Neuromarketing: Buying Behavior & the Brain

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Introduction

Market researchers know just how difficult it can be to test not only the engagement of the consumer with their product, but how the consumer feels about their product, and the likelihood that they will purchase it when compared with a competitor's. Instead of relying on personal testimonies, some researchers are going straight to the source of the consumer's decision-making: their brain. Neuromarketing is a relatively new field using applied-neuroscience research methods (fMRI, eye-tracking, EEG, etc) to determine how consumers make decisions based on marketing stimuli. Using neuroscience, marketers have made discoveries such as: display mannequins without heads are unappealing to consumers; rounded edges are more pleasing than sharp edges; and men pay attention to a product's features, while women are more interested in its price (Karlinsky, 2011). By examining the history of neuromarketing and how it is being used in different sectors today, we can better understand the future of the field, and the ethical implications that come with it.

History

Neuromarketing can be defined as "a new branch of marketing in the perspective of increasing the efficacy of the commercial actions of companies" (Boricean, 2009). This new marketing strategy is based on techniques from neuroscience, and strives to better identify and understand the cerebral mechanisms that drive consumer behavior. The practice of using neuroimaging techniques for market research was first developed by Gerry Zaltman at Harvard University during the early 1990s (Reid, 2005). Zaltman was recruited by a few Fortune 500 companies (Reid, 2005) to work on a series of projects to improve their market research techniques. Zaltman and his team at Harvard decided to use fMRI to measure subjects' responses to advertisements, with the goal of increasing retail sales of the product. The end result was that

the company who employed the experiment was able to increase gross sales of the product four times over (Reid, 2005).

The use of neuromarketing spread rapidly during the 1990s. The number of advertisements Americans viewed per day had grown from around 500 ads in 1970 to almost 5,000 by the early 1990s. Because of this ad saturation, it became increasingly important for marketers to capture the attention of their target markets. What they needed were highly targeted communications in order to survive (4imprint, 2010).

While the utilization of fMRI as a marketing tool had been around for almost a decade, the first use of the word 'neuromarketing' did not come about until 2002. The term is credited to Ale Smidts, a professor of economics at Erasmus University Rotterdam in the Netherlands in 2002 (Lewis, 2005). Smidts is currently the Director of the Centre of Neuroeconomics at Erasmus. Even after the practice had a name, it took an additional two years before the first neuromarketing conference was held to address the growing field. The Baylor College of Medicine in Houston organized the first international symposium dedicated to the use of neuronal imaging in marketing studies in April of 2004 (Lewis, 2005). One of the purposes of the conference was to discuss the different methods, technologies, and techniques researchers found to be effective in measuring the decision-making processes of their subjects. Today, the most common neuroscientific tools used to study consumer buying behavior are fMRI, EEG, eye-tracking, and GSR.

fMRI

fMRI stands for functional magnetic resonance imaging, and was developed in the early 1990s as a specialized type of conventional MRI (Montague, 2005). While MRI scans image the anatomical structures of the brain, fMRI scans image the metabolic activity within the

anatomical structures (Wallis, 2004). In other words, fMRI can show researchers which brain structures "light up" during certain tasks or in the presence of certain stimuli.

When the subject comes in for any type of MRI scan, they typically lie on a table, with their head surrounded by a large, cylindrical magnet. A conventional MRI causes the protons inside of the subject's brain to align with the magnetic field emitted by the magnet in the machine (Montague, 2005). A pulse of radio waves is then directed at the protons, which is used to capture and construct the brain image.

For fMRI, the subject will lie on a table similar to the one in a conventional MRI, but they will usually have to place their head in a brace to keep it still (RadiologyInfo, 2011). Patients are usually given headphones or goggles to wear, in order for the stimuli to be administered effectively. fMRI uses a conventional MRI scanner to capture the image, but focuses on blood flow, rather than the radio waves emitted by protons (Montague, 2005). The iron atoms in our blood cells carry oxygen, which is an important key to using fMRI. When a structure of our brain becomes more "active" than others, oxygenated blood flows into that region. With more blood cells localized to one region than normal, a small change in the magnetic field is created (Montague, 2005). The fMRI scanner picks up on this change, and allows us to see which structures "lit up".

