

The Potential of Neuromarketing as a Marketing Tool

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ABSTRACT

In recent years, the emerging field of neuromarketing, which makes use of brain research in a managerial context, has gained increasing popularity in the academic literature as well as the practical world. Therefore, the purpose of the present paper is to evaluate upon the influence of neuromarketing tools on traditional marketing inputs in order to complete the understanding of consumer behavior. Yet, no available neuromarketing study provided an detailed overview of neuromarketing's influence on traditional marketing inputs while considering technical as well as ethical issues. The article uses the approach of an in-depth literature review in order to do so.

The increased use of neuromarketing techniques for the evaluation of customer preferences and decision-making processes is considered to be an advantage for customers and marketers simultaneously. EEG, fMRI and MEG rank among the most appropriate technicalities in the area of neuroscience. However, critics emphasize the restriction of the consumer's free will and their reduced ability to make individual decisions in their buying behavior due to neuromarketing's implementation.

After an evaluation of Outside reflexes, input-/Output models and Inside reflexes to analyze brain activities, the current paper evaluates upon the influence of neuromarketing on different relevant marketing inputs, followed by the consideration of its ethical defensibility.

The results indicate that neuromarketing is associated to have a high influence on consumer buying behavior, advertising, pricing, distribution of products, branding and decision-making as marketing inputs.

Therefore, neuromarketing may be considered to be a remarkable extension in the research of human behavior and the brain as the "black box" which can positively contribute to its practical applicability.

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Keywords

Neuroeconomics, neuromarketing, Neuroscience, marketing, consumer behavior, fMRI, EEG

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1. INTRODUCTION

1.1. Relevance of topic

Since the emergence of the field of Neuromarketing in 2002, its importance is constantly growing and its fame is spreading over companies, marketers and advertisers (Morin, 2011). Although the topic gains increasing attention in the medical industry and psychology, this paper will concentrate on the clarification of human behavior by the use of neuromarketing and its benefits and drawbacks in the economic sector (Sanfey, Loewenstein, McClure, & Cohen, 2006; Khushaba, Wise, Kodagoda, Louviere, Kahn & Townsend, 2013; Hubert, 2010).

There is certain evidence suggesting that the brain itself is the main mediator of human behavior, expressed emotions and decision-making processes (Murphy, Illes, & Reiner, 2008). Additionally, certain evidence shows that in the majority of the cases, people are unable to express their reasons for behavior or the reasons for preference of certain things, consciously or unconsciously (Vecchiato, Astolfi, De Vico Fallani, Toppi, Aloise, Bez, & Babiloni, 2011). With this in mind, the argumentation by Camerer, Loewenstein and Prelec (2005), Kenning and Plassmann (2005), Riedl, Hubert and Kenning (2010), Sanfey, Loewenstein, McClure and Cohen (2006), stating that neuroeconomics takes neural and physiological processes as the basis for the explanation of consumer behavior, seems justifiable. Although neuromarketing is not going to compensate for traditional approaches, there is high evidence that emerging tools such as fMRI (functional magnetic resonance imaging) will upgrade the productivity of marketing strategies (Keller, 2008; Venkatraman, Clithero, Fitzsimons, & Huettel, 2012; Adolphs, Tranel, Koenigs, & Damasio, 2005). Since branding and advertising are assumed to have relevant impact on consumer preferences for products, it is likely that neuromarketing could contribute and influence these consumer preferences by the application of neuromarketing techniques in a positive way (Bruce, Bruce, Black, Lepping, Henry, Cherry, & Savage, 2014; Esch, Möll, Elger, Neuhaus, & Weber, 2008).

1.2. Why is neuromarketing important

The issue of the effects of neuromarketing for companies and society is important since it is assumed that there is potential to discover implicit and automatic processes which determine the decision making process, and that it will reveal secret information about consumer behavior which was not obtainable by the traditional marketing methods (Hubert, & Kenning, 2008; Tusche, Bode, & Haynes, 2010; Ariely, & Berns, 2010; Senior, & Lee, 2008). Although there are also critical arguments against neuromarketing's intervention into the privacy of customers, it is expected that with this method, more effective customer segmentation can be carried out, which in turn leads to improved marketing of products by considering individual product and brand preferences as well as consumer behavior in general (Venkatraman, Clithero, Fitzsimons, & Huettel, 2012).

1.3. Background

Primarily, neuromarketing's emergence and its background will be discussed: It is eye-catching that the interest in using neuromarketing when doing consumer research, was and still is growing rapidly (Kenning, & Plassmann, 2008; Kenning, & Linzmajer, 2011; Politsier, 2008; Madan, 2010). This is proven by the fact that an enormous amount of neuromarketing companies were founded in the past years, while at the same time the number of publications in top marketing journals regarding neuromarketing and entries on Google has increased exponentially (Plassmann, Ramsøy, & Milosavljevic, 2012). Namely, when looking up the word "neuromarketing" on

Google, it can be seen that in 2002 there were just a few hits while in 2010 there were several thousand entries (Morin, 2011). This rapid emergence can be traced back to the emergence of Information Technology (IT) and the implementation of computers and the internet, which dramatically changed and facilitated the way information is collected, communication is taking place and advertisement is arranged, and how all of this influenced all other economic transactions (Riedl, Mohr, Kenning, Davis, & Heekeren, 2011). Symbols of the emergence of the so called "neuroculture" (Fisher, Chin, & Klitzman, 2010) are for example that around its beginnings in 2002, the first two neuromarketing companies in the United States were formed, namely Brighthouse and SalesBrain, offering neuromarketing research and consulting services (Morin, 2011).

1.4. Description of Situation

Nowadays, with markets overcrowded by numerous similar and yet slightly different products, it became a key discipline to constantly innovate and differentiate products, which meet customer needs as good as possible (Leonard, & Rayport, 1997; Dapkevičius, & Melnikas, 2011). Due to this increased importance of meeting customer needs, and the fact that in the past, it was not possible to analyze the underlying mental processes taking place when decisions are made, this objective perspective provided by neuromarketing research and neuroscience seems very promising (Kenning & Plassmann, 2008; Huettel et al., 2009b). Additionally, approximately 80% of all new products fail within its first three years on the economic market, which indicates that there should be made further alignments between newly invented products and actual user requirements (Calvert & Brammer, 2012). Therefore, non-invasive brain-imaging techniques of neuromarketing such as psychophysiological tools (e.g., eye tracking, skin conductance) and brain imaging tools (e.g., fMRI, EEG) received increasing attention and made it possible to actively make brain observations during the execution of certain tasks, which provides marketers with additional inside information about consumers (Lieberman, 2007; Dimoka, Banker, Benbasat, Davis, Dennis, Gefen, & Weber, 2012; Calvert, & Brammer, 2012; Ariely & Berns, 2010; Venkatraman et al., 2012).

1.5. Definition of Neuromarketing

The traditional term "marketing" can be defined as an activity which tries to bring together products and people by understanding and analyzing human behavior which is relevant to the trade market (Ariely, & Berns, 2010; Lee et al., 2007). Although Madan (2010) argues that the activity of marketing is purely commercial and focused on sales, we take the underlying definition of Ariely and Berns (2010) as the basis, stating that marketing on the one hand deals with the presentation of products focusing on consumer needs, and on the other hand influencing the decision making process of the customer. When considering the development from marketing to neuromarketing, essentially, the key issue which changed is the way in which information about consumer wants and preferences is acquired (Ariely, & Berns, 2010).

Within the "neuro-area", we can differentiate between three terms, namely neuroscience, neuroeconomics and neuromarketing. According to Plassmann et al. (2012), neuroscience "is the study of the nervous system that seeks to understand the biological basis of behavior" (p.18). Put differently, it is the practical application of neurological findings to sciences that tries to understand human behavior, emotions and thoughts. (Esch, Möll, Elger, Neuhaus, & Weber, 2008; Kumlehn, 2011; Camerer, Loewenstein, & Prelec, 2004). Then, neuroeconomics can be seen as some kind of sub-

discipline of neurosciences in general. As stated by Rustichini (2005) and Sanfey, Loewenstein, McClure and Cohen (2006), neuroeconomics makes use of the techniques offered by the field of neurosciences and tries to explore brain processes with it, but having a main focus on decision-making and economic aspects at the same time. It tries to understand all ongoing and economically relevant processes in the brain (Braeutigam, 2005).

Finally, let us come to the actual term of neuromarketing. Although there exist several different definitions, we will summarize the most important ones in the following. Neuromarketing can be seen as a sub-field of neuroeconomics, and therewith also of neurosciences, which deals with problems relevant to marketing by making use of methods from brain research in managerial practice (Hubert, 2010; Fugate, 2007; Lee, Broderick, & Chamberlain, 2007; Gang, Lin, Qi, & Yan, 2012; Hubert, & Kenning, 2008; Ariely, & Berns, 2010; Dapkevičius, & Melnikas, 2011; Fisher, Chin, & Klitzman, 2010). Formulated differently by Lee et al. (2007) neuromarketing is “the application of neuroscientific methods to analyze and understand human behavior in relation to markets and marketing exchanges” (p.200). Calvert and Brammer’s definition (2012) also points to the measurement of “non-conscious” responses of the brain that can only be observed with neuromarketing techniques.

1.6. Goal of Study

One of the goals of the present study is to familiarize the reader with the broad topic of neuromarketing and its use for the company as well as for the consumer. However, the primary goal is to evaluate upon the influence of neuromarketing on several marketing inputs, namely consumer buying behavior, advertising, pricing, new product development, communication, distribution of products, branding and decision-making. The aim is to figure out which of these marketing inputs are influenced by neuromarketing what this could mean for the future. This new technique and its objective analysis of the brain are expected to produce more feasible strategies to attract consumers (Gang, Lin, Qi, & Yan, 2012). Additionally, since there are very divergent views on the topic of neuromarketing and its effect, the study is necessary to provide the reader with a comprised and objective evaluation of different scientific literature.

Generally speaking, by the further implementation of neuromarketing techniques, it is desired that otherwise unavailable information about customers behavior and their preferences will be revealed, money will be saved and marketing processes will be facilitated, and that the analysis of neuromarketing research results will help to segment humans in such a way that individual differences in decision-making processes can be identified (Ariely, & Berns, 2010; Venkatraman et al., 2012). In this literature review, the main focus is on gathering and evaluating upon all relevant literature concerning the influence of neuromarketing on the key marketing inputs mentioned above.

Academic Relevance

In the present paper, the key focus lies on the interconnection between the key marketing inputs (see Figure 1) and the influence of neuromarketing as a new tool on these factors, next to the market and consumer reactions. There does not exist any literature incorporating all these aforementioned factors, an in-depth explanation of its technicalities plus ethical issues within one single paper, although these are the key issues concerning neuromarketing. Therewith, it is expected that by publishing the paper, a cornerstone in the literature of the neuromarketing field will be provided to societies worldwide.

Practical Relevance

With regard to the practice-oriented impacts, it is expected to reveal contradicting points of view. On the one hand, more detailed information on what is requested by customers can enable companies to structure marketing, pricing, advertisement and new product development strategies in a way that facilitate the sales of products. On the other hand, one can argue that the technique of analyzing brain activities and develop marketing strategies accordingly is an attack on consumer privacy and manipulates the freedom of choice of customers, which at the moment is the most powerful tool humans possess entirely themselves. According to Morin (2011), in case this would be taken away, there would not exist free markets anymore.

On basis of the previous introduction to the topic and its argumentation, the following research questions evolved:

Regarding the background of research, what is the influence of the use of neuromarketing as an effective marketing input?

Sub- Research Questions

- *What is neuromarketing (in regard to three different methods that help gain access to the brain)?*
- *Which of the following marketing areas, namely (1)consumer buying behavior, (2)advertising, (3)pricing, (4)new product development, (5)communication, (6)distribution of products, (7)branding and (8)decision-making could effectively be influenced by neuromarketing?*
- *In how far are neuromarketing activities, which are used for marketing issues, ethically justifiable?*

The paper will be structured as in the following. In the Literature Review part, all concerns of neuromarketing and its importance as a marketing input will be explained in depth, structuring it into eight prevalent factors: consumer buying behavior, advertising, pricing, new product development, communication, distribution of products, branding and decision-making. Afterwards, a critical evaluation will follow, where the accompanying consequences for customers and users will be explained and critically reviewed. The literature review will finalize with an overall evaluation by presenting a clear overview of the in detail considered components, while it is expected that certain components will emphasize to be more relevant in the neuromarketing process than others.

2. METHODOLOGY

In order to identify the influence of neuromarketing on the marketing input tools, the present paper systematically analyzes numerous relevant scientific literature concerning the topic of neuromarketing, its mechanisms, namely outside reflexes, input-/output-models and inside reflexes, and its influence on the key marketing inputs. In regard to the topic, a literature review is chosen as a method since in this way, it is possible to combine discovered findings of previous research and condense the experiences and findings of other researchers. The reason why no entire research can be conducted concerning the topic of neuromarketing is the tremendous time and cost exposure. Due to insufficient necessity, no distinction has been made between academic and professional literature, nor between quantitative and qualitative studies.

The raw data of the literature review has been mainly gathered by making use of electronic search engines like Google Scholar, Scopus and the online library of the University of Twente, but also by searching relevant literature in offline libraries. Basically one can say that an in-depth content analysis was

applied to the literature discovered. In turn, all relevant information was neatly entered into a complex literature matrix in order to ensure a comprehensive overview of the topic (see Figure 1a and 1b). This matrix listed the different names of the articles in APA style in the top row rightwards, and the relevant (sub-) topics in the first column downwards. By applying this method of selection, a clear and structured overview can be made from which the extraction of information is simple. In order to decide if an article turns out to be relevant, the abstract is scanned primarily, followed by the year of publication, the journal in which it is published, followed by an inspection of the introduction and conclusion, and finally the in depth-inspection of the entire article. Within this procedure, every article is scanned and judged independently in regard to its relevance. In total, 85 relevant scientific articles were found, accompanied by five relevant online web pages.

The key search terms used in order to get access to relevant literature were primarily 'neuromarketing', but also 'neuroscience', 'neuroeconomics', 'marketing', 'brain research', 'consumer buying behavior', 'fMRI', 'EEG' and 'neural influence'. In this regard, it is important to mention that when the search term 'neuromarketing' was entered into Google Scholar, it yielded 5.270 results. When the language filter was limited to only English and German results, one ended up with 3.380 results. When the same was done at the online library of the University of Twente, the term yielded 327 results. The search engine Science Direct led to 129 results, while Scopus resulted in 97 hits. From the articles considered to be relevant, the reference list was additionally scanned in regard to title, year of publication and type of journal, leading to numerous additional useful articles.

A frequently discussed article during the paper concerning neuromarketing from April 2010 is the one by Ariely and Berns. It elaborates upon the recent gain in popularity of the topic of neuromarketing and traces it back to the possibly more efficient cost-benefit trade-off than other marketing methods, and additionally to the suspicion that new, undiscovered information could be revealed about consumers and their decision making processes (Ariely, & Berns, 2010).

Furthermore, another highly relevant source of literature is the book "Anatomie van de Verleiding – Neuromarketing successful toegepast" by Paul Postma from 2012, where he elaborates upon the three different methods to access information about the brain, namely 'Outside reflexes', 'Input-Output-Models' and 'inside reflexes', while explaining in how far the neuromarketing approach still offers and is likely to offer marketers and managers a competitive advantage.

In the Article "What is 'neuromarketing'? A discussion and agenda for future research" Lee et al. (2007) discuss the application of neuroscience techniques to market research in general, while at the same time critically evaluating upon the ethical and moral accuracy of the issue (Lee et al., 2007).

Moreover, Morin in his article "Neuromarketing: The New Science of Consumer Behavior" (2011) discusses the issue of neuromarketing on a more consumer- advertisement related direction.

Due to the fact that several different and partly contradicting literatures are evaluated in the following, it will be assessed on a critical basis in order to end up with strong and persuasive arguments.

3. METHODS TO MEASURE BRAIN ACTIVITIES IN REGARD TO CONSUMER BUYING BEHAVIOR

3.1 The Brain

The brain itself can be described as an organ located inside of the skull, which is part of the central nervous system and which makes it possible to control all mental and physical processes of a human being, including thinking and feeling (Minddisorders, 2014; Macmillandictionary, 2014).

There are different ways to subdivide the brain. On the one hand, one can differentiate between three brain areas, namely the forebrain, the midbrain and the hindbrain, where the forebrain is concerned with the control and execution of speech and thought, the midbrain deals with the eye movements recognitions, and the hindbrain takes care of all unconscious processes going on in the body like breathing and heart action (Oxforddictionaries, 2014). On the other hand, Renvoisé and Morin (2005) differentiate between three brains as well, but between the old, middle and the new brain. According to their theory, the old brain is concerned with the decision-making, the middle brain involves thinking, and the new brain is dealing with the process of feeling. So, when considering this division, neuromarketing is concerned with the old brain since it is trying to figure out the decision-making processes influencing consumer buying behavior (Kampakoglou, 2012).

The brain itself as an organ is responsible for all consumer behavior that is taking place. Interestingly, although it presents only 2% of the whole body, it burns approximately 20% of humans' energy. Another important fact is that about 80% of the human's brain activity is taking place unconsciously in order to sustain the tranquility state, leaving only 20% of the brain activity for conscious purposes (Morin, 2011). Due to the origin of a human as a hunter and collector who is striving for survival, the brain was and still is used to scan the environment for potential dangers, which is mainly done by the part called 'reptilian brain'. This part is capable of processing all visual stimuli by not making use of the visual cortex, which is the biological argumentation for the fact that human beings in general have a general preference for images over words, or comparably experiences over explanations (Morin, 2011). So, knowing that the brain is one of the most complex and interwoven biological organs existing, including numerous interconnected cells, it should be obvious that the translation and interpretation of its activity is a highly complex procedure (Purves, Fitzpatrick, Augustine, & Katz, 2008). Although it is acquainted that the purchasing decision does not represent a binary social response, meaning that one cannot predict that with using a certain advertisement one will make the purchase for sure, there are still high expectations in the ability of neuromarketing observing and analyzing the entire brain in order to find out new, unpredictable results that give new insights into the field of neuroscience (Lee, & Kacen, 2008; Hubert, & Kenning, 2008).

3.2 General Information about Technicalities of Neuromarketing

The overall goal of using neuromarketing techniques is to understand the interconnection between marketing activities and the response upon that from consumers (Kumlehn, 2011). It is expected that by doing so, next to the subjective self-assessment methods, an objective perspective of brain activity can be assessed (Hubert, & Kenning, 2008). The various methods available in this field range from Body Language,

Facial Coding, Empathic design, Eye tracking, over fMRI, EEG, MEG to galvanic skin conductance and heart rate (Calvert, & Brammer, 2012), with the most advanced being EEG (Electroencephalography) and fMRI (functional Magnetic Resonance Imaging) brain imaging (Kumlehn, 2011). These technicalities are methods expected to offer an inside view into the black box, which is the brain (Kenning et al., 2007). The primary reason for making use of these more established methods is that the data can be captured without conscious manipulation by respondents, while at the same time being able to record the unconscious processes taking place in the human body. Therefore, neuromarketing measures can be a supplement to the self-report measures. However, one always has to keep in mind that neuromarketing measurements mostly take place in an artificial environment instead of an accustomed surrounding, which might bias the test results (Dimoka, Banker, Benbasat, Davis, Dennis, Gefen, & Weber, 2012).

3.3 Outside reflexes

Due to the fact that people are mostly not able to reconstruct and express their thoughts and feelings in a valid and reliable manner, self-report measures are constantly contrasting the actual inner state (Bagozzi, 1991). Therefore, in the following, we differentiate between outside reflexes, Input-Output models and inside reflexes.

The collection of different methods which already exist for a longer time period, namely body language, empathic design, facial coding and eye tracking, all together fall under the topic of outside reflexes. Since the technology was not that advanced earlier, these methods were the most appropriate in former times in order to collect information about the brain. Specifically, these methods do not look at the inside activities of the brain, but perceive the outside reflexes which have their origin in the brain, without considering the statements of the observed people about certain things. These so called "outside reflexes" are simply observable when one concentrates on them. Put differently, it can be described as a method, which, on basis of biological reactions, can determine what the brain of a person actually thinks, feels or does, without considering what the person says, or even when the person does not say anything. A famous example of a measurement of outside reflexes is a lie detector. This machine reacts upon sweat glands at the inside of the hand, which normally gives a biological reaction of sweating upon an emotional stimulus. However, since the reason for the emotional stimulus can also stem from something else than lying, this method cannot be considered as totally reliable (Postma, 2012).

3.3.1. Body language

One should keep in mind that outside reflexes are activities originated in the body, which are hardly suppressible and basically reflect persons' emotions. An analysis of these biological reflexes such as body language can offer access to the brain, just as an fMRI scanner. The main difference though is that with body language, one is concerned with the non-verbal communication, or more specifically, with the contraction or relaxation of muscles. The amount of communication taking place via body language is oftentimes underestimated, since an immense amount of communication is actually expressed by this. Body language, as a form of non-verbal communication, can be expressed in form of conscious or unconscious ways, specifically in gestures, mimic, posture and other body movements. It is considered to have a key impact on the actual statement being made. Obviously, in order

to analyze body language, no devices are necessary and therewith the procedure is extremely simplified (Postma, 2012).

3.3.2. Empathic design

Another method where human beings are being analyzed without making use of any devices is called 'empathic design'. The meaning of the word 'empathic' can be also referred to as sensitive. Within this method, observation is made in the consumer's own environment so that it can take place in the normal course of daily routine (Postma, 2012; Leonard, & Rayport, 1997). Additionally, possible areas of improvement can be figured out.

In comparison to body language, it differs since within empathic design, the test subjects are aware of the fact that they are being observed. Obviously a precondition is that the product needs to be available. Since the observer is most likely always subjective, it should be specified in detail beforehand what one wants to observe, otherwise this could have devastating effects on the final measures. In practical terms, it is essential that the observer does not make any remarks or comments, but only silently and unobtrusively observes how the test person uses the product in a natural environment. This procedure, where you are expected to get more information by gathering, analyzing, applying and observing instead of directly asking a person, is called the direct-marketing-principle (Postma, 2012; Leonard, & Rayport, 1997).

Empathic design is an attractive method to potentially identify consumer wants and needs because it is a low-cost and low-risk method (Leonard, & Rayport, 1997). However, one can make the suggestion not to make use of this technique in isolation, but rather use it as a supplementation to other techniques like facial coding and eye tracking in order to bring out its full potential (Leonard, & Rayport, 1997).

3.3.3. Facial coding

Facial coding is a specialized form of body language where facial expressions are systematized and coupled to emotions of a human being. An important researcher of this method is Dan Hill, who established 24 combinations of muscle movements, which can be traced back to seven basic emotions. The method is said to be universally applicable since researcher Darwin found out that people from different nations actually have the same inherent facial expressions. Well-known business case examples are Toyota and Capital One, since they are extensively making use of facial coding as an analysis of consumer behavior. Further Dutch companies who are experienced in using this method are for instance C1000 and KPN. In practical terms, test persons are basically confronted with the stimulus while at the same time their facial expression is determined, interpreted and analyzed. During that procedure, the test person is aware of the fact that he/she is being observed (Postma, 2012).

3.3.4. Eye tracking

The final form of the discussed outside reflexes is the eye-tracking method giving inside information about internal brain activity that is a non-suppressible reflex. The method itself is not new to the world, since it was already executed during the 1980's for relatively simple methods. Nowadays, the entire eye-tracking process is computer-controlled, and therewith the range of possibilities is enlarged. The method is relatively easy to apply to commercials, mailings, webpages and online games, since with these things it is easy to track what a person actually sees and to which things he/she pays special attention. The chronological order in which things are being looked at can be determined as well. However, there is one difficulty with the

analysis of the method. In the specific case when the eyes fix a certain point for a longer time period, there are two different interpretations than can be made. On the one hand, one can assume that the person has to focus a spot for a longer time period because it is not directly understandable. On the other hand, it could be possible that a person looks more intensively because he/she is so attracted to it. The eye tracking method cannot differentiate between these two ways of looking at something (Postma, 2012).

3.4 Input-/Output models

With the input-/Output model one does not get access to the brain by analyzing inside or outside reflexes, but by systematically establishing the result, which is yielded by a certain stimulus. This means that you do not look at the "motor", which is the brain, in order to see how the performance is being built, but you insert certain inputs in order to elaborate the resulting output like certain behavior. An example can be that one pushes the accelerator pedal (=input) and records that you are going faster (=output). By this method, it cannot be revealed which areas are being responsible, but it becomes explicit what actions lead to what reactions. So, in the Input/output Model the brain can be considered as a "black box" because you do not get any insights. When making use of this method, one precondition is that there is a measurable output in regard to marketing, for example an order or a payment. Until some years ago, neuroscientists only considered the input and output without understanding the process in between. Specifically, they were looking at how the inputs were processed by the sense organs and what kinds of outputs are related to that. The brain activity itself as a measurable process only received attention later on (Postma, 2012).

3.5 Inside reflexes

The third approach mentioned by Postma is doing the same as the previous two approaches, only in a different way. Specifically, the "Inside reflexes" approach drags in technological advanced methods originally developed for the medical area. By making use of this approach, one is looking inside the brain self. This is done properly by using EEG or fMRI-scans, which will be explained in the following sections. One significant difference between the input-/output model and the inside reflexes is the applicability: Neuromarketing in inside reflexes is about advertising, packaging, and association with brands. No one is being asked to actually make a purchase, but you can determine what a person experiences during an advertisement and if the desire can be determined neurologically. Neuromarketing in the input-/output model is more about the buying processes themselves (Postma, 2012).

3.5.1. EEG

EEG is the abbreviation for Electroencephalography, which means an electrical reproduction of brain activity (Postma, 2012). Although the technique of EEG is a relatively old method, it is still considered to be an appropriate way to measure changes in the electrical field in certain brain regions (Ariely, & Berns, 2010; Morin, 2011; Camerer, Loewenstein, & Prelec, 2004; Madan, 2010). It makes use of numerous electrodes attached to the skull that recognize electronic signals which represent current brain activity (Postma, 2012; Morin, 2012; Ariely, & Berns, 2010; Madan, 2010). Usually a short-period recording of approximately 20 to 40 minutes can be made. The responsible cells for all our cognitive responses are called neurons. Therefrom, every human being has more than 100 billion at its command, which are interconnected with trillions of synapses (Morin, 2011). These neurons have relatively long extensions where electricity runs through.

Therefore, if a certain stimulus like advertising is presented, neurons fire some electric current that can be perceived by the EEG (Morin, 2011). Put differently, if multiple neurons are "communicating" to a certain spot, more electricity is produced than normal, which can ultimately be measured with the EEG on the scalp. If upon that, neurological knowledge is applied, the recognized electricity can be attached to certain function-areas in the brain, which in turn can provide relevant insights to marketing (Postma, 2012). In practical terms, a researcher can simply put on the electrodes attached to a helmet or cap on a person's head, and then present certain products or services from which the attractiveness in form of brain activity can ultimately be measured and recorded (Morin, 2011; Postma, 2012). An advantage of the method is that EEG is very precise in regard to timing since its temporal resolution is in milliseconds. Therewith, short neural activity can be easily detected (Ariely, & Berns, 2010; Camerer, Loewenstein, & Prelec, 2004). Additionally, one should keep in mind that the equipment necessary to carry out an EEG measurement is relatively light and portable, which facilitates the act of measurement (Madan, 2010). Thus, the person being studied is not being stressed during the measurement since he/she can move freely, although the measurement will mostly take place in a laboratory (Postma, 2012). A drawback of this method is that with using EEG, undesired electronic activities in the brain, which one does not want to measure, will be recorded (Postma, 2012). Therefore, the spatial resolution is relatively imprecise (approximately precise to one centimeter), which can be increased by the number of electrodes attached to the skull (Ariely, & Berns, 2010; Camerer, Loewenstein, & Prelec, 2004; Morin, 2011). These disturbances have to be filtered out at the end. An effective method can be also to combine the EEG method with the eye tracking method, since then brain activities can be recorded more specifically (Postma, 2012).

3.5.2. FMRI

The term MRI stands for 'magnetic resonance imaging' and basically describes a tool, which makes an anatomic representation of the brain by making use of magnets (Postma, 2012). An MRI scanner is used to measure the blood oxygen level, which can give an indication of increased brain activity in certain regions (Ariely, & Berns, 2010). The measurement works as follows: The magnetic field is able to recognize the blood oxygen content in the brain. Therefore, if neural activity in a certain brain area is increasing, the oxygen-rich blood increases too because oxygen is required by the brain to work.

A sub area of MRI, and also the latest and most popular brain imaging method in the field of neuromarketing used for investigation of brain activation differences is the so called "fMRI", where the f stands for 'functional', indicating that it is a process instead of a snapshot being observed (Postma, 2012; Dimoka et al., 2012; Madan, 2010; Vecchiato et al., 2011). The method became practicable during the 1990's and enabled scientists' insights into the human brain, which was until then some kind of a black box (Kumlehn, 2011). Simply speaking, it displays the blood flow of oxygen-rich blood to different regions in the brain in order to explore human behavior (Eser, Isin, & Tolon, 2011).

FMRI is a form of non-invasive neuroimaging technology that is primarily used for marketing purposes. The interest in it has increased enormously during the past years since it makes it possible to isolate certain systems of neurons that are connected with specific functions of the brain (Postma, 2012; Wilson, Gaines, & Hill, 2008). This isolation of the neural system is a highly complex task and is only facilitated by today's advanced technology (Kumlehn, 2011).

If a stimulus is presented to a person, the fMRI method is able to recognize an increase in oxygen-rich blood in certain regions, which indicates increased activity in a certain brain region (Postma, 2012; Camerer, Loewenstein, & Prelec, 2004). Due to the fact that oxygenated blood has distinct magnetic waves compared to deoxygenated blood, this difference can be picked up in form of a signal by the fMRI scanner (Camerer, Loewenstein, & Prelec, 2004).

Therefore, during an fMRI experiment, there is first a brain scan made at a persons "rest condition" or when there is no stimulus being presented (Raichle, & Mintun, 2006). Afterwards, a stimulus is presented for instance in form of an advertisement which in turn activates certain brain areas and increases the oxygen-rich blood flow to certain regions being recognized by the fMRI (Wilson, Gaines, & Hill, 2008; Morin, 2011).

A famous example where this method was used is "The Pepsi Paradox", where participants were initially presented with the blind taste test, where two glasses were offered without knowing if Coke or Pepsi is inside. Within this blind taste test, the majority of participants decided that the Pepsi drink is the more delicious one. Afterwards, participants were informed about the contents brand, and then an activation in the "thinking part" of the brain is recognized since the participant remembers the attractive Coke advertisements, which finally drives him to choose for the Coke drink as the more delicious drink (Gang, Lin, Qi, & Yan, 2012, May).

In practice, the observed person is lying in some kind of tunnel where the head and the brain are positioned in a magnetic field.

As already mentioned in regard to EEG, if you know which brain activities are responsible for which functions, explicit statements about brain activity can be made. An advantage of this method is that it can also recognize the order of brain activities, in case there are several ones going on. A further advantage compared to the EEG method is that the fMRI method enables deeper insights into the brain, especially where the emotional processes are taking place. However, one has to keep in mind that the required devices are relatively expensive and that the situation for the person being observed is not very pleasant (Postma, 2012).

An fMRI brain scanner costs approximately \$US 2.5 million to buy, and approximately \$US 1000 to rent per hour (Eser, Isin, & TOLON, 2011). Furthermore, Moore (2005) states that an average neuromarketing study with an fMRI costs between \$94,000 and \$188,000, which is only somewhat more expensive than conventional methods.

Next to all the advantages of this method, one should keep in mind that there are several critiques going on, stating that this method is the reason why it will be possible to soon create advertising techniques which are impossible to resist and which ultimately harm society (Editorial, 2004).

3.5.3. MEG

The Magnetoencephalography is a similar non-invasive procedure in order to investigate neural activity. During the past years this procedure also gained increasingly more attention and is closely related to the EEG method. While the method of EEG conducts the local voltage fluctuations on the scalp, the MEG captures the magnetic fields of neural activity. This method is frequently used in the neurosurgery since it enables the identification of recreation processes after injuries, and therewith the success of treatment. In the practical measurement, highly sensitive SQUID-detectors are used, while actions are being taken to eliminate fields of interference (Braun, 2007). Spectrums of sensors, which are shaped like a

cylinder, monitor the magnetic field of the test-persons skull. Therewith, the location and intensity of brain activity in different regions can be determined (Miller, Bentsen, Clendenning, Harris, & Speert, 2008). Although the methods of MEG and EEG both have excellent time resolution, MEG has a better spatial resolution than the EEG method (Morin, 2011). Nevertheless, one should still keep in mind that this technology, as well as the EEG and the fMRI technology, are very cost intensive (Morin, 2011).

4. THEORETICAL FRAMEWORK

Due to a lack of appropriate theoretical models in the currently available literature, the present paper suggests a brand-new model that considers the entire range of all relevant marketing inputs appropriately to the current development of the topic of neuromarketing and its era.

As can be seen in figure 2, the theoretical framework "Neuromarketing's possible influence on marketing tools may result in improved marketing performance" considers the influence of neuromarketing on the marketing inputs (1)consumer buying behavior, (2)advertising, (3)pricing, (4)new product development, (5)communication, (6)distribution of products, (7)branding and (8)decision-making and assumes that this will lead to improved marketing performance. The results will be presented in the discussion and can be found in figure 3.

5. NEUROMARKETING'S INFLUENCE ON RESPECTIVE MARKETING INPUTS

The qualitative research technique neuromarketing – the implementation of neuroscience techniques to marketing - delivers enormous benefits compared to traditional marketing approaches (Kosslyn, 1999; Taher, 2006). Therefore, the following relevant marketing tools will be considered in further detail and while it will be evaluated if neuromarketing techniques turn out to be useful in regard to consumer behavior. Finally one ends up with a clearly structured overview stating which marketing tools are effectively influenced by neuromarketing.

5.1. Neuromarketing on Consumer Buying behavior

Beginning with the influence of neuromarketing on the marketing tool Consumer Buying behavior, the following statements can be made. Due to the fact that dazzling representations of products are growing constantly, an in-depth analysis, specifically by the use of neuromarketing techniques, of consumer-buying behavior can be advantageous (Gang, Lin, Qi, & Yan, 2012, May; Butler, 2008). However, there are certain things that need consideration. First of all, it is significant that consumers are mostly not able to phrase their desires and needs when asked explicitly, which is why it is assumed that the brain itself encloses internal information, which could elucidate true desires and needs. If this knowledge would be available, the buying behavior of people could most likely be influenced and the disadvantage in regard to the cost aspect of neuromarketing aspects would be outweighed by the advantage of the internal information delivered (Ariely, & Berns, 2010). Therefore, neuromarketing techniques are a perfect opportunity (Kenning et al., 2007). As stated by Eser, Isin and TOLON (2011), "neuromarketing uses the latest advances in brain scanning to learn more about the mental processes behind customer purchasing decisions" (p.854). The critical

statement about a “buy button” in the brain, which would in theory be able to determine the buying behavior of consumers by activating the brain area responsible for making the final decision, can herewith be denied since all neural and cognitive processes connected with buying decisions are influenced by several factors, or so called multi factors, and thus cannot be reduced to one single area (Ariely, & Berns, 2010). Finally, one can say that neuromarketing methods in general, and especially in regard to consumer buying behavior, can measure significant influences, and its results can be used as a template for future analysis or product development (Wilson, Gaines, & Hill, 2008).

5.2. 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. Therefore, the topic of advertisement and product presentation to consumers on the market are becoming increasingly relevant. Since the effects of advertising are not very well understood yet, neuromarketing and specifically neuroimaging techniques are considered to be an exiting and helpful instrument for marketers (Ariely & Berns, 2010).

A recent study by Kenning and Linzmajer (2011) elaborated upon the attractiveness of an advertisement and its correlated activation of brain areas. By making use of neuromarketing tools, they figured out that more attractive advertisements activate the ventromedial prefrontal cortex and the ventral striatum, which are responsible for emotions in the decision-making process and the cognition of rewards. These brain regions were not activated when a less attractive advertisement was presented. This indicates that by making use of neuromarketing techniques, it is possible to find out if an advertisement is perceived to be attractive or not, and therewith figure out its effectiveness. Furthermore, in their study, it was detected that advertisements were increasingly remembered if they were either very attractive or very unattractive. Additionally, positive facial expressions are crucial and highly necessary in order to produce an advertisement, which is attractive to consumers (Kenning, & Linzmajer, 2011). In relatively mature studies from Ambler and Burne (1999) and Ambler et al. (2000), results showed that the presentation of emotional images in advertisements are also indicators which support the remembering process of advertisements. However, taking all the presented information into account, we suggest that neuromarketing can have an effective and positive influence on advertising when applied properly. Since with the background knowledge about which brain areas are responsible for which thoughts and activities in the brain plus the technical analysis showing which brain areas are activated, very informative knowledge can be gained. Thus, when presenting an advertisement to a test person and applying neuromarketing techniques such as fMRI or EEG, it is very realistic to end up with information indicating if an advertisement is appealing or not. Although by making use of this method you are not able to determine for certain if a consumer will make the buying decision, one can try to make advertisements as attractive as possible by making use of neuromarketing techniques and therewith enhancing the buying decision in a positive way. Concluding, one can say that if advertisers have the power to determine which images cause which responses in the medial prefrontal cortex, it should enable advertisers to increase sales by making use of this method (Cranston, 2004).

5.3. Neuromarketing on Pricing

Coming to the influence of neuromarketing on pricing, there are several different scientific literatures that should be taken into account. Since pricing is a key indicator in regard to the presentation of a product and its appearance to consumers, there are several existing marketing researches exploring its effect on consumers (Bijmolt et al., 2005). Price is an important indicator in regard to the decision-making process because in a decision, mostly, costs are evaluated against benefits (Lee, Broderick, & Chamberlain, 2007). Therefore, it can also be the case that consumers are being misled by higher prices since they simply expect higher quality, although this might not always be the case (Kenning, & Linzmajer, 2011).

In order to set prices of products appropriately, it is helpful to know their “willingness to pay”, which means the maximum price that a consumer is ready to invest in exchange for a certain product or service (Simon, & Dolan, 1998). However, there is a problem with the expression of this willingness to pay. Specifically, it is proven that consumers are relatively often not in the position to retrieve prices of certain products and, maybe more important, not in the position to exactly determine how much they would be willing to pay for certain products (Vanhuele, & Drèze, 2002; Evanschitzky, Kenning, & Vogel, 2004). On basis of that, one can argue that the application of neuromarketing techniques can be very helpful in order to determine consumers’ willingness to pay and marketers can, upon that, adjust prices accordingly. Confronting test persons with products and a choice of different prices can do this. One can then ask which of the presented prices would represent the maximum willingness to pay and analyze the brain activities going on in addition. When analyzing the brain activity, one sees if there are rather regions of pain or happiness being activated.

5.4. Neuromarketing on New Product Development

Concerning neuromarketings’ influence on the marketing tool new product development, one can state that the effectiveness might be more limited. As stated by Ariely and Berns (2010), the techniques of neuromarketing are more appropriate when considering the product experience itself, and not decisions prior to the actual design of the product. In other words, it is assumed that no valid results can be elaborated prior to the product development. Therefore, it is suggested to make use of alternative methods when developing new products (Ariely, & Berns, 2010). However, when considering the study of Calvert and Brammer (2012), the argumentation looks quite different. Specifically, in their study it is stated that due to the fact that fMRI can filter information effectively, this method could be applied in the process of pretest and development of new products, as it would disclose internal information. When considering both argumentations, the paper suggests that, although neuromarketing techniques can be effective, they might not be the best way to develop new products, as they are more appropriate for final product testing. Rather, methods like the SWOT analysis, which identifies strengths, weaknesses, opportunities and threats of products and markets can be seen as a more appropriate method to consider new product development.

5.5. Neuromarketing on Communication

Next, neuromarketings' influence on communication will be evaluated. Due to a lack of explicit literature concerning this topic, some argumentation is based on logical thinking. Since body language and facial expressions can also be described as non-verbal communication, one can state that these non-verbal expressions of human beings can definitely be analyzed by neuromarketing methods, specifically by the outside reflexes "body language" (Postma, 2012). However, as stated earlier, these measurements are not as accurate as for instance fMRI measures or EEG measures. Therefore, one can suggest that verbal communication as such will not be highly influenced by neuromarketing measurements since the statements expressed verbally do not need neuromarketing analysis, but can be analyzed in the traditional way.

5.6. Neuromarketing on Distribution of Products

Coming to neuromarketings influence on the distribution of products, it can be argued that with the help of neuromarketing techniques such as eye tracking, body language, EEG or fMRI, relevant internal information can be obtained in regard to that (Ailawadi, & Keller, 2004; Kotler, & Keller, 2006). A specific example concerning decision-making and the distribution of products and its analysis by neuromarketing techniques is the top-shelf example. Within this example, it is stated that the only products, which are actually evaluated by consumers are the ones on the top shelves in stores (Chandon, Hutchinson, Bradlow, & Young, 2009). This is because top locations are known to attract more attention and are therewith more likely to be chosen by buyers (Pieters, & Warlop, 1999). When consumers would for instance go grocery shopping, one can simply attach an EEG cap to their heads and follow their ways through the supermarket, as well as perform eye tracking. All of this could at the end be analyzed and is likely to deliver detailed information about the decision-making process of people (Plassmann, Ramsøy, & Milosavljevic, 2012). This experiment cannot be only carried out in real shops, but can also be applied to online shops (Dreze, & Hussherr, 2003).

5.7. Neuromarketing on branding

In the following, the influence of neuromarketing on branding will be considered. First of all it is important to remember that branding and loyalty of consumers to their preferred brands is interconnected with intense emotions in the decision making process compared to other brands. Customers are likely to act loyal to their preferred brand. Specifically, the study by Bechara and Damasio (2005) showed that only the most favorite brand could generate emotions that can influence the decision-making process, which is called the "winner-take-all" effect (Bechara and Damasio, 2005). Therefore, the branding process and a brand in general is an important aspect of a marketing strategy and should be dealt with respectfully by marketers. As studies in regard to brand with the fMRI showed, there is a compelling difference in brain activity between common brands and preferred brands (Kenning, & Linzmajer, 2011; Hubert, & Kenning, 2008; Deppe, Schwindt, Kugel, Plassmann, & Kenning, 2005).

So, one can state that by making use of fMRI, EEG or MEG techniques, it should be possible for marketers to figure out which brain areas are being activated when products from certain brands are being presented, and in how far these brands influence the decision-making process in general. Since this branding issue has tremendous effects on the final decision making of a consumer and can highly influence it although

qualitative or price issues might be worse than with neutral brands, it can be advised to intensify the application of neuromarketing methods to the branding in order to improve and perfect the representation of a certain brand. All in all, neural activity can be applied in regard to brand familiarity and product preference (McClure et al., 2004; Schaefer, Berens, Heinze, & Rotte, 2006; Walter, Abler, Ciaramidaro, & Erk, 2005). Put differently, Hubert and Kenning (2008) argue that brands can operate as intuitive and hidden apprehensions that have an effect on the decision-making process although the test persons even started to think about the strengths and weaknesses of a product.

5.8. Neuromarketing on decision-making

Coming to the influence of neuromarketing on the decision-making process made by human beings, there is numerous literature which should be considered. First of all, it is important to exactly define what decision-making means. According to Rangel, Camerer, & Montague (2008), there are five different stages in decision making, namely "(a) identifying the decision problem; (b) weighing the possible choices; (c) making a decision based upon the evaluation of the choices available; (d) after carrying out the decision, consider the resulting consequences; and (e) learn from the decision-making process in order to make better decisions in the future" (p.39). This decision-making as described above is a marketing tool, which can be analyzed by the neuromarketing technique fMRI (Gang, Lin, Qi, & Yan, 2012, May). It is argued that the decision-making process is highly influenced by the integration of emotions, which oftentimes can provide one with additional information (Plassmann et al, 2012). Still, several researches prove that the use of neuromarketing techniques is able to analyze the decision making process. In order to evaluate if a decision might be positive or negative, the ventromedial prefrontal cortex and the striatum are the brain regions which are claimed and which, in turn, can be analyzed by certain neuromarketing techniques such as fMRI or EEG (O'Doherty, Dayan, Schultz, Deichmann, Friston, & Dolan, 2004; Peelen, Li, & Kastner, 2009; Zurawicki, 2011; Grosenick, Greer, & Knutson, 2008). Specifically, Knutson et al (2007) argue that the actual final decision depends on the overall evaluation of gain and loss in value before and after the decision has been made. Common anxiety in regard to that is the fact that there are certain argumentations that this evaluation and free decision-making can be manipulated (Vohs, & Schooler, 2008; Montague, 2008).

5.9. Neuromarketing on product design

Let us finally consider the influence of neuromarketing on product design. The design of a product and its presentation in a store or by packaging are first images which consumers perceive. Therefore, the design of a product itself as well as its representation should be considered carefully and developed in detail. Since neuromarketing tools like fMRI and EEG can specifically detect which brain regions are activated in certain points of time, these tools are seen to be highly useful when thinking about the product design. Several different designs of products can be presented to a consumer and the brain can analyze which of these products ensures the most positive effects in the brain. Since this process is taking place unconsciously in the brain, its reliability is higher than when respondents are simply giving verbal descriptions of their preferences. It can always be the case that the expressions of consumers do not correspond to their actual desires and preferences. In a study by Reimann, Zaichkowsky, Neuhaus, Bender and Weber (2010), it was found that an attractive and

aesthetic representation of a product in form of its design or its packaging compellingly does increase the activation of the nucleus accumbens and the ventromedial pre frontal cortex, which are responsible for emotions in the decision-making process and the cognition of rewards. FMRI and EEG are the only methods capable of perceiving these activations. Therewith, we can conclude that the application of neuromarketing techniques in order to influence the effectiveness of the present marketing tool pricing can be highly effective when applied appropriately (Gang, Lin, Qi, Yan, & 2012,May).

6. ETHICAL ISSUE OF NEUROMARKETING AND CRITICAL EVALUATION

6.1 Ethical Issue

There are several ethical concerns, which need to be taken into account when talking about the research method of neuromarketing. On the one hand, there is a scientific point of view stating that there does not exist anything like a marketing strategy, which would be able to enhance the elimination of an individual's free will (Madan, 2010). However, numerous other opinions that were considering neuromarketing see potential risks, as explained in the following. First of all, several parties are concerned that by the use of neuromarketing techniques, the so called "buy button", which is expected to completely eliminate consumers free will and to turn customers into "buying robots" who are unable to resist attractive offers (Commercial Alert, 2003; Kenning, & Linzmajer, 2011; Wilson, Gaines, & Hill, 2008; Lee, Broderick, & Chamberlain, 2007).

One has to keep in mind that nowadays, with the enormous amount of different but yet similar products and the affluent society, the free will of consumers and their ability to make individual choices is one of their main powers. In case this would be taken away or manipulated, the idea of a free market would disappear (Wilson et al., 2008). If this should become the case, the entire focus of trade would be commercial gain, without considering the fact of customers' actual desires, and therewith a big problem concerning the free will would occur (Madan, 2010). Additionally, the trustful aspect, which nowadays is necessary in order to establish a good customer-company relationship, presupposes certain privacy policies (Iles, & Racine, 2005). Put differently, the withholding of information or intentional manipulation of consumer behavior by making use of technology that probes the internal brain activities clearly represents an ethical concern, which is why there should be preventions made (Senior, & Lee, 2008; Eser, Isin, & Tolon, 2011). When taking the ethical aspect of neuromarketing into account, one also has to consider the opinion of Murphy, Illes, and Reiner (2008). According to them, there are two key ethical issues concerning the research of neuromarketing: on the one hand, the protection of affected parties who may suffer or get harmed by the research itself or by the application of neuromarketing, and on the other hand, the independence and autonomy of the consumer in regard to decision making, especially when the efficiency of neuromarketing will make further developments. Evidence for this ethical concern can be provided by the rapid growth of firms who offer neuromarketing services (Reid, 2006; Kenning & Linzmajer, 2011).

The Lancet (2004) already discusses the urgent need and ideas of the prevention of the exaggerated interference into personal privacy. As suggested by Murphy et al. (2008), a "code of ethics" could be introduced. A further opportunity would be the

invention of new and enhanced techniques and a more responsible use of these, while at the same time fixing the problem with the lack of regulation by for example introducing industry-internal standards. (Hubert, & Kenning, 2008; Kumlehn, 2011; Airely & Berns, 2010).

6.2 Critical evaluation

There are several critical opinions that need to be taken into account when considering the issue of neuromarketing. Gary Ruskin, a executive director of Commercial Alert, argues that the reasons of epidemics like obesity, diabetes, alcoholism, gambling, and smoking, can be tracked back to the severe impacts of purposeful marketing strategies (Wahlberg, 2004). Other effects can be over-consumption and product addiction, which are considered to be harmful as well. (Lee, Broderick, & Chamberlain, 2007). Therewith, he forecasts that any enhancement in the productivity of marketing strategies can be harmful for the society self (Wahlberg, 2004). Yet other critics argue that although neuromarketing activities ultimately invade into the privacy of society, it is not foreseeable that the trend is going to stop in the near future since many firms still see their profit increase as their main goal – no matter if there could be any possible interference into privacy and freedom of choice (Dapkevičius, & Melnikas, 2011; Kumlehn, 2011).

Yet, an other perspective argues that by making use of neuromarketing techniques, it is not possible to measure the actual behavior of a person, but only the physiological evidence of its behavior, indicating that it is therewith impossible to find some kind of "buy button" since only parts of the brain can be observed instead of influenced (Kenning, & Linzmajer, 2011).

However, concluding one can state that the biggest threat and thus the biggest critic concerning neuromarketing is the fact that neuromarketing findings do present the potential that they tremendously intervene with the consumer free will and therewith their privacy (Wilson et al., 2008).

7. CONCLUSIONS

In the present paper, we have provided a detailed overview of what neuromarketing is, explained the technical components in detail and evaluated upon the influence of neuromarketing on the eight most relevant marketing inputs. There were several knowledge discoveries made during the development of the paper, from which the most important ones will be summarized again.

The implementation of neuromarketing and neuroscientific techniques resulted in the attainment of more objective results than without these techniques, which are expected to reveal unknown internal information about human behavior in general (Hubert, & Kenning, 2008; Kenning, & Linzmajer, 2011; Ariely, & Berns, 2010). By making use of neuromarketing techniques, marketers can analyze the effects of consumer buying behavior, advertising, pricing, distribution of products and decision making on a much more scientific basis by evaluating upon the test person as well as the marketing input itself (Fugate, 2007). Neuromarketing itself is frequently described as a tool to determine internal unknown "secrets" of the human brain by making use of imaging technology (Kampakoglou, 2012). This can be influenced by the fact that researchers increasingly pay attention to emotions and unconscious processes that influence human behavior, and that argumentations and ways of reasoning cannot be regarded as rational anymore (Bechara, & Damasio, 2005; Camerer, Loewenstein, & Prelec, 2005; Oehler, & Reisch, 2008). Additionally, the prefrontal cortex has been established to be

the most important region in the brain in regard to the research of neuromarketing since in that area, conscious processes as well as emotions are taking place (Vecchiato et al., 2011). All in all, one can say that if the ethical aspect is taken care of by executing neuromarketing activities in an ethically correct way, it can be argued that the emergence of neuromarketing creates a win-win situation for marketers and consumers at the same time. Marketers can gain internal information which leads to better product commercialization and customers are provided with more customized products (Kenning, & Linzmajer, 2011; Ariely, & Berns, 2010; Lee, Broderick, & Chamberlain, 2007; Madan, 2010). The method combines the commercial part of economics with the psychological part of neuroscience (Madan, 2010).

8. DISCUSSION

After the in-depth evaluation of neuromarketings' influence on the eight presented marketing inputs, it became explicit that not all of the aforementioned marketing inputs can profit from neuromarketing. Namely, as can be seen in Figure 3 (see Appendix), the marketing inputs where actual potential can be seen when considering the influence of neuromarketing are consumer buying behavior, advertising, pricing, distribution of products, branding and decision-making. In the areas new product development, communication, branding and product design, no perceivable effects could be extracted on basis of our literature review analysis.

9. LIMITATIONS

Next to all the advantages and new insights, which the current literature review presented, there are obviously certain limitations that should be considered.

First of all, the time aspect restricts the dimension of the study. Since the timeframe from the very beginning to the presentation of the results is restricted to a maximum of ten weeks in total, there is obviously very limited time in which all the literature has to be found, scanned and read, relevant information has to be selected and, based upon that, a new piece of scientific literature has to be created. This is also the reason why the topic of neuromarketing is not being researched by making an empirical study, but rather a review of relevant existing scientific literature in regard to the topic. An empirical study would also extend the cost factor of any bachelor thesis.

However, the very fact that only already published and thus not new-to-the-world information is being investigated, which enormously limits the possibility to actually research the influence of neuromarketing when applied to a human being. An empirical research where several human beings are being confronted with products and then fMRI or EEG measurements are executed would increase the validity of the study. Furthermore, then all the eight discussed marketing inputs could be evaluated upon separately. An additional limitation is that we, as students from the University of Twente, did not have access to all the existing literature about neuromarketing since there are still some journals where we do not get any access.

10. FUTURE RESEARCH

In regard to the future research possibilities of the topic of neuromarketing, one can state the following. First of all, one can expect that the costs of the application of neuromarketing techniques are likely to decrease so that the possibility to be able to execute actual neuromarketing researches is likely to

increase. As stated earlier, the research of neuromarketing is still in its infancy and the actual research in that direction has basically just started (Lee, Broderick, & Chamberlain, 2007). Since it is expected to clarify the issue of human behavior, research in all directions should definitely be continued.

Furthermore, it is advised to put more importance on the ethical issue of neuromarketing since this basically is the main critic in regard to neuromarketing. If this issue can be controlled by an in-depth elaboration of a general code of ethics in regard to neuromarketing, which would be globally applied, the concerns of consumers and human rights activists could be controlled and the actual research could progress effectively (Murphy, Illes, & Reiner, 2008).

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10.APPENDIX

Figure 1a Template of Literature Matrix

Literature Matrix	<u>Postma</u> (2012)	<u>Ariely & Berns</u> (2010)	<u>Kenning & Linzmajer</u> (2011)	<u>Kenning & Plassmann</u> (2008)	<u>Gang, Lin, Qi & Yan</u> (2012)	<u>Tusche, Bode, Hayes</u> (2010)	<u>Wilson, Gaines, Hill</u> (2008)	<u>Fischer, Chin, Klitzman</u> (2010)
Relevance of topic									
Background									
Goal of study									
Description of situation									
Importance									
Neuromarketing									
Neuroeconomics									
Neuroscience									
Marketing									
Technical aspects									
Brain									
Outside Reflexes									
Input-/Output models									
Inside reflexes									
FMRI									
EEG									
MEG									
Neuromarketings'									

Figure 2b. Template of Literature Matrix

influence on consumer buying behavior									
" On advertising									
"On pricing									
" On new product development									
" On communication									
" On distribution of products									
" On branding									
" On decision making									
" On product design									
Ethical Issues									
Critics									
Discussion									
Conclusion									
Limitations									
Further Research									



Figure 2. Theoretical Framework - Neuromarketing's possible influence on marketing tools may result in improved marketing performance



Figure 3. Theoretical Framework - Neuromarketing's actual influence on certain marketing tools results in improved marketing performance