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**Are the Brain and the Mind One?
Neuromarketing and How Consumers Make
Decisions**

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Science, Technology, and Society Honors Thesis

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| Abstract

Neuromarketing utilizes brain-imaging technology, such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) machines, to understand consumers' neurological responses to marketing stimuli. In this paper, I demonstrate how neuromarketing connects to the history of subliminal messaging and our current neuro-obsessed culture (neuroculture). These factors affect how critics view neuromarketing and the implications involved for the future of this study. I hypothesize that, when used correctly, neuromarketing can initiate a new section of the marketing world that will serve as a useful component to more traditional marketing practices. By taking away social bias and inaccurate answers present in market research, neuromarketing will provide insights into the consumer brain that will ultimately be helpful to efficiently market products. However, when used incorrectly, neuromarketing can be invasive to the consumer, and results may be easily manipulated by vendors and misunderstood by readers. In order to support my hypothesis, I research the implications of neuromarketing as a market research tool in regards to consumer decision-making, price, and promotion. In three case studies I show a) how neuromarketing transforms or supports each case and b) if neuromarketing proves more effective than traditional marketing tactics. This will serve as a beneficial guide to understanding the impact of neuromarketing and the ability to which neuromarketers are able to understand how factors regarding product, price, and promotion may affect a consumer's decision.

Introduction

A man, let's call him Ben, attempts to sell a bone to an elephant. It is evident from what we know about elephants, and from figure 1, that the elephant is uninterested. Ben knows little about his audience and little about the product he is trying to sell. This cartoon depicts the marketer's dilemma, which addresses the central question of marketing: how can Ben know who is audience is and who wants to buy his product?

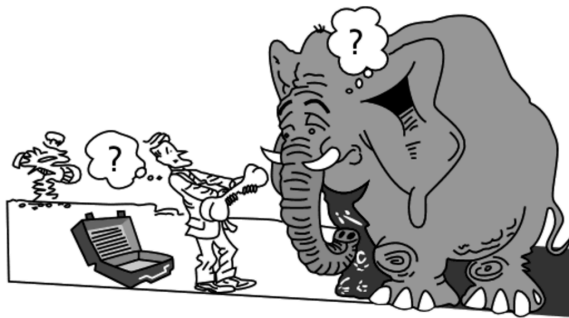


Figure 1 The Marketer, the Bone, and the Elephant- Source: George et al., 2013, p. 13.

In order to find out who wants the bone, Ben would typically observe the four Ps of marketing, also called the “Marketing Mix”—product, price, promotion, and place. If Ben had studied the first P, product, he would have asked who the target audience was for the bone, and would have likely discovered it was dogs, not elephants. If Ben continued to pursue the elephant, he would likely find that the elephant would not accept a high price for the product because he does not need or want the product and therefore will not sacrifice for it. Promotion relates to advertising, so Ben would have to create advertisements with catchy slogans (all elephants need bones), convincing the elephant he or she needs the product. Hopefully, this advertisement sends the elephant to a store (place), therefore Ben would need to calculate where it is most likely the elephant would go to look for the bone and contact these stores. The use of market research involving questionnaires, focus groups, and product testing would help Ben find the answer to who wants the product, at what price, and how to best reach this audience. But what if there was a way for Ben to bypass the market research by looking directly into the elephant’s mind to discover what it truly wanted?

Neuromarketing aims to understand how consumers think and why the consumer chooses products by applying “neuroscientific methods to analyze and understand human behavior in relation to markets and marketing exchanges” (Lee, Broderick, & Chamberlain, 2007, p. 200). It is a subset of the study of neuroeconomics, which combines neuroscience, genetics, economics, and psychology to understand how specific neuron activation may lead to larger scale market behavior (Levallois et al., 2012). While both neuromarketing and neuroeconomics involve the use of neuroimaging tools, neuromarketing focuses on the aspect of selling to a consumer and how to create a better

product or advertisement to attract consumers. The neuroimaging technology helps scientists and marketers understand the consumers' mind to find the motives behind his or her purchases. An example of this is Campbell's Soup.

In 2010, Campbell Soup changed its label from the historic metallic spoon on a white background to a large white bowl filled with steaming soup. This was due largely to the research done by Innerscope, a neuromarketing research company, where scientists recorded consumers' responses to the old labels using eye-tracking, pupil dilation tests, and biometric measurements of heart and respiratory rates, sweat levels and body postures. Researchers collected over half a billion data points and ran these points through an algorithm that gave insights into activity within the participants' brain. Robert Woodard, Campbell's vice president of global consumer and customer insights, found that traditional interviews had not been entirely useful because oftentimes people's words "could not fully capture their unconscious responses", while this approach captured the neurological and bodily responses rather than how people thought they were responding (Brat, 2010). While these tools may not entirely be able to pinpoint emotions or what a person is precisely thinking, if these biological metrics are moving in the same direction for a diverse group of people then it is likely that all subjects are being emotionally engaged in the same fashion (Brat, 2010). More so, since 2010, Campbell's stock has risen significantly and consistently, implying that perhaps this change in soup label had an overall positive affect on sales.

The Campbell's soup campaign, among other studies, relies on the forgone conclusion that "the brain and the mind are one" (Breiter et al., 2015, p. 3). In other

words, what we think and how we create our persona is located in the brain, and thus the brain defines our wants and needs.

This paper will strive to answer the question: to what extent is neuromarketing impacting the field of market research? By first covering the vocabulary and proven science regarding the brain and neuromarketing, I will show how neuromarketing is connected to the history of subliminal messaging and the neuro-obsessed culture (neuroculture) and how this relates to our current views of psychology and the power of marketing. Then, using three case studies that relate to the four P's of marketing, I will look in-depth at brand research, consumer decision-making, and the impact of neuromarketing on advertising. In these case studies I will show a) how neuromarketing transforms or supports each case and b) if neuromarketing demonstrates more effective insights about the consumer than traditional marketing tactics. Finally, I will examine the ethics behind this field of study, what critics are saying, and the future of neuromarketing. This paper will serve as a beneficial guide to understanding the impact of neuromarketing on the marketing field and how factors of product, price, and promotion could be improved. Neuromarketing is launching a new sector within marketing, and, when used correctly, can be used to support traditional marketing claims by understanding how to market products lucratively towards customers.

Neuroimaging: How this Benefits Marketing and Methods of Visualize the Brain

If marketers could accurately see into, and understand, consumer's thoughts without a social filter, it would cut down on incorrect market research data and provide a more efficiently marketed product or service. Current market research strategies can be

expensive and provide inaccurate data of what consumers want because often times consumer's can feel pressured by social bias, what they feel the marketer wants to hear, or unsure of how they truly feel and ultimately lead the marketer astray. Marketers hope that neuroimaging will be an efficient replacement for market research as a system that is more effective in determining what the consumer wants (Ariely & Berns, 2010). This hope is based on the knowledge that the consumer's brain may contain information about their true preferences for a product or service, where "the brain and the mind are one" (Ariely & Berns, 2010; Breiter et al., 2015, p. 3). This hope also relies on the assumption that scientists can locate this information within the brain.

Neuromarketing utilizes neuroimaging machines to view which areas of the brain are being activated by given marketing stimuli. Current research primarily focuses on brain-mapping; primarily answering questions such as "how is a certain areas of the brain activated and what can this tell us? Further study is still needed to fully characterize why certain areas are being activated over others. For example, the insular cortex is the area of the brain associated with emotions, such as love; however, it can also indicate emotions of disgust or hate. Therefore, when Lindstrom (2011) published his article "You Love Your iPhone, Literally", saying that when consumers looked at their phone there was activation in the insular cortex implying love, neuroscientists retorted that the same science could have been used to say "You Are Disgusted By Your iPhone. Literally". Rather than using neuroimaging technology to jump to conclusions about how we feel and judge certain products, it should be used in understanding what areas of the brain are activated and how that makes us act. We cannot yet use this science to make conclusions about how we feel or definitively predict what we do.

Neurons and Neuroimaging Machines

Neuroimaging machines work by responding to the activity of neurons within our brains to trace which areas of our brain are responsive to given stimuli. Neuroimaging technology relies on the knowledge that the activation of certain neurons in specific regions of the brain correlate with what a person is thinking.

The brain is part of a larger system called the central nervous system (CNS), which includes both the brain and the spinal cord. Neurons are one kind of cell within the nervous system and their main function is to communicate with other neurons or with target cells. This communication is mediated either electrically or chemically.

Neuroimaging tools can trace both forms to provide images of the activated areas of the brain.

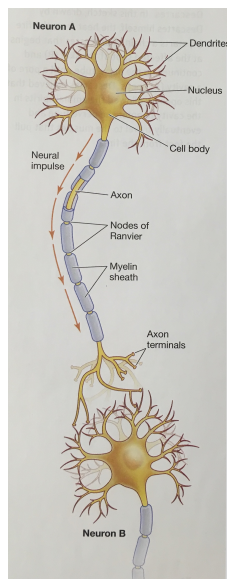


Figure 2 Anatomy of a Neuron- Source: Gleitman, Gross, Reisberg, 2011, p. 88.

The signals between neurons pass through the synapse—the very small space between the axon ending and the dendrites (see figure 2). A presynaptic neuron is a neuron that is sending a signal to another neuron, where presynaptic means that the neuron is lying before the synapse; let's refer to the presynaptic neuron as neuron A. Neuron B would be the postsynaptic neuron, the neuron after the synapse that is awaiting information from neuron A. The dendrites on neuron B receive information from neuron A. You can see from figure 2 how the axon terminal of neuron A “connects” with the dendrites on neuron B. When a neuron fires, an electrical signal is sent through the axon, reaching the axon terminal of neuron A. Chemicals, called neurotransmitters, are released into the synapse and send a signal to neuron B, potentially causing this neuron to fire and perpetuating the signal. When a neuron fires, the active cell requires more oxygen, so the blood volume around the area increases. Therefore, when a neuron fires there is an electrical current from an activated neuron and an increased flow of blood to the area.

The Frontal Lobe and Prefrontal Cortex

Neuroscientists are continually observing the different areas of the brain, how they relate to one another, and what this means for how consumers interact. According to current studies, the areas of the brain that are relevant in neuromarketing lie within the frontal lobe and the subcortical structures of the nucleus acumbens, which is related to the reward center of the brain, and the amygdala, which is associated with emotion (see figure 5).

Anatomy and Functional Areas of the Brain

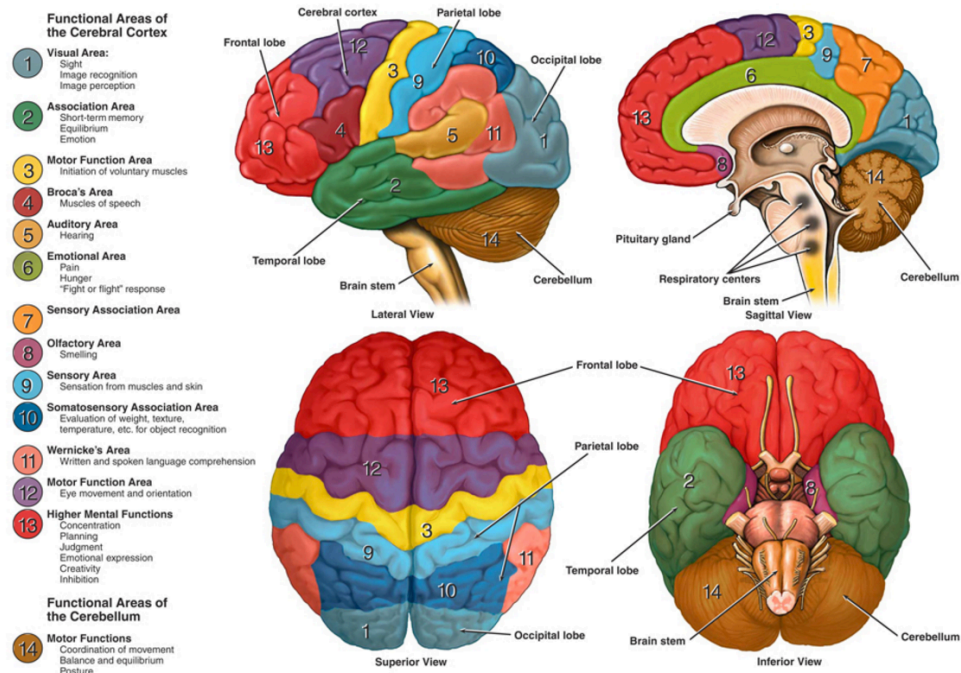


Figure 5 The Brain and Various Regions Related to Marketing - Source: Sukel (2011).

The neurons in the frontal lobe are associated with actions of executive functioning, meaning “the capacities that enable a person to engage in purposive, independent, and self-serving behavior” (Kramer, Miller, & Kemenoff, 2002), this is one of the most highly developed areas of our brain and is the part that separates us from our primate ancestors. Specifically within the frontal lobe lies the prefrontal cortex, the area correlated with emotion, reward, planning, and judgment. These are essentially the functions used when making a decision while shopping and as a result the area that is monitored by consumer neuroscientists. Recall that Phineas Gage damaged his prefrontal cortex in the accident (see figure 3, the iron rod shoots through Gages frontal lobe); the result of his injury is the most famous case for how this region affects decision-making and emotional processes.

Neuroimaging Technology

Neuroimaging technology detects the increased electricity or blood oxygenation levels when a neuron fires and, using these markers, detects where the neurons are activated in the brain (Pinel, 2003). Depending on the machine, it will produce either images that show increased blood flow to certain areas of the brain or higher levels of electricity; both of these suggest neuron activation. There are three main categories of tools used in consumer neuroscience—measurements of blood level oxygenation, measurements of electrical potential, and physiological and chemical measurements. These tools are credited with creating an unbiased view of what the consumer thinks. Between market research techniques and neuroimaging tools we have numerous ways to understand the consumer. Appendix A maps the stark differences between the available research options and how they compare to one another.

Just because neuroimaging technology can dictate where marketing stimuli activates the brain, it does not mean that we can yet tell why or precisely what this means. Perhaps an area of the brain is responding to another activation, or is responding to a different emotion. Thus far, successful neuromarketing studies have combined traditional market research with neuroimaging studies in an effort to develop an unbiased idea of what a consumer wants, what is the best way to advertise, and how consumers behave when shopping. The most effective modes of neuroimaging to date are the fMRI, EEG, and physiological/chemical measurements.

fMRI: Measurement of Blood Flow

The functional magnetic resonance imaging machine (fMRI) is the most commonly used technology for measuring the oxygenation levels of the blood flow that occurs in response to neuronal activity in the brain—otherwise known as blood oxygenation level dependent (BOLD) signals. The fMRI divides the brain into a large number of small cubic volumes and monitors the BOLD signals when neurons fire in response to marketing stimuli; it can then pinpoint where in the brain these neurons are firing. Because neurons fire extremely quickly, up to 200 times per second, and the fMRI can only catch BOLD signals every few seconds, there is a time lag from when the neuron fires and when the fMRI detects it (Pinel, 2003). Until a more efficient machine can be created, the fMRI is limited as a tool to investigate *when* information is processed and is currently better suited to understanding *where* information is processed in the brain (Apperly, 2011). Because of the exceedingly better spatial resolution, fMRI researchers look at specific areas of the brain that are affected by certain marketing schemes. In the process of understanding consumer decisions, marketers search for answers to questions such as: where do BOLD signals arise when looking at advertisements? What areas of the brain are activated when a consumer buys a product or is debating a price? By continuing this sort of brain-mapping, researchers can discover what area of the brain are most affected when purchasing items and, potentially, how to stimulate these areas in promotional materials.

There are a few major disadvantages to an fMRI machine. The first is that for the fMRI machine to scan the brain, the “consumer” must be lying inside the machine inside of a machine in the hospital, which is not conducive to eliciting the same reaction as

watching a TV ad on the couch or shopping in a store. Another disadvantage is that a scanner costs approximately \$1 million with an annual operating cost of \$100,000-\$300,000 (Ariely & Berns, 2010), making it difficult for the average company to use it for market research.

EEG: Measurement of Electric Potentials

Electroencephalography (EEG) measures the electrical pulses created when a neuron fires. Since there are billions of neurons in the brain, their activity combines to produce electrical potentials so large the activity can be detected at the surface of the skull. It fits like a cap of electrodes around the head and is therefore far more portable and inexpensive than an fMRI. The electrodes are disk-shaped, about half the size of a dime, and are taped to the skull where they are able to detect electrical signals from the entire head as well as skin, muscles, blood, and eyes (Pinel, 2003). Though an EEG has poor spatial resolution compared to the fMRI, EEGs have a far superior temporal resolution. As a result, an EEG is used in neuromarketing to understand how a consumer is reacting to an advertisement, or to understand what is happening in a consumer's brain when interacting with a salesperson. These are time-sensitive questions rather than spatially located questions.

The EEG machine's only real disadvantage is that it produces less structurally accurate information compared to the fMRI machine. Despite its cheaper cost compared to an fMRI, the poor spatial resolution of the EEG makes it a meager substitute for many tests done with an fMRI. Studies are currently underway to make the EEG a more effective tool in neuromarketing (Telpaz, Webb, and Levy, 2015). Because of its cheaper

cost and more portable aspects, if the EEG could become more prominent in market research, more companies would be able to afford neuromarketing studies.

Physiological and Chemical Measurements

Physiological and chemical measurements look at aspects beyond brain-imaging technology, such as hormone secretion, eye tracking, heart rate, etc., which can tell scientists about how the human body is reacting to various stimuli. The Campbell's soup study is an example of how different physiological actions can be related to the brain and consumer actions. Regarding chemicals in the body, neuromarketers are able to track and monitor various neurotransmitters and follow the effects these chemicals have on our moods and actions. They do this by either increasing or decreasing, in controlled substances, the levels of various chemicals within the consumer's body and observing how this may affect the consumer.