Physical sensations such as the five senses (sight, sound, taste, touch, and smell), problem solving, as well as movement, can activate different brain areas that can be imaged by fMRI. fMRI is the most commonly used technique by neuromarketing researchers because the procedure is non-invasive (it does not require injections of radioactive isotopes), it requires very little time to obtain an image, and the quality of the image is very clear (Wallis, 2004). A common misconception with fMRI is that it displays which areas of the brain are "active" during

certain tasks, but in reality, it shows which areas are more active than others. Our brain is active at all times, but some structures are used to a greater extent during certain tasks. fMRI research tells the researchers "what areas of the brain receive more oxygenated blood in response to one task as compared to another" (Natalie, 2011). An example of fMRI output images can be seen in *Figure 1*.

The most common neuromarketing studies done using fMRI have subjects lying in the large, magnetic imaging device, where they are then shown different marketing materials through the use of goggles and/or earphones to administer the stimuli. While fMRI allows researchers to see specific location-based brain activity, it costs around $15,000 to run 20 test subjects (4imprint, 2010).

EEG

EEG stands for electroencephalography, and is used to measure the minute electrical activity in the brain. EEG is most commonly used as a diagnostic test for epilepsy (Mayo, 2011).

Neurons communicate with each other via action potentials. Action potentials represent rapid changes in the voltage of the neurons across the plasma membrane of their axons (see *Figure 2* for a diagram of a neuron). The charge is mitigated through the myelin sheath until it reaches the end of the axon, called the axon terminal. Vesicles in the presynaptic cell's axon terminal then release neurotransmitters into the synapse (the space between the pre- and post-synaptic cells), where they bind to receptors on the postsynaptic dendrite (see *Figure 3)*. This transfer of neurotransmitters is the pathway of communication between neurons.

EEG is a non-invasive way to detect these action potentials, and to see if neurons in a subject's brain are communicating normally. A technician will attach small, flat, metal discs called electrodes on the subject's scalp (see *Figure 4*) to detect and record patterns of electrical

activity (Mega, 2011). The electrodes can be attached to the scalp with a gel-like adhesive, or through the subject wearing an elastic cab (Mayo, 2011). Once the electrodes are secure, the procedure will last anywhere from 20-60 minutes (Mayo, 2011). For the duration of the EEG, subjects will usually be asked to perform simple tasks, such as reading a few sentences, or opening and closing their eyes. The electrodes are connected to a machine that amplifies the electrical activity, which is demonstrated by wavy lines on an EEG recording (see *Figure 5*), which can be on the computer or a paper graph. These wavy lines represent the different brain waves functioning in the subject.

Humans have four main types of brain waves, all of which can be measured by an EEG. Alpha waves appear when you are in a relaxed but conscious state. Alpha waves are most commonly seen when your eyes are closed but you are awake (mentally alert). Beta waves appear when you are highly alert, and are associated with periods of active concentration. Theta waves are present when you are drowsy and nearing sleep. Delta waves only occur when you are asleep (Healthwise, 2010). Based on the magnitude of the lines recorded from the EEG, researchers can determine which brain waves are being emitted (See *Figure 6*). Neuromarketers are interested in the level and magnitude of the beta brainwaves, as they indicate the level of attention the subject has to the experimental stimulus. If a subject is wearing an EEG cap while viewing a commercial, researchers can pinpoint (in real time) which specific parts of the commercial the subject attended to the most, and which were the least engaging.

While not as specific as fMRI in regard to what exact structure of the brain is active, there are some advantages to using EEG. EEG technology is significantly cheaper than fMRI, more portable, quieter, and doesn't expose patients to the high-intensity magnetic fields that fMRI machines do (Mega, 2011). EEGs can be carried out at a similar cost to a focus group,

making them extremely accessible to most businesses (4imprint, 2010). While fMRI images can be seen in seconds, EEG images can be viewed in milliseconds, giving it a more accurate real-time picture of the brain.

Eye-Tracking

An eye-tracking device is just what it sounds like – it measures eye movement and the point of gaze of the subject (Schroeder, 1998). The device (see *Figure 7*) is mounted on the subject's head and is connected to a computer. Most eye-trackers include two of the same components: The first is an infrared light source directed at the subject's eyes, and the second is a camera.

Eye tracking takes advantage of the light-reflective properties of parts of the human eye. The infrared light source on the headset projects a beam of light into the eye. This beam of light allows the researchers to track two different reflections coming back from the eye. The first reflection comes from the retina (see *Figure 8*). Photoreceptors inside of the retina reflect the light, causing the pupil to "light up" for the camera (Forster, 2011). The camera can now easily film the pupil's movements, but it still does not have a point of reference as to where the subject's head is positioned in relation to the camera. When the beam of infrared light is projected onto the eye, a small portion is reflected back by the cornea (Forster, 2011). This reflection appears as a small, bright dot on the eye. This dot remains stationary, even as you shift your gaze, so it is used as the anchor point for your head position. The eye tracking refers to the position your pupil moves in relation to the stationary corneal reflection. To ensure that your head position doesn't move during the test, participants are often asked to put their head into a chinrest to remain still. The results of eye-tracking studies are shown as a heat map over the image or video on a computer screen (see *Figure 9*).

The many different patterns of eye movement that can be seen on a heat map can answer very important questions for the researchers (Hernandez, 2010). If eye movement is random and scattered all over the screen, the subjects are probably confused, and will probably not internalize the message you are trying to convey. If the subject's gaze is fixed on specific parts of the screen, many researchers will conclude that those fixations are what the subject attended to the most, because that is where there gaze was held the longest (Hernandez, 2010).

Eye-tracking is used in neuromarketing studies to determine whether or not users are looking at the screen, the difference between actually reading a page as opposed to just scanning it, and the relative intensity of a user's attention to specific parts of the screen (Schroeder, 1998). With eye-tracking, it is easy to tell if your product, message, brand name, etc. was ignored by the subject or not. Eye-tracking is most commonly used to determine the effectiveness of different internet marketing techniques, such as paid search and banner ads. *Figure 10* shows a composite average of how people tend to scan a web page (Outing, 2006). Offline, advertisers use the technology to determine which parts of a television advertisement or print ad are most often attended to, and which are ignored. *Figure 11* displays some of the effective uses of eye-tracking to test print ads for the hair-care brand Sunsilk. When the model looked at the subject, they mainly attended to her face, and gave almost no recognition to the brand name at the bottom of the page, or to the product being advertised. As a result, Sunsilk created a new print ad, which simply switched the model's gaze from the subject to the product. The eye-tracking results showed a huge improvement from the previous print ad. By having the model lead the subject's gaze to the product, people now attended to the product and brand name.

There is some debate as to whether or not eye-tracking can truly be classified as a neuroimaging technique when it doesn't scan the actual brain, but I am including it here because of its widespread use in many neuromarketing studies.

GSR

GSR stands for galvanic skin response, which measures changes in skin conductivity, temperature, and sweat. Because of the responses it measures, a GSR is commonly known as a lie detector. While not as popular as the above applied neuroscience techniques, it is still a tool of measurement in some neuromarketing studies, and deserves recognition.

Usually measured from the palms or fingertips, the GSR tracks changes in the sympathetic nervous system, which usually indicates emotional arousal (Fuller, 2002). In a typical GSR experiment, the subject will place a finger in the GSR amplifier (see *Figure 12*), which applies a constant voltage to the skin through small electrodes in the device (Andre, 2004). The voltage in the amplifier is so small that the subject cannot feel it. Because human skin is a good conductor, applying a weak electrical current to it makes changes in the skin's conduction easy to measure (Andre, 2004). As humans become aroused, they sweat, decreasing their skin resistance. Electricity can more easily pass through wet skin than dry skin.

Two main types of skin conductance are measured through GSR. The first is tonic skin conductance (TSC), which is the baseline level of skin conductance for the subject (Andre, 2004). The subject is said to have TSC when there is an absence of provoking stimuli. The subject's TSC is used as a control for the level to which they become aroused in the presence of an experimental stimulus. Phasic skin conductance is the level of skin conductance when the subject becomes aroused. Environmental stimuli such as sights, sounds, and smells will evoke changes

in a subject's skin conductance (Andre, 2004). Changes in skin conductance due to arousal typically last for 10-20 seconds, and then return to baseline.

The factors that researchers look at when analyzing GSR output are the size of the change in skin resistance (amplitude), latency of the change in skin resistance (length of time the change lasts for), and what stimuli could have caused the change. While the GSR can detect changes in - or the presence - of emotions in the subject, it cannot identify what emotion is being felt. Fear, surprise, joy, and sexual arousal are all types of emotional responses that can be measured through the use of a GSR amplifier. Neuromarketers normally use GSR concurrently with eye-tracking. Eye-tracking can show researchers what parts of the advertisement the subjects are looking at, and GSR can tell them what parts the subjects are reacting to.

When looking at the results from the GSR amplifier, it is important to note that the lower the value recorded, the lower the skin resistance to electricity. Lower values on the graph indicate higher levels of arousal. *Figure 13* shows the GSR of a subject playing a video game while hooked up to an amplifier (Andre, 2004). As the subject progresses through the game, he becomes more stressed, and the amplifier records increasingly lower values of skin resistance. The point where the subject's character is killed is the point of lowest resistance.

Current Uses

One of the barriers market researchers find between themselves and their target market is the unreliability of self reported data. Self-report measures - such as surveys and focus groups - produce notoriously inaccurate data (Dewey, 2007) when it comes to how subjects will act in reality, versus the hypothetical situations presented in self-report measures. Around $117 billion dollars is spent on advertising each year in the US, with $6.8 billion being spent on "focus groups, opinion polling, and ad tracking" alone (Wells, 2003). Neuromarketing emerged as a

result of companies and other institutions wanting to find a more accurate measure per dollar of consumer preferences than asking their customers for their opinions themselves. By looking at studies done in academic, industry, and government settings, we can see how neuromarketing acts as a solution to current problems in market research.

Academia

Many private companies and governments petition different academic institutions to conduct neuromarketing research for them, but some universities will carry out studies based on their own research interests. While neuromarketing seems like an inherently business-related field, it has a growing presence in academic institutions as well. Before examining how people respond to products, it is important to know the role of different parts of the brain. What good would a neuromarketing study that showed the VMF lighting up be if one didn't know what role the VMF played in the brain? Without the neuroscientific research of universities, neuromarketing could not be a practical choice for market researchers.

One of the most famous neuromarketing studies to date came out of the Baylor University College of Medicine in 2004, about six months after they hosted the first neuromarketing conference in the world. The researchers were interested in the question of how advertising shapes consumer perceptions to the point of modifying their behavioral preferences (McClure et. al., 2004). In their experiment, they examined the famous Pepsi taste-test challenge using two different conditions. The first condition had the subjects drink an unlabeled glass of Coke and Pepsi while in an fMRI, and asked them to identify which drink they preferred. The anonymous taste test found that there was an even split between those who preferred Coke and those who preferred Pepsi when they didn't know which soda they were drinking. In both instances, the ventral putamen – one of the brain's reward centers – "lit up", but the response

was five times stronger when the subjects drank Pepsi than Coke. The impact of advertising could be seen when the subjects were in the fMRI and knew which brand they were drinking. The same people who had been split on Pepsi versus Coke now showed a 75% preference to Coke than Pepsi. Not only did their spoken preferences change once they knew which drink they had, but their brain activity changed. When subjects drank Coke, their medial prefrontal cortex (MPFC) – the part of the rain that controls higher-level thinking – was activated (see *Figure 14*). The researchers concluded that when the subjects knew which brand they were drinking, their brain recalled images and ideas from commercials, and the power of the brand was overriding the actual quality of the product.

Consumers not only do poorly when self-reporting their own preferences, but they can be inaccurate predictors of their own behavior changes as well. A study done at the University of California, Los Angeles (Falk et. al., 2010) demonstrated that neural responses to persuasive messages could predict a subject's behavior change better than the subject could. First, subjects indicated their sunscreen use over the past week, their intentions to use sunscreen during the following week, and their attitudes towards sunscreen in general. Next, the participants were placed in an fMRI, and listened to and viewed a public service announcement about the importance of wearing sunscreen. After exiting the scanner, subjects completed the same questionnaire as before, again indicating their attitudes towards sunscreen and their intentions to use it in the next week. Upon leaving, they each received a free bottle of sunscreen, so that they would have easy access to it without having to purchase it themselves. One week later, the participants received an email, and reported the number of days they used sunscreen in the week following their fMRI scan. Based on the level of blood flow to the subjects' medial prefrontal cortex (MPFC), the researchers could accurately predict the subjects who were more influenced

by the public service announcement than the subjects could themselves. The researchers were able to predict an increase in sunscreen use with about 75% accuracy, compared to less than 50% for the subjects' own predictions about their future behavior (Falk et. al., 2010). People are used to being exposed to persuasive messages in their daily lives, with an obvious example being advertisements. This study shows again that self-reported behavior is not always accurate, and also creates a good argument for the use of neuroimaging in market research. If the researchers can predict consumer behavior with fMRI better than the consumer, neuroimaging seems to be an ideal and accurate way to measure potential success of an advertisement.

It is no surprise that successful advertisements often use attractive celebrities or models to sell their products. Neuroimaging studies in academia are beginning to answer exactly why sex sells. A study led by Itzhak Aharon (Aharon et. al., 2001) was the first to identify the brain's response to attractive males and females. The study was completed in two different trials. In the first trial, the subjects (all heterosexual males) were situated in an fMRI. They viewed 80 images, 40 of males and 40 of females, and were asked to rate the attractiveness of them from a scale of 1 (very unattractive) to 7 (very attractive). The ratings given to unattractive versus attractive faces were statistically significant, with a large gap between those the subjects found appealing and those they did not. Interestingly, there was no statistical significance in the difference between the attractive male and attractive female faces that were presented to the subjects. In the second trial, the subjects, still in the fMRI, were shown the same 80 images randomly, but this time they had the option of pressing one key to keep the image present longer, or pressing a different key to remove the image and be presented with the next one. In this task, there was again statistical significance between the beautiful and non-beautiful images, with the subjects pressing the key to keep the image much more often for beautiful faces, and subjects pressing the key to remove

the image much more often for unattractive faces. In this trial, there was statistical significance between the genders, with female faces key-pressed to remain in-sight for a longer period of time, and male faces almost never kept. The results from the neuroimaging studies showed that the brain's reward pathway was integral to our motivated behavior. The two tasks revealed dissociation between aesthetic assessments and reward. In the first task, the subjects rated some of the male images as "attractive", but did not exert the effort to key-press in order to increase their viewing time. However, the same female images the subjects rated as "attractive" in the first task were key-pressed for in the second. The fMRI images showed increased activity in the nucleus accumbens (NA) – an integral part of our reward pathway – when the subjects passively viewed and key-pressed for the female faces. The NA did not light up for either sex during the first "rating" task, and did not light up for any male images in the "key-press" task. These results suggest that the necessary stimuli to activate our reward pathway do not include aesthetic assessment (Aharon et. al., 2001). Male consumers not only enjoy seeing attractive women in an advertisement, the act of viewing them actually lights up their reward pathway.

A concept similar to neuromarketing that is studied primarily in academic institutions is neuroeconomics. Neuroeconomics looks at the biological model of decision-making in economic environments (Neuroeconomics, 2002). Neuroeconomics differs from neuromarketing in that it examines human buying behavior in any economic environment, not just one with advertising. Many neuromarketers want to know how their customers behave in everyday economic situations to see if they act differently when exposed to their marketing techniques.

One such study that examined neuroeconomics was done as a joint effort between McGill University and the University of Pennsylvania in 2011 (Camille et. al., 2011). Previous neuroimaging studies had shown that the ventromedial frontal lobe (VMF) was active while

subjects decided the value of different options during choice tasks. While the VMF (see *Figure 15*) is known to be integral in our perceptions of risk and fear, its role in decision-making behavior was not conclusive. While previous studies showed it was *active* in those choice tasks, it was not known whether or not a well-functioning VMF was *necessary* to make value-maximizing choices. To conclude the relationship between the VMF and decision-making, the researchers used subjects with damage to their VMF (see *Figure 16*) compared with those without VMF damage to see if there were any differences in their choice behaviors. The subjects were asked to choose a type of candy bar they liked, as well as a type of drink they liked. They were then presented with different "bundles" – combinations of candy bars and drink – to choose from, with each participant being shown a total of 11 different bundles. An example of a bundle is: 1 bar of chocolate and 6 boxes of juice. They were then given a hypothetical income, and the items in the bundles were all given prices. The results showed that participants with VMF damage tended to make more irrational purchasing decisions than their counterparts (based on their "incomes" and the prices of the bundles). The researchers concluded that the VMF plays a critical role in economic decision-making.

Market researchers are well aware that price plays an integral role in the buying behavior of their customers. In fact, an introductory microeconomics class will tell you that purchases are driven by two factors: consumer preference and price. Researchers from Stanford University, Carnegie Mellon University, and MIT (Knutson et. al., 2007) wanted to use neuroimaging to find out consumer's reactions when faced with different purchasing decision scenarios. The results showed the powerful effect that brand and price can play on the brain. When shown favorable products and/or brand names while in an fMRI, subjects' nucleus accumbens (NA) lit up. Remember, the NA is integral to the reward pathway, and is the same part that is activated when

taking a drug or having sex. Talk about brand loyalty! The study also found an interesting brain reaction when it came to the subjects viewing a price as being "unfair" or "excessive". In this scenario, the subjects were placed in an fMRI, and it was seen that their insulas became activated. Previous studies show that the anticipation of physical pain, as well as negative arousal, activates the insula. Unfair prices literally cause the brain to have a pain reaction. With these results in mind, market researchers must be more vigilant than ever to make sure their pricing matches their customer preference.

As we have seen, understanding the role of emotion in purchasing decisions is critical in helping businesses choose effective marketing campaigns. An experiment was done by Columbia University, The University of California at San Diego, and Duke University to examine the role of emotion in product preference (Lee, L. et. al., 2009). The researchers set up a series of 4 experiments to test their hypothesis that more emotional engagement from the consumer would lead them to be more likely to purchase the product. In the first experiment, subjects were only given the names of objects that could be purchased. All of the objects were small technological devices, such as a "voice recording pen" or "super bright LED clip light" (see *Figure 17*). The subjects in trial 2 were given the names of the devices, as well as a black and white picture of them. The third group was shown the name of the devices and a color photo of them. Finally, the fourth group was given the history of the company, as well as a color photo and the name. At the end of the experiment, the subjects had the option of entering into a raffle to win some of the devices. Those who had been in the fourth trial were much more likely to submit their name for the lottery than those in the first trial. The results showed that products that elicited a stronger emotional response from the subject were more likely to be preferred over those that did not

elicit an emotional response. Market researchers should take from this study the knowledge that products that emotionally engage their customers are more likely to be purchased.

While emotion is important to consider in marketing, you must also think about what triggers the emotional reaction in your consumer. One of the five senses – sight, sound, taste, touch, and smell – is usually responsible for eliciting an emotional reaction in the customer. Sight and sound usually get a lot of attention when it comes to marketing techniques, but an emerging branch of marketing is focusing on smell to get consumer attