajbich, Armel, & Rangel, 2011; Litt, Plassmann, Shiv, & Rangel, 2011) have discovered that respondents were able to make purchase decisions about food stimuli in 500- 2000ms. In multi-choice scenarios (displays with 16 items), Reutskaja, Nagel, Camerer, and Rangel (2011) indicated that respondents were able to make precise decisions in less than three seconds.



Figure 7: Brands of Organic Cereals

The initial eye-tracking study yielded exciting results. During the investigation, five images flashed in random order with each cue was flashed for three seconds. Heatmaps show that male participants spent the most time viewing the evaluative cues, rather than the facts, for most packages. There was one exception. People spent the most amount of time on the brand and the flavor (see Table 2), both of which are facts when viewing the *five: am* packaging. The following table represents a summary of the results:

Table 2: Summary of the Results

Male Participants	***Female Participants***
Lean on Me: The majority of the three seconds was spent focusing on the face of the woman. While still significant, less time was spent on reading the phrase "*Lean on Me."* Even lesser time was attributed to the phrase on "nutritious living." All 3 of these are evaluative cues: cues that allow the viewer to make their own interpretation and derive meaning relevant to themselves alone.	*Lean on Me*: The majority of the time was spent reading the *Lean on Me* brand name, which is an evaluative cue. While still significant, less time was spent on the face of the woman, weighingscale, and the phrase "nutritious living."
Australia's Own Organic: While the packaging had a great amount of objective and factual cues, most male participants chose to focus on the "From the organic farm" line, which is a subjective cue because most people would attach their own emotive value to the phrase.	*Australia's Own Organic*: While men mostly only focused on the claim "From the organic farm," women also spent a minor amount of time on the objective name of the brand.
Buckinis: Most people spent most time viewing the name of the product, which is a play on the word "bikinis." It is not improbable that this will trigger a subconscious liking to the brand due to the word bikini.	Buckinis: Like the men, women also spent most of their time on the name of the product "Buckinis," which is play on the word "bikini."
Mom's Best: As the trend seems to be, most people spent their time viewing the name of the product, "Mom's best," as well as the product type, which is Crispy Cocoa Rice. The brand name has an emotive attachment to it, because it might cue participants to think of their own mothers.	*Mom's Best*: Like the male participants, women participants also focused most of their attention on the brand name, *Mom's Best*, and the type and flavor of the product.
five:am: Given that this packaging had very few subjective cues that the participant could focus on, most people focused on the brand name and the name of the flavor.	*five:am*: Once again, the women participants focused most of their attention on the brand name and product flavor, presumably due to the lack of any other major cues on the packaging.

In the same study, researchers also examined the skin conductance or GSR readings, considering the highest average and the most significant responses, to gain a better understanding of emotional arousal. Results showed that *Buckinis* caused the highest arousal peaks among the men, followed by *five: am* and *Lean on Me*. Among the women, the only packaging that produced a maximum in GSR scores (above the threshold) was *five: am*.

Since humans naturally planned to convey and communicate emotion through facial expression, the face provides a luxurious canvas of passion. While GSR scores can show the hormonal-level emotional arousal, the iMotions software uses the eye-tracking and facial recognition tools to record and provide meaning to the broad reactions people felt towards the cues. Affective Emotion Analytics Dashboard (AFFDEX) systematically computes and determines respondents' emotions and facial expressions using high-tech computer systems and "machine learning techniques. iMotions identified the following main features: Smile (Enjoyment), Brow Furrow (Concentration, Confusion, Dislike), Brow Raise (Surprise), Lip Corner Depressor (Sadness). *Australia's Own*, which had the highest average purchase intention scores, also had the most top scores on attention and engagement. Moreover, the five strongest manifested emotions were also broadly positive (smile, inner brow raise, joy). The results of the packaging with the lowest purchase intention scores (*Mom's Best)* demonstrated that the highest ratings were on negative factors like contempt and smirks.

Some interesting patterns emerge, considering the context of the heatmaps, some interesting patterns emerged. For example, *Australia's Own* had a significantly higher purchase intention when compared to other brands. This s purchase intention coincided with emotional arousal associated with packaging and positive AFFDEX scores.

This result stems from the fact that the participant only viewed the evaluative cue. One can also see this result with *Buckinis*. While *Buckinis* is an attempt to be "emotive" with its play on words, it does not produce any impact. Most people viewed the evaluative cue of *Buckinis* and felt emotional arousal that was most akin to surprise and attention. Neither of these is strong enough to be positive impacts on purchase intention, and this reflects in their purchase intention scores.

Interestingly, *Lean on Me* made the highest purchase intention scores among the women. Based on the survey and regression analysis, people indicated that they would like to purchase the product. Their bodies and emotions seem to suggest otherwise. The GSR scores show no significant emotional arousal, and this finding is supported by the AFFDEX index, which demonstrated that most people seemed to be uncertain or doubtful about the product.

In conclusion, this study provided significant proof to support that consumers spend more time viewing evaluative cues over external cues. And Attitudes developed towards the brand are impacted by both evaluative and objective packaging cues, and different packaging designs provide a variety of prompts for the consumer, which affects purchase intention. Von Alvesleben (2001) indicated that the factors which drive attitude are formed by whether or not the packaging

can communicate the nutritional and health perception (health), enjoyment, convenience (attractiveness), safety, transparency, and environmental motives (trust). Attitude, product perception, formed from the cues and product information present on the packaging. Lastly, there is substantial proof that actual product emotional arousal increases purchase intention.

5. Conclusion

Neuromarketing has gradually become accepted as a tool to gain actionable customer insight. In 2014 Ulman, Cakar, and Yildiz (2015) reported that well over 300 companies are utilizing neuromarketing techniques. The example provided here shows that measuring customer autonomic body reaction provided a robust understanding of a person's preference and choice. Companies can fine-tune their product design and promotional material to increase engagement, attention, and ultimately alter purchase decision favourably. The last example of political marketing brings to light some important ethical considerations. It is now clear that emotions have a determining effect on decision making and behaviour. Facial expression analysis can now operate using a powerful high-resolution gigapixel camera. These cameras are mounted on tall rise towers or drones and can analyse any passer-by facial expression and emotional states from miles away. Government and corporations can also use such advanced technological toolset. Since allied with artificial intelligence, it has become possible to monitor and possibly alter a person's emotional state in real-time (Soni, Sharma, Singh, & Kapoor, 2019). Facebook was bragging to advertisers about their post monitoring algorithm that was able to detect if teenagers experienced "stressed," "worthless," "useless," "insecure," and a "failure." Their purpose is to micro-target commercials down to instants while young people require a self-assurance enhancement (Machkovech, 2017). Lately, a scientist has focused on using radiofrequency waves such as simple WIFI like signals to measure people's heart rates and emotional states (Adib, 2019). For example, Zhao, Adib, and Katabi (2016) demonstrated that it is possible to infer a person's emotions using standard cell phone signals reflected off of his or her body. Such techniques that use a high degree of signal processing permit to detect a person's emotional state with a degree of accuracy is equivalent to a person attached to an EEG. Amassing data about individuals and manipulating their emotional states without them being aware and giving their consent has been identified as a breach of privacy and human rights (Perry & Roda, 2017; Volovelsky, 2014). Ienca and Andorno (2017), proposed new powers to be added to the chart of human rights "the right to cognitive liberty, the right to mental privacy, the right to mental integrity, and the right to psychological continuity." In immemorial times, the human mind was a sanctuary for personal freedom and self-determination. Today, without regulations, this ultimate refuge may no longer be.

Many social sciences in our current day haven't yet adopted neuroimaging as a daily device or a type of process in their studies. Nevertheless, economics began utilizing neuroimaging methods in its studies – causing the formation of 'neuroeconomics' (e.g., Braeutigam, 2005; Kenning & Plassmann, 2005; Rustichini, 2005). Marketing science has lagged in the waking of the advantages of imaging research, even though marketing and other related fields share many common problems concerning decision making and exchange. Economics has already started utilizing neuroimaging. In recent years they've already coined the term 'neuroeconomics' (e.g., Braeutigam, 2005; Kenning & Plassmann, 2005; Rustichini, 2005). The field of marketing, however, has been much slower to realize the benefits of imaging research. This circumstance is surprising because both subjects were having a lot of common ground in their study. There are many justifications for the absence of picking up brain imaging practices in marketing science. Empathizing with a marketing academic, neurophysiology, and cognitive psychology, commonly, can be daunting topics. There are a few understandable rationales of why marketers haven't recognized the advantages of brain imaging procedures, though. From a marketing point-of-view, neuroscience and cognitive psychology can be frightening and touchy topics.

Moreover, a lot of marketing scholars can see imaging procedures as 'unobtainable' for them in their branches. Nonetheless, usually, this is not the issue; a lot of business scholars work in a much broader perspective, such as a university with many skilled facilities to perform research with brain imaging. The ignorance of scholars, however, may reduce the rate of these imaging techniques to grow within the scholarly community.

In spite of its excellent capabilities, it's evident that preceding implementations of neuroimaging in the marketing narrative exists within the vision of brands and consumer behaviour. Neuroimaging has never been used to explore academic marketing but has been focused on by brands and consumer behaviour. Correctly, EEG is being used and has been used by scholars to accumulate data of reactions to television commercials. For instance, Young (2002) studied if specific instants in ads are mainly responsible for the development of brands and whether those instants are solely responsible for acquiring the attention of the audience. Rossiter, Silberstein, Harris, and Nield (2001) have been interested in using memory and information processing. He has used EEG to convey the fact that certain parts of the brain more easily familiarize specific graphic pictures. Within neuroscience narratives, Ioannides et al. (2000) and Ambler, Ioannides, and Rose (2003) state the outcomes of MEG tests, demonstrating the effects of intellectual and emotional commercials stimulate various cortical centres.

Generalizing these findings, it suggests that various traits or forms of marketing produce substantially different styles of brain activity, perhaps causing disparities in methods of ad productivity. Thus far, these types of studies are incomplete. The choices that consumers make has demonstrated a broad topic for neurophysiological studies, but none has made it into marketing literature yet. Braeutigam, Stins, Rose, Swithenby, and Ambler (2001) and Ambler, Braeutigam, Stins, Rose, and Swithenby (2004) have discovered the distinction among probable and erratic choices, where likely decisions can be linked the incidence of previous use of the item, and the time interval among the selection and exposure to the given commercial or ad. This finding indicates that choice predictability stimulates various areas of the brain. Erratic choices prompt commotion in sections of the brain connected to the judgment of prize and muted vocalization. Differences between genders were also a factor that played into the study. The latest studies suggest that various parts of the brain are linked. This connection stimulates and releases certain endorphins to the body due to the feeling of satisfaction and rewards (e.g., Senior, 2003). These areas of the brain are part of continuous study. Erk, Spitzer, Wunderlich, Galley, and Walter (2002) discovered how specific objects could stimulate the mind more than others.

An example being the purchase of expensive clothes. This purchase associates one to high social value, stimulate that specific part of the brain more than, say, buying sweatpants or slippers. Lastly, McClure et al. (2004) study show that the majority of the test subjects preferred Coke over Pepsi. The results indicated the reaction of the brain once the participants knew they were drinking Coke or Pepsi. Nevertheless, blind tests showed absolutely no difference between the two groups drinking different drinks. Studies like these strengthen the idea that choice-making, although comfortable, is a very intricate subject.

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