Neurotransmitters are chemicals released, generally by the presynaptic neuron, which trigger a response in another neuron as means of communication. When released, these chemicals impact the brain and influence other neurons and chemical reactions (Gleitman, Gross, & Reisberg, 2011). In this paper, I will specifically focus on the neurotransmitter serotonin because of the role serotonin plays in regulating human moods and emotion. Some drugs activate serotonin in the brain to treat depression and anxiety because of its positive effects on mood (Pinel, 2003, p. 472); it is also known to be linked to feelings of decreased impulsivity and aggression (Pattij & Schoffelmeer, 2015).

Methods and Procedures

In order to understand how neuromarketing develops into a plausible area of study and how it affects current marketing practices, I used in-lab case studies and academic papers to research how neuromarketing is being used, if it is successful, and how the public responds to the studies. The primary research comes from psychological studies, which will serve as my case studies. Here, I develop a comprehensive overview of how neuromarketing has blossomed into a potentially viable marketing technique that claims to improve our current understanding of how the consumer makes decisions. The use of neuromarketing in replacement of traditional marketing techniques will give a comprehensive view of how neuromarketing is either improving the field while gathering useful data on the consumer, or is producing data that is inaccurate and unbeneficial to the marketing field. My secondary sources are opinion pieces and commentary on how the public, including marketers, historians, and academics are responding to this new field of study. Reactions to neuromarketing, particularly in comparison to how people reacted to similar fields in the past (subliminal messaging) will help to demonstrate the potential of neuromarketing.

I selected journals based on their impact factor, which measures the frequency its articles have been cited in a particular year—a measure of how many people are reading and responding to its articles. The top journals I use are: the *Journal of Marketing Research*, *Nature Reviews Neuroscience*, and the *Journal of Consumer Behavior*. The *Journal of Marketing Research* is a prestigious journal published by the American Marketing Association whose articles on neuromarketing primarily show the usefulness of the study in market research. *Nature Reviews Neuroscience* is an influential science

journal that is rated as having the highest impact factor of neuroscience journals. The journal has published articles in support of, and against, neuromarketing with various views on the subject. The *Journal of Consumer Behavior* focuses on how consumer behavior is affected by increasing amounts of technology in the market. The journal has been interested in neuromarketing for many years now and highlights the ethics and future of the field of study.

The difficult, yet intriguing, part of my project comes from the range of opinions I have found on the validity of neuromarketing, including the difference between the media and scientific portrayal of neuromarketing. While we do yet have enough substantive information about how the brain works in the economic market (e.g. how we make decisions, if our brain influences us to buy one product over another), I believe that when combined with behavioral studies and traditional market research, neuromarketing can give a valuable glimpse into the mind of the consumer.

History of Marketing

In order to sell goods effectively, it is necessary for marketers to understand what the consumer wants and why they choose one product over another (remember Ben). Marketing began in an official capacity during the economic prosperity of the 1920s. The marketplace became saturated with goods; supply was greater than demand and marketing was needed to sell the excess products to consumers. The Great Depression in 1929 only catalyzed the market industry because companies had to be innovative to sell their products to unwilling consumers. Finding new clients and eliminating competitors became essential for good business (Samuel, 2010). Using consumer behavior studies as

its base, marketing became more rational and scientific, following research claims and data rather than general assumptions (Neuromarketing: Consumers Under the Influence, 2009).

Psychology, emotions, reason, and decision-making took on a larger role in marketing, and by the 1940s-1950s scientists understood more of the brain and its functions as a decision-making organ. At this time, the tale of Phineas Gage's 1848 injury returned as a popular psychological study that marketers began tapping into in order to understand how consumers made their decisions (Damasio et al., 1994), ultimately connecting that a consumer's decision and emotions were connected.



Figure 3 Diagram of the Iron Through Gage's Head- Source: Damasio et al. 1994.

In 1848, railroad worker Phineas Gage was cutting railroad bed with a tampering iron when explosive powder detonated and the iron speared Gage's left cheek. It ripped into Gage's brain, exited through his skull, and landed several feet away (see Figure 3 for the areas of the brain/skull damaged in the accident). Gage survived the incident. He remained alert, able-bodied, and had full range of movement and speech. He was able to learn new material and retained full memory function. However, once a well-liked man in the railroad industry, who was described as "the most efficient and capable man in their

employ” (Damasio et al., 1994, p. 1102), Gage’s employer had to lay him off after the accident because of the change in his personality; Gage had become short-tempered and was no longer capable of making sensible decisions. Understanding Gage’s change in demeanor helped scientists see that emotion and reason are closely linked in the brain (Neuromarketing: Consumers Under the Influence 2009). While this concept had been hypothesized as far back as 450 BC when Alcmaeon of Croton in Greece theorized that the brain could be responsible for thoughts and feelings; it was not scientifically demonstrated until Gage (Georges et al., 2013).

Using this information, marketing managers in the mid 1900’s began measuring consumer emotions to understand what motivates our decisions. In this time period, the most respected marketing journals began devoting increasing amounts of attention to market research and consumer emotion (Packard, 1957). Psychology tests in marketing involved focus groups, preference questionnaires, stimulated choice methods, and market tests. All of these tests focus on the ability to understand how the consumer makes decisions. However, marketers found this difficult because, as a group, consumers are diverse, inconsistent, and strongly influenced by social bias. In an effort to advertise effectively, subliminal advertising became a popular method, however one that was feared by the public because of its invasive and manipulative manner.

Subliminal messages were thought to appeal to the consumer’s subconscious. Subliminal means below the threshold of conscious thought, therefore, the messages were created to appeal to the consumer in their subconscious. Vance Packard’s book, *The Hidden Persuaders*, published in 1957, revealed hitherto widespread practices that generated a large-scale fear of subliminal messaging. He discussed amoral marketers

using psychology to get inside of our minds, and that we must be aware because when “probing and manipulating, nothing is immune or sacred” (Packard, 1957, p. 5).

The original subliminal messaging scare in 1957 was created by a cinema owner, who allegedly flashed “Drink Coca-Cola” and “Eat popcorn” on the screen so fast that no one consciously saw it but, subconsciously, many in the audience began craving Coca-Cola and popcorn. The owner claimed sales skyrocketed. The fear of subliminal messaging persisted after 1957, worrying the American public and resulting in the U.S. society developing a tendency to revolt from all concepts in advertising that led to marketers manipulating or knowing the consumer’s decisions without his or her knowledge. The *Saturday Review* posted an article by the editor Norman Cousins (1957) about the use of subliminal messaging:

The subconscious mind is the most delicate part of the most delicate apparatus in the entire universe. It is not to be smudged, sullied, or twisted in order to boost the sales of popcorn or anything else. Nothing is more difficult in the modern world than to protect the privacy of the human soul.

Cousin’s review was typical of many of the articles written on subliminal messaging at this time. In response to this reaction, Congress enacted a law, later revised in 1988, against deceptive advertising techniques, which proclaimed “subliminal or similar techniques are prohibited,” where subliminal or similar techniques “refers to any device or technique that is used to convey, or attempts to convey, a message to a person by means of images or sounds of a very brief nature that cannot be perceived at a normal level of awareness” (27 C.F.R. sec. 5.65 (h) (1988)). This law remains today.

Though consumers felt violated and manipulated by subliminal messaging, it was a revolutionary idea for marketers. As scientists’ understanding of psychology and the brain increased, advertisers began understanding how to take advantage of the mind to

sell products, or switch consumers to new products. Reflecting on neuroscience in marketing was the logical step in the development of our modern day marketing system. The EEG (electroencephalogram) was developed in the 1950s and the MRI invented twenty years later. These have both made significant contributions to understanding how the brain works and have been viewed as an “opaque window on the mind” (Nunez, 2002). Neuromarketing differs from subliminal messaging because rather than using a device to sway a consumer’s opinion, neuromarketing looks to understand what a consumer thinks and market towards those thoughts and preferences.

However, much like subliminal messaging, the media and American public are opposed to neuromarketing because of the fear that the consumer is being manipulated. Primarily in the U.S. there is a prevalent argument that neuromarketing takes away the consumer’s free will. If an ad is created in an effort to program our brain to enjoy it, are we making the choice to buy the product? This manipulative factor in the neuromarketing strategies is linked to the subliminal messaging scare in the fifties, creating the same fear and revulsion. However, while both neuromarketing and subliminal messaging work to access deeper levels of the brain and interact with consumers below the level of conscious thought, neuromarketing will not manipulate a consumer into liking or feeling something they do not want.

The goal of marketing is to promote and sell a product or service to as many consumers as possible. As markets became increasingly competitive with more options in the marketplace, it became necessary for marketers to advertise in more efficient ways, leading to psychological strategies that target the consumer at a subconscious level. Neuromarketing then played off this concept by working to understand what the

consumer thinks and how the consumer makes decisions, and then market to these decisions.

Neuromarketing emerged from the laboratory and psychological studies and into the public realms in the early 2000s. This happened as a result of Read Montague's research at Baylor University, where he performed a twenty-first century Pepsi Challenge (Georges et al., 2013). In this challenge, Montague et al. (2004) did both an anonymous, blind taste test of Coke and Pepsi and a brand-cued taste test in order to determine why and how consumers made their decision to choose one over the other. When consumers performed the blind-test taste, they said they preferred Pepsi over Coke, however when performing a brand-cued taste test, the consumers said they liked coke over Pepsi. Montague et al. then performed the same test inside of an fMRI machine and observed that specific areas of the brain within the prefrontal cortex spiked when drinking Pepsi, confirming the consumers enjoyed Pepsi more than Coke. Montague found the advertising campaign behind Coke was far more successful than Pepsi, and this essentially tricked the consumers into thinking they enjoyed Coke more. Ultimately concluding that brand information can have a strong, cultural influence on behavioral preferences.

This study demonstrated that by use of the brain, marketers could understand what the consumer wants without worrying that the consumer is lying or feeling pressured by social bias. Since Montague's study, an increasing number of critics have stepped forward to warn others of the dangers and manipulative aspects of neuromarketing (Wilson, Gaines, & Hill, 2008). Neuroscience is a revolutionary concept in the world of marketing because it promises to solve the marketer's dilemma of

understanding what the buyer is thinking and how best to sell a product. Despite this, it remains as an area of study rather than a conclusive result because scientists are continually discovering more insights to understand the brain and marketing.

Neuroculture

We currently live in an age of “neuroculture” where neuroscientific knowledge is constantly incorporated into our life, culture, and intellectual discourses (Frazetto & Anker, 2009). Unlike other organs in our body, mainstream Westerners understand the brain as being accountable for many of the functions that we find irreplaceable. The brain is considered the holding cell for our “personhood;” our identity, our free will, our compassion, and our ability to love are all processed and understood in the mainstream notions of the brain (Frazetto & Anker, 2009, p.816).

A study published in 2012 looks at the number of articles discussing brain research from January 1, 2000 to December 31, 2010. The search was limited to six national UK daily newspapers: *the Daily Telegraph*, *The Times*, *Daily Mail*, *The Sun*, *The Mirror*, and *The Guardian*. Once duplicate articles such as obituaries and television listings were removed, 2,931 articles remained that mentioned neuroscience. The number of articles published per year climbed steadily from about 180 in 2000 to about 350 by 2006 before dipping slightly in 2007 and more dramatically in 2009 (likely as a result of the economic depression), before rebounding above 300 articles per year by 2010 and leveling off. This indicates an increasing interest by society in how we understand the brain as being relevant to our lives.

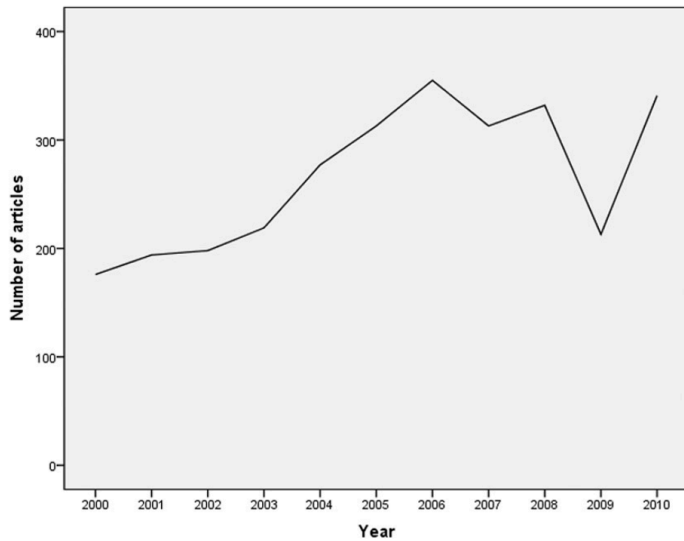


Figure 4 The Number of Neuroscience Articles Written per Year- Source: O'Connor 2012 p. 224

Lindstrom's article (2011), "You Love Your iPhone. Literally" published by *The New York Times* op-ed, leads the average person to believe that their love for their mother is the same as their love for their iPhone. Because of our cultural obsession with the brain's ability to control our functions and personhood, explanations of psychological phenomena generate more interest and credibility when supported, however loosely, by neuroscientific evidence (Weisberg et al., 2008). Therefore, when the media begins reporting that there are mindreading machines that predict our moves as consumers and lead us to believe there are "buy buttons" in our brains to make us buy products, the public often responds negatively because few have the ability to understand neuroscience enough to negate the claims. The general assumption that it must be true because of the "science" backing the claims is the "neuroculture" taking over.

In reality, neuromarketing cannot be a productive study on its own; there is no buy-button in our brain and we cannot definitively look at a brain scan and tell whether the emotion being portrayed is love. Without market research, we cannot do much with neuroimaging. Therefore, with marketing it is still necessary to use the marketing mix.

The Four Ps and Neuromarketing

The goal of the Marketing Mix is to find a target audience who needs a particular good or service (product), for a price that they are willing to pay (price), by creating a want or awareness of this item (promotion), and offer it at a place the target audience frequents (place). By following the Marketing Mix, and doing market research behind a product, one can ideally avoid the scenario of trying to sell a bone to elephant (see Figure 1). A successful brand not only has an effective marketing mix, but also demonstrates to the consumer that there is no substitute for that brand.

The Marketing Mix is the most commonly used marketing tool and has been around for decades. Brain-imaging technology can allow for the measurement of neural activity during marketing-relevant behavior (attention, memory, affect, and choice) and in the periods before and after purchase, can aid in understanding how the Marketing Mix may affect the consumer (Plassman et al., 2015). Since the Marketing Mix is crucial in understanding how to market a product, neuromarketing can either replace or benefit the price, product, placement, or promotion by understanding what the consumer thinks and how to market towards that consumer. With each case study, I will focus on a specific “P” and how neuromarketing has been used to replace or supplement it.

Product

Whenever a company designs a product, they must first conduct market research to answer the question: What does the consumer need? What benefits will satisfy these needs? A good product consists of the numerous advantages that customers choose to buy; this can mean a good, a service, or a combination (Ruskin-Brown, 2006). According

to Hall and Schneider (2011): “75% of all consumer packaged goods and retail products fail to earn even \$7.5 million during their first year”. Neuromarketing could aid in product market research by helping marketers understand what the consumer is looking for and why they choose certain products over others. Think back to Ben and the elephant. What if Ben was able to look into the elephant’s brain and understand not only what the elephant wanted but also why he wanted it and why he would not like the bone. As can be seen from Appendix A, Ben could take some simpler approaches such as questionnaires and focus groups, which are often easier and cheaper to implement than neuroimaging techniques that require machine operators and scientists. However, these market research techniques hold the social bias of the consumer and may be misleading. If Ben takes the assumption that neuroimaging tools can help the marketer see inside the brain to recognize the hidden preferences of the consumer, then he can begin looking at the relationship between the brain and the expressed preferences to understand the consumer without bias and therefore create a true market research test (Ariely & Berns, 2010). We know that parts of the brain are activated by things that are aesthetic or desired and thus by showing products, packaging, or ads, neuroscientists can discover which areas are most strongly and reliably activated by these systems.

Place

Within the Marketing Mix, place mainly applies to distribution of an item. Where are you selling a product and will the people there buy it? This can relate both to what store and where within the store a product is placed. For example, if you were selling a brand of tires it would be more likely that you would reach out to car dealers and auto shops rather than hair salons to store your product. Within the shop, it would be most

beneficial for the shop owner to place your tires under the tire section rather than with oil.

Neuromarketing can further aid in the placement of products by conducting eye-tracking exams on consumers. This means tracking the consumer's eye when he or she walks into a store to understand what customers look at first when they walk in and what they may never see at all. This ultimately allows products to be placed strategically to get optimal sales. Within my case studies I do not look in depth into place, mainly because place falls under the concept of neuroeconomics (how individuals make their economic decisions) rather than neuromarketing (how consumers respond to marketing stimuli).

Price

Price is considered to be an indication of value: the higher the price of the product, the more valuable that product is. A product that underwent a successful marketing campaign and therefore has large demand will be able to sell at a higher price than a product with low demand. Again looking at the elephant and the bone, an elephant would likely pay a low price for a bone while a dog (the better audience) would pay a higher price.

Price is closely linked with consumer decision-making and many factors go into how to price a product and how that price may change over the course of the products life cycle. Price is also closely linked with brand. Often times, brand name items cost more than their generic counterparts because the consumer is paying for an item they can "trust". While neuromarketing likely cannot generate an exact price for what a product should cost, it could help in understanding what price means to the consumer and differences between high and low prices of products.

Promotion

The promotion of a product is how future customers learn about the product and why they should buy it (Ruskin-Brown, 2006). This involves advertising the product to the key market demographic. As a famous saying in marketing goes: “I know that half the money I spend on advertising works. Unfortunately I don’t know which half” (Ruskin-Brown, 2006, p. 141). Companies know advertising works, just not what the best advertising is.

Neuromarketing could aid promotion of a product by helping to create ads that advertise to the consumer only what he or she needs to hear and what is most memorable. If successfully done, TV ads would be created to keep the consumer interested and would be more profitable, and the consumer would be targeted with products they are more likely to be attracted to. Overall, this would create more cost-effective advertisements with happier consumers.

Case Studies

By examining the use of neuroimaging in marketing practices, I will be able to find if neuromarketing is a fallacy or if it is improving the marketing field. Each case study is focused on a specific aspect of the Marketing Mix: product, price, and promotion. The main objective is to ascertain what neuromarketing can add to these factors of marketing. Within each case study, I use two articles to support each claim. These case studies serve as a primary resource to understand how neuromarketing is being used in the marketing field today and what it has taught us thus far about marketing practices.

Product: Predicting Consumer Decisions

Traditionally, the process of finding the correct audience for a product is done through market research, which involves asking potential consumers questions in a focus group or sending out questionnaires (see Appendix A). However, due to biases and inaccurate results that arise from consumers feeling pressure to answer a specific way, are unsure what they truly want or unsure of how to express their feelings, this system has proved relatively inaccurate. Neuroimaging focuses on a consumer's initial impulse within the brain before they have the ability to articulate their feelings; therefore, hypothetically, a neuromarketer could discover what a consumer truly wants.

The first article of this case study is on the influence of food consumption and impulsive choice, and the second study focuses on the replacement of neuroimaging machines for market research. It should be noted that both articles are from the *Journal of Marketing Research*. While this is a reputable source, *JMR* has a bias towards marketing practices and may not have the neuroscience credibility that predominately science-focused journals may provide.

Telpaz, Webb, and Levy (2015), analyzed the use of an EEG machine to predict consumers' future choices. This study found that the use of market research tools such as "questionnaires for evaluating consumers' preferences, attitudes, and purchase intent can result in a biased or inaccurate result" (Telpaz, Webb, & Levy, 2015). Since it is vital for a marketer's campaign to influence a consumer's preference and attitude, misinformation on why a consumer likes a product is detrimental to a marketer's purpose. The EEG provides a cost-effective tool that could predict a consumer's choices and ultimately

become beneficial to marketing campaigns. Recent studies address the problem of consumer choice using an fMRI, which is extremely expensive. By using an EEG machine, the authors demonstrate that EEG measurement of neural activity may be used to “predict both rank-ordered preference ratings and actual choices in a subsequent behavioral task” (Telpaz, Webb, & Levy, 2015). This is important because it gives companies who cannot afford fMRI machines the opportunity to use neuroimaging technology. The experimenters examine the EEG response to consumer products using two methods: ERP (event-related potential) and ERSP (event-related spectral perturbations). The EEG picks up the constant background noise of general brain activity, so the ERP studies the evoked segments of potential from specific events. In other words, the ERP activity is “time locked” and the changes are viewed in relation to a specific event, giving the ability to measure how fast one responds to a stimulus (Kosslyn & Ganis, 2002). See Figure 6 as an example of the general background segment and evoked potential within an EEG.

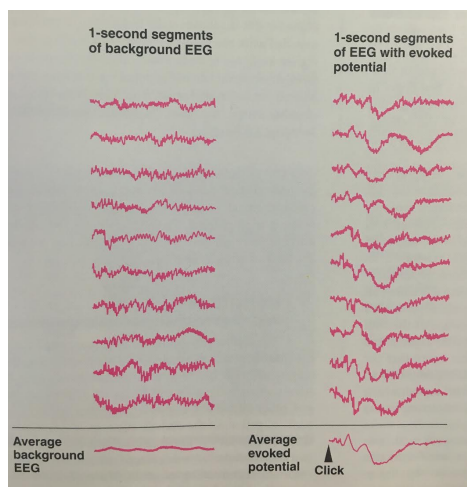


Figure 6 EEG vs. ERP Waves- Source: Pinel, 2003, p. 111.

The second method is the ERSP. The ERSP technique measures the response to a stimulus over time, but it divides the EEG signal into different frequency bands. This

gives the experimenters the ability to examine whether and to what extent there is a change in the power of a given frequency band across time. Telpaz, Webb, and Levy's study follows a three-stage procedure:

Stage 1: participants receive a description of the procedure and familiarize themselves with ten consumer products. Participants are not informed of the actual prices of the products.

Stage 2: neural activity is measured with an EEG while the participants view pictures of the products they encountered in Stage 1. This is done to acquire an independent measurement of neural activity for each product in isolation.

Stage 3: the participants remove the EEG electrode cap and are presented with pairs of the consumer products shown in stages 1 and 2. They must make choices between the products and then rank the products according to their preferences.

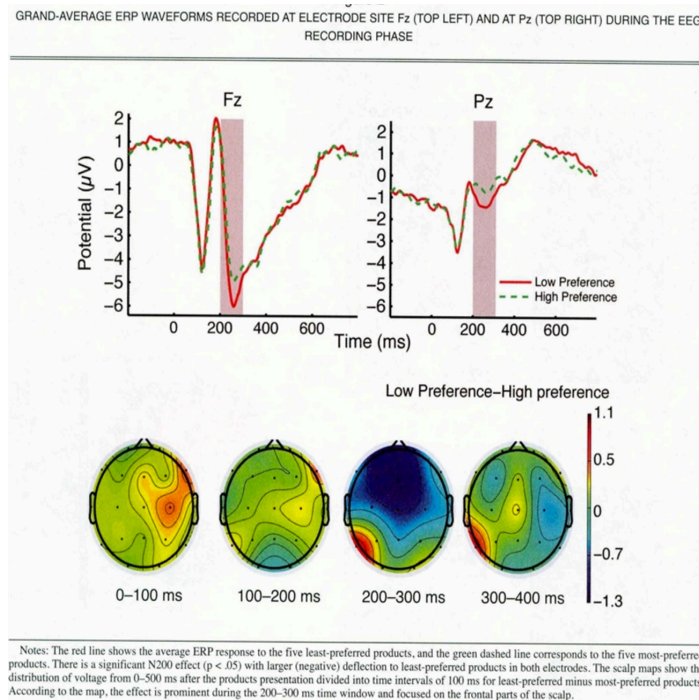


Figure 7 ERP and ERSP Maps of Five Least Preferred Products- Source: Telpaz, Webb, and Levy, 2015.

The experimenters were able to use the EEG data from stage 2 to predict what consumers would choose in stage 3. Figure 7 shows the ERP and ERSP maps of the five least preferred products. One can see that at 200-300 milliseconds the evaluations of the

products are internalized and a decision is formed. This ultimately shows how an EEG could help to predict how a consumer views a product.

The results of this study means that marketers may potentially stop performing inaccurate market research and begin testing their consumers based on EEG neuroimaging data. This approach rules out bias from social pressure and therefore pinpoints exactly what areas of the brain are related to their dislike in the product, what that means for the consumers, and what that means for marketing a product.

Arul Mishra and Humanshu Mishra (2010), both University of Utah marketing professors, examined the reaction of neurotransmitters on our actions. Neurotransmitters are the chemicals released from neurons after they fire. They serve as the basis of communication between neurons and assist in the activation of multiple functions for the body including reactions such as arousal, reward seeking, temperature maintenance, and sleep (Breedlove et al., G-16; Mishra & Mishra, 2010). Mishra and Mishra posit that by influencing specific neurotransmitters, one could potentially influence a person's preference or ability to make a decision. Specifically, certain foods can inhibit or enhance the quantity of certain neurotransmitters. When one consumes turkey, for example, one is consuming an increased amount of tryptophan, which is an enzyme that catalyzes the production of serotonin, a neurotransmitter that influences one's ability to make impulsive choices. Mishra and Mishra (2010) hypothesize that a large consumption of food that enhances serotonin levels, such as turkey and carbohydrates (the main ingredients in Thanksgiving dinner), can "reduce impulsive choice and impulsive responding" (Mishra & Mishra, 2010, p. 1130). According to this study, higher levels of serotonin lead to less impulsive behavior. Mishra and Mishra defined impulsive buying

as “a sudden and unplanned urge that is immediately gratifying or acting on an impulse without careful deliberation of the negative or long-term consequences”(p. 1130). Since serotonin modulates impulsive behavior, Mishra and Mishra hypothesized that when you increase the serotonin levels of a consumer then their impulsive behavior will be inhibited.

Tested under two separate study conditions of a lab environment and a real-world scenario, the two studies were compared to understand how serotonin levels influence impulsivity. In the real-world conditions, participants ate a tryptophan heavy dinner (Thanksgiving dinner) and were then observed while shopping on Black Friday, the Friday after Thanksgiving known for discounted prices. In the lab, participants were given a drink made to increase serotonin levels and then took a *Go/no-go* numbers test. This test measured their levels of impulsivity by calculating how fast they were able to press the Y key when they saw numbers designated as “good” numbers and withhold a response when they saw “bad” numbers (any other number).

The study concluded that in both the naturally occurring and controlled studies, serotonin has the ability to reduce impulsive consumer choice. Interestingly, this should mean that Black Friday would not be successful because after eating large quantities of turkey, people would buy fewer products. However, this study supports the concept that consumer decisions cannot be completely influenced because there are numerous factors that play into a decision and no method for a marketer to harness and control every influence. While this study demonstrates how our decisions are a result of the chemicals and neuronal connections within our brain, it does not give a solution for marketers to affectively harness these connections. This study does not affect marketing strategies for

the future, but it does support our assumption that consumer decisions can, at least case-by-case, be predicted within the brain, a fact of which can be the basis for future neuromarketing studies.

These two studies support the idea that the brain contains information about consumer preferences. However, it also demonstrates how consumer preference can change based on what a person eats for dinner and that certain foods be heavily determinate factors to what we buy. Therefore, while we can make predictions about what product a consumer may or may not like, we cannot make predictions about what the consumer will buy. This conclusion is evidence that neuromarketing would be most beneficial when collaborated with market research, but due to lack of research and knowledge of brain function is not yet prepared to replace traditional market research tests. Even though Telpaz et al. confirmed that decisions could be understood using an EEG, Mishra and Mishra suggested that multiple factors such as food and environment could go into a decision, concluding that one cannot defiantly say what a consumer will choose.

Predicting consumer decisions is the most contested area of neuromarketing due to its infringement on the rights of privacy and free will. While cracking the code to how a consumer forms a decision would be the key that every marketer is looking for, it may also be impossible. Think of the last decision you made to buy an article of clothing. Was it a spur of the moment decision? Had you been thinking about that article or item for a while? Maybe an event was coming up you had to prepare for. You were sad and needed a pick-me-up or you just got a raise and wanted to splurge. Needless to say, there are a

million different factors that can go into a decision to buy a product, which makes understanding the neuroscience behind decision-making extremely difficult.

Price: The Relation Between Brand and Price

The second case study focuses on the effectiveness of neuromarketing in brand research. Brand name products are generally more expensive than generic products because a brand gives the consumer a sense of trust and therefore develops a higher value. When looking at brands, I found it was productive to look both at the effects of labels and price. There are two relevant studies that look at these areas: the first focuses on price and how the price of wine affects taste, while the second study looks at how a brand affects a consumer’s decision when choosing products. The overall goal of this case study is to understand what neuromarketing can tell us about how a product is branded and priced.

Table 1			
<i>Wine #</i>	<i>Price told</i>	<i>Drinker Preference</i>	<i>Brain Effect</i>
Wine 1a	\$5 (retail)	Dislike	-0.3% decreased change in mOFC
Wine 1b	\$45 (retail \$5)	Like	0.2 % increased change in mOFC
Wine 3	\$35 - control	Neutral	
Wine 2a	\$10 (retail \$90)	Dislike	-0.35% decreased change in mOFC
Wine 2b	\$90 (retail)	Like	0.3 % increased change in mOFC

Plassman, et al. (2008) conducted a study that examined whether marketing actions, such as the change in price of a product, “can affect the neural representations of experienced pleasure” (p. 1050). The experimenters conducted this study by scanning the brains of individuals who were drinking wine inside of an fMRI machine. Subjects of the study were told they were sampling five different Cabernet Sauvignons. In reality, the

participants were only sampling three different wines and two of them were administered twice (see table 1 for the cost of the wines).

The results for the study indicate that by increasing the price of wine, the subjects found the flavor to be more pleasant. This is also indicated by the increased BOLD activities in the medial orbitofrontal cortex (mOFC), an area residing within the prefrontal cortex that Plassman et al. found to encode experienced pleasantness. Figure 8 shows the graph and brain scan from this test. Graph D shows the difference between the two lines the best. The blue line—the wine declared as \$10—shows a negative percent change in the mOFC compared to the green line—the wine declared as \$90—which shows an increase of up to 0.5%, indicating the brains pleasure center was more activated when drinking expensive wine. The scan shown in E reflects this increased change with a clear activation in the mOFC.

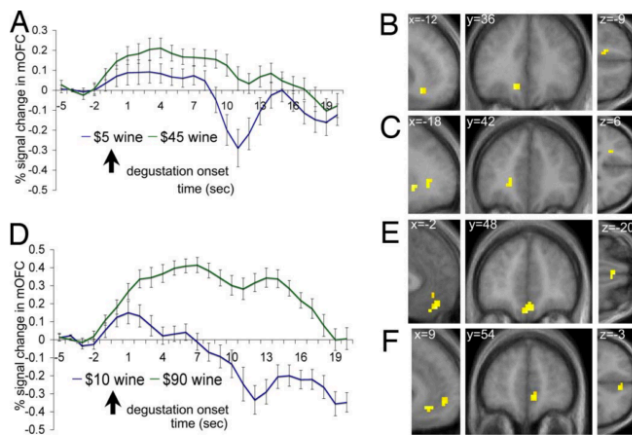


Fig. 2. The effect of price on each wine. (A) Wine 1: averaged time courses in the medial OFC voxels shown in B (error bars denote standard errors). (B) Wine 1: activity in the mOFC was higher for the high- (\$45) than the low-price condition (\$5). Activation maps are shown at a threshold of $P < 0.001$ uncorrected and with an extend threshold of five voxels. (C) Wine 1: activity in the vmPFC was also selected by the same contrast. (D) Wine 2: averaged time courses in the medial OFC voxels shown in E. (E) Wine 2: activity in the mOFC was higher for the high- (\$90) than for the low-price condition (\$10). (F) Wine 2: activity in the vmPFC was higher for the same contrast.

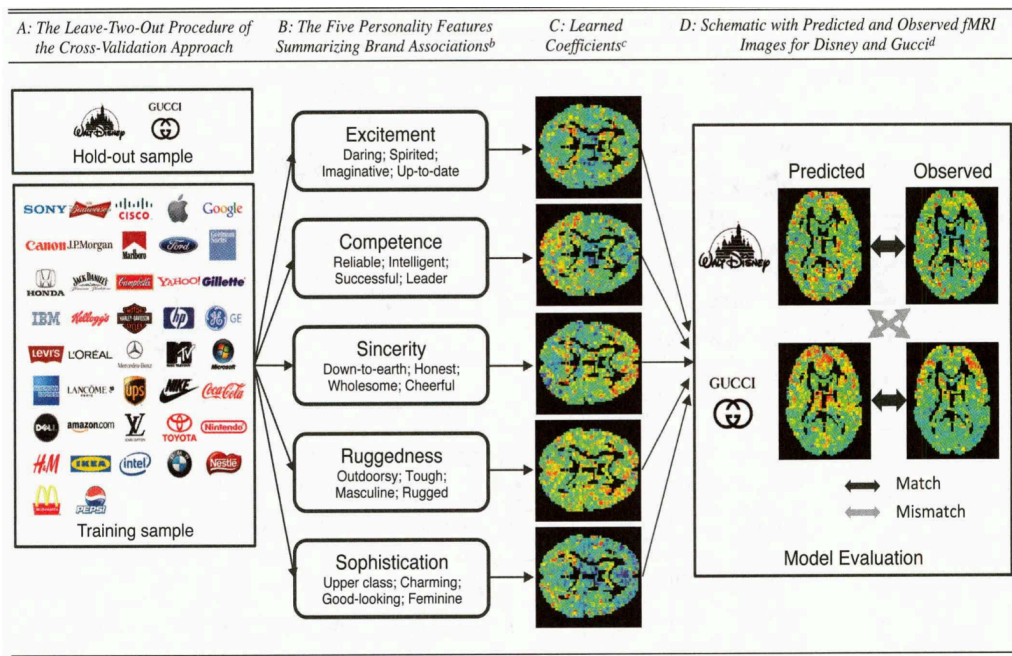
Figure 8 Wine Price and its Relation to the mOFC- Source: Plassman et al., 2008, p. 1051.

Overall, this study shows the effects of price and branding on taste and the brain. This is an example of how social bias (the assumption that expensive wine should taste better) can have a real effect on how we taste and experience products. Wine is a luxury item and this demonstrates how neuromarketing may have the ability to change the marketing strategies of luxury items and the way consumers experience them. This study ultimately improves the future of neuromarketing by giving marketing professionals an insight into the consumer brain and how price and bias can have a real effect on experience.

Chen, Nelson, and Hsu (2015) conducted another study that examined the effects of brand personality on the brain. When we think of certain brands, we associate that brand with certain traits. For example, we may associate Disney with being wholesome or innocent. Chen, Nelson, and Hsu (2015) examined whether branding has a pre-existing personality in a consumers' mind or whether the personality is a product of outside influences and reflection. In order to test this, the experimenters recruited seventeen participants to observe brand logos. They placed each participant in an fMRI machine. While being scanned, the participant passively viewed logos of 44 well-known brands. Each of the 44 stimuli was presented four times in random sequences on a gray background lasting four to eight seconds. Afterwards, participants were asked to complete a survey that asked for the familiarity and preference for each of the 44 brands. Results of the study show that the experimenters were able to predict the brand the participants were thinking about by looking at their brain scans, seeing how they were feeling, and comparing their findings to the survey. This was done "solely on the basis of

the relationship between brand personality and brain activity” (Chen, Nelson, & Hsu, 2015, p. 462), showing that brand personality exists a priori in consumers mind.

Figure 9 displays some of the findings of this study. The brain scans are single-axial slice depictions of the brain from the fMRI machine with color representing the image intensity, red being high intensity and blue being low intensity. Part A shows the various brands that were used. Part B shows the various personalities that each brand could possess. Part C shows the predicted brain scans of each personality. Part D compares and contrasts “Disney” as a brand, to “Gucci”. Looking at the predicted versus observed Disney scans, you can see there is activation in the very top and bottom areas of the brain. Gucci, on the other hand, shows activation in the top half but very limited activation in the lower half of the brain. From this description, it is clear that the Gucci predicted brain scan does not match the Disney observed brain scan. Figure 9 demonstrates that for every brand, different areas of the brain are activated, implying a different perception of the brand by the consumer.



^aFor each iteration, two brands were held out of the training set (e.g., Disney and Gucci), and model calibration was done using the remaining 42 brands in the training set.
^bNeural signatures of brand association were estimated using brands' personality features derived from participants' ratings.
^cCoefficients for the five personality features are depicted in single-axial slice, with color representing image intensity.
^dCross-validation is completed by using trained neural signatures to predict observed neural responses to holdout brands. The predicted image for the holdout brand is calculated as a linear combination of the personality features of the holdout brands, weighted by the estimated coefficients associated with each feature.

Figure 9 Personality and Brand Affiliations- Source: Chen, Nelson, Hsu, 2015, p. 458.

This study suggests the impact that brands can have in our brains for developing a personality, and captures the brand experience and specifically, it labels the areas of the brain that are stimulated during the perception of a brand. By understanding where this activity occurs during certain thought processes, the experimenters were able to predict the consumer's emotions about a particular brand. Future studies could expand and look at the effects of marketing actions on brands to understand how to best market specific brands given these particular personalities. Particularly in how the mindset of personality, memory, and promotion can positively impact sales (Plassman et al. 2007).

Overall, this case study suggests that neuromarketing has initiated innovative concepts about the effect of branding and price on products and how consumers perceive them. While the neuroimaging has done little to change the marketing of wine or affected how Disney or Gucci markets their brains, it serves as useful data when compared to

behavioral studies and traditional market research about what people look for when they are purchasing specific brands or bottles of wine.

Promotion: Effective Advertising

Promoting and advertising a brand, store, or product is a major part of marketing today. Neuromarketing has attempted to influence the promotion of brands and TV advertisements by understanding why and how consumers respond to ads. The question behind neuromarketing and advertisements is: how can neuroimaging data help marketers create productive and useful ads that consumers will remember? Many studies have been done to investigate the neural correlates of consumer preferences to advertisements. The studies of Plassman et al. (2007) and Stoll, Baecke, and Kenning (2008) demonstrate how advertisements, emotion, and packaging can have an effect on the consumer's decision to buy and Wang et al (2013) determines how anti-smoking advertisements can be more effective. These studies all focus on how a product is promoted through its advertisements and packaging and how these factors affect consumer decision-making.

Stoll, Baecke, and Kenning (2008) hypothesized that the brain processes negative stimuli (unattractive packaging) differently than it process positive stimuli (attractive packaging). They used this hypothesis to test how package designs may affect the brain and sales of a product; visual stimuli could trigger varying levels of attention, which could have an influence on choice of brand and overall sales of an object. It is known that attractive packaging can have positive affects on sales; this is why firms often spend more money on packaging than on advertising a product (Stoll et al., 2008).

Within an fMRI machine, consumers were asked their preferences on the package attractiveness displayed on a screen. Stoll, Baecke, and Kenning found increased

activation in the medial prefrontal cortex (MPFC), an area that, as previously discussed, is crucial for human decision-making. Overall, Stoll et al. found that there was a higher level of attention paid to attractive packaging and unattractive packaging triggered areas of medial, middle, and superior frontal cortices, these are areas also located in the frontal lobe but are typically associated with unfavorable outcomes, responses to conflicts, and expected risk.

While attractive packaging will not guarantee the sale of a product, it will most likely improve consumer memory of the product and increase the likelihood that it may be purchased. This study is the first that investigates the neural correlates of attractive and unattractive packaging; therefore, there is room for future studies that are less explorative and more directed at specific types of packaging and products.

Wang et al. (2013) did another study on promotion of products, specifically on the impact of televised anti-tobacco advertisements. To test the effectiveness of the advertisements, the experimenters did a urine test at the beginning of each exam to test for cotinine levels, which is an indicator for the level of tobacco in ones system. They also completed the Fagerstrom Test of Nicotine Dependence, gave the average number of cigarettes per day, and their baseline intention to quit smoking. Within an fMRI, the patients observed different anti-tobacco advertisements, which had been previously appraised by different raters to determine the format (message sensation value, MSV) and content (argument strength, AS) of each ad. The experimenters tested the impact the advertisements had on the smokers based on the AS and MSV content One-month after the fMRI tests, the subjects were asked to come back in for a follow-up session and to

deliver another urine test, which was used to find how often the patients were smoking after the original ad test.

Through the BOLD levels in the fMRI tests, experimenters found increased activation in the dorsolateral prefrontal cortex (dMPFC) when patients watched ads that had both high AS and MSV ratings. This is an area of the brain in the prefrontal cortex

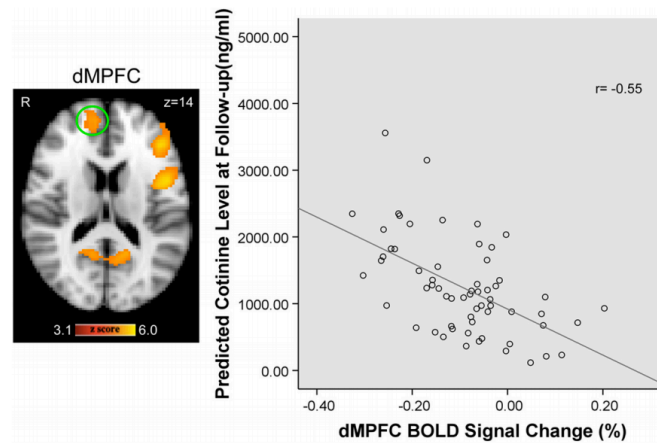


Figure 3. Left, dMPFC activation associated with AS by MSV interaction. Statistical map (yellow-red scale) is displayed over the MNI brain template and thresholded at $z = 3.1$ (cluster corrected at $p < 0.001$). Right, Correlation between percentage BOLD signal change in dMPFC and predicted cotinine levels at 1 month follow-up, adjusting for the baseline cotinine levels and AS groups.

Figure 10 The dMPFC and it's Relation to Dropping Cotinine Levels – Source: Wang et al., p. 7425.

that aids planning and judgment and is responsible for cognitive control and decision-making (see Figure 5). It is most commonly activated during tasks that involve introspective processes, such as self-will, and is deactivated during tasks that involve externally focused attention, such as driving.

Wang et al. found the dMPFC was the strongest indicator for a reduction in the urinary cotinine levels after a 1-month follow up. These findings suggest that participants whose dMPFC was activated were more likely to quit smoking. This can be observed in Figure 10. The brain scan shows the activation of the dMPFC and the graph shows how

an increase in the BOLD signal in the dMPFC area of the brain is associated with lower cotinine levels in the urine sample, meaning the subjects were smoking less after one month.

This study is an example of how neuromarketing can potentially affect future marketing campaigns for anti-tobacco ads. By creating an ad that focuses on both content and format, it will have a lasting affect on a smoker's addiction problem. Overall, this demonstrates how neuromarketing can benefit the public by improving public service announcements and even potentially save lives by making anti-smoking advertisements more effective to consumers.

Understanding how advertisements and packaging grab the attention and memory of viewers combines concepts of both consumer decision-making and brand personalities. For example, in order to advertise for anti-Tobacco ads, a neuromarketer would look to target a different area of the brain than would someone advertising a Disney movie. While this may seem obvious, the knowledge of what brain areas should be activated and what content will stimulate these areas is beneficial not only to the marketer, but to the consumer.

Ethics

Neuromarketing is often accused of transgressing ethical boundaries and breaking the consumer's trust; ethical objections to neuromarketing fall under the category that neuromarketing generates "risks of harm and violations of rights" (Stanton et al., 2016). There are two common ethical issues attributed to neuromarketing: there is a buy-button in the brain that can be used to manipulate and influence consumer choice, and the

companies that use neuromarketing have a potentially unfair advantage over those that cannot, or do not, use it.

The “buy-button” is the theory that a neuromarketer could find a certain level of drugs, or create advertising campaigns that we cannot resist and use this knowledge for increased sales (Broderick, Chamberlain, & Lee, 2007). However, this idea of complete manipulation and influence of consumer choice is currently an unrealistic problem. As I discussed using the first case study, there is not enough science to accurately predict what consumers want before they know it themselves. This being said, just because the science is not there yet does not mean this cannot be discussed as a relevant issue. If neuromarketing and our understanding of the human brain continue along the same trajectory, this may be an issue we need to discuss sooner rather than later.

The media portrays neuromarketing as a field of study that finds a “buy button” in the consumers’ brain and can sway consumers to buy products. In reality, the purpose behind neuromarketing is for the company to create a better product or advertisement to entice the consumer, but not manipulate or influence the consumer’s mind; “a fundamental goal of marketing is to understand and address consumers’ needs”(Stanton et al., 2016). Neuromarketing is created as a supplement to traditional marketing practices, not a new, manipulative practice. Therefore, rather than swaying a consumer to one product over the other, it is marketing one product that the consumer is more likely to enjoy.

This, however, highlights another ethical issue. If neuromarketing is successful at marketing products that the consumer needs, what if neuromarketing is also being used to market products the consumer does not need, such as cigarettes? And if neuromarketing

is more successful at selling products, what happens to the smaller companies that cannot afford the machines to use it? This means that the companies with money to buy fMRI and EEG machines will be the ones that benefit from neuromarketing science, while the smaller companies without the money to afford these luxuries will struggle to market their products in comparison. This could provide a situation where larger companies are able to take customers from the smaller companies using this superior marketing practice and offering a superior product, ultimately phasing out the smaller companies.

Currently, the Institutional Review Board (IRB), which ensures ethical conduct of research for companies, is not responsible for marketing or neuromarketing practices, meaning companies can conduct market research without being questioned on their ethics (Stanton et al., 2016). If neuromarketing practices become more prominent and gain more insight into consumer minds, it will become necessary that they comply with a review board and a set of laws to check their ethics.

Critics

There are many critics who point at the current flaws and shortcomings of neuromarketing as evidence that it is either unreliable and cannot be used accurately or that it is too reliable and they fear what it can say about the consumer. In 2004, the French parliament passed a law stating: “Brain-imaging methods can be used only for medical or scientific research purposes or in the context of court expertise” (Oullier, 2012); by doing this, the parliament banned all neuromarketing companies from practicing in France. Therefore, neuroimaging studies are valued enough to send someone to death row, but not enough to be used for TV commercials? This is likely a

result of the hype surrounding what neuromarketing has the potential to do rather than what it can actually accomplish.

In order to clear up what is and is not known about neuromarketing, here is a brief description of what scientists and marketers know. Neuroscientists are worried about the “where” function of the brain and are still looking to understand the brain as a map. Marketers and consumer neuroscientists are looking for the “what”, what does it mean when a certain area of the brain is activated? How can this be used practically? While the brain continues to be understood and mapped, these questions cannot be answered fully until we know more about the brain (Chen et al., 2015). As a result, neuromarketing cannot be used as a study on it’s own and is most successful as a complement to current market research.

The fear and critical view of neuromarketing relates to our neuroculture. Since 2000, an increasing number of articles have been written on the subject of *brain optimization*, meaning enhancements or threats to brain function that could be made to optimize the functions of the brain (O’Connor, 2012). This implies that the brain is malleable and can be impacted by outside sources, supporting the cultural theory that our brain could be manipulated and impacted by scientific forces such as neuromarketing. O’Connor (2012) discusses how “established cultural concerns and values can be projected onto scientific knowledge” (p. 225), leading the public to misinterpret or misunderstand the established facts of neuroscience. Olivier Oullier (2012) described the influx of neuroscience data as the new genetics “the latest scientific field to be used and sometimes hijacked to explain human behavior” (p. 7). People are taking the information that is not totally understood and making broad generalizations. As Klass Bertrand states

in response to the subliminal advertising scare in 1958, “too frequently, in our search for speed and efficiency, we oversimplify the nature of the problems... we disregard existing facts and information, and engage in heated debated before fully understanding the subject matter we are debating” (Klass, 1958, p. 146). Similar to how the media and public have been handling neuromarketing, we must remember that until we know more facts about the brain and examples of what neuromarketing has the ability to do, we cannot make a logical or definitive argument for its powers.

Future of Neuromarketing

The future of neuromarketing is likely one of growth and deeper understanding, but in science, most often with advancement comes consequences. As discussed, the brain is culturally seen as an important part of our society; the mere mention of its manipulation has greater cultural impacts. Through neuromarketing’s growth over the past decade, there has been a steady growth of neuroscientists conducting research in business school and an influx of consumer neuroscientists developing their expertise and producing more studies and findings (Plassman et al., 2015).

The majority of American citizens take pride in independence and the ability to have freedom of speech; we attribute many of our actions such as thought and reason as coming from our brain. When the media reports fears that scientists can control our brains, read our thoughts, or perhaps create a “buy-button” in our brain (Singer, 2010; Renvois et al. 2007), consumers feel they have lost the freedom to make decisions. Both subliminal messaging and neuromarketing have created this sort of reaction from the consumer. Despite this, companies such as Google, CBS, Disney, and Frito-lay use

neuromarketing to test consumer impressions; really any large corporation that can spend the money is using neuromarketing as a novel way to attract more consumers (Singer, 2010). However, because of this consumer fear of manipulation the studies done by these large corporations are kept under wraps and out of sight from the public.

In order for neuromarketing to avoid suffering the same dismal fate as subliminal messaging, the academic community must take the matter seriously and “not leave it to the neuromarketers and the op-ed page of the *New York Times*” (Ariely and Berns, 2010, p. 291). When articles are solely published in these sectors, titles such as “Ads that Whisper to Your Brain” and “You Love Your iPhone, Literally” flourish and can scare consumers (Singer, 2010; Lindstrom, 2011). In order for the academic community to take this study sincerely, and for the standards of marketing practices to change, then neuromarketing must take a more active role in academic papers as well as education, medicine, business or even political policy (Breiter et al., 2015). This likely means neuromarketing companies will have to address the ethical dilemmas and critics of the study before they are able to move forward.

Conclusion

I hypothesized that neuromarketing is the beginning of a new field of study in the marketing world, and that when used correctly, neuromarketing can effectively support traditional marketing claims and aid marketers in understanding how to market products towards the consumer more effectively. While it is not likely that this will replace the traditional Marketing Mix, neuromarketing can add support to marketing claims and aid in finding the correct audience for a product. Moreover, neuromarketing can assist

marketers in understanding what happens when a consumer chooses a product, help brain-mapping initiatives, and increase the knowledge of the brain and our bodily responses. Marketing has changed and morphed numerous times over the years and neuromarketing has the potential to be the next big change in the field.

The studies presented here demonstrate how the current areas of neuromarketing are being studied and how they impact existing market strategies. Those that are most affected are promotion and price, which had the most effect on market research tactics. By increasing the price of wine, Plassman et al. (2008) demonstrated a correlated activation in the region that is associated with pleasantness, showing that social stigmas not only create a bias, but also trick our brains into perceiving the wine as better. This study paired with that of Chen, Nelson and Hsu's (2015), reveals our brains associating personality aspects of different brands. By showing the perceived perception of price and brand on the brain, marketers could potentially change their marketing strategy to fit an appropriate price or brand name to an item. T.V., magazine, and radio advertisements could also change in response to neuromarketing strategies because they can develop the ability to entice consumers to stop harmful actions. The anti-tobacco commercial's activation of the dMPFC correlated with lower cotinine levels can help future companies create more enticing commercials that will help people quit a harmful practices.

Numerous factors play into a consumer's ability to make decisions and combined with the ethical arguments for consumer free will, it is fairly clear that this area of neuromarketing is the least likely to make any headway and the most contested aspect of consumer marketing. Because of this, it is unlikely that neuromarketing will be able to make serious impact into predicting consumers' thoughts or behaviors. Ultimately, I

think neuromarketing has a strong future as a companion to market research. Used in this way, future marketers should be able to have more knowledge about the product they are selling and the target audience, ultimately benefiting the consumer from being sold something he or she does not want while also saving the company money from pointless advertising and effort. Hopefully, no marketer will have to sell a bone to an elephant.

Appendix A: Market Research vs. Neuroimaging Tools

Technique	What is measured?	Advantages	Disadvantages	Cost	Technical Skill Required
Focus Group	Open-ended answers, body language and behavior; not suitable for statistical analysis	Low cost, wide variety of answers	Speculative, bias from the group, social pressure to answer in specific fashion, risk if misuse of data by seller	Low cost	Moderation skills for inside the group and ethnographic skills for observers and analysis
Questionnaire	Importance weighted for various product attributes	Helps to determine customer trade-offs, easy to administer	Risk of alerting competitors of product and weaknesses	Moderate cost	Questionnaire design and statistical analysis
Simulated choice method	Choices among products	More realistic options than in a focus group or questionnaire	Hypothetical, potential to alert competitors	Moderate cost	Experimental design and statistical analysis (including choice modeling)
Market Test	Decision to buy and choice among products	High reward, most accurate data	High risk of alerting competitors	High cost	Running an instrumental market
fMRI	Localized brain areas' oxygen use (BOLD)	Good temporal precision, excellent spatial resolution	Restrictive environment for subjects	Highest Cost	Technician needed to run machine and interpret results
EEG	Localized Brain areas electrical activity	Least expensive brain imaging, excellent temporal resolution	Limited spatial resolution	High Cost	Technician needed to run machine and interpret results
Hormones	Hormone concentration in saliva, blood, etc.	Can be non-invasive, collected in field and lab	Less temporally precise	Moderate cost (Low when compared to other neuroimaging technology)	Specialist needed to interpret results and meaning of hormone levels
Eye Tracking	Target of gaze and pupil diameter	Unique measure of attention, low cost, excellent temporal resolution	Difficult to attribute valence to eye movements	Moderate cost	Specialist needed to set up device and interpret results

Sources: Stanton et al., (2016); Ariely & Berns (2010).

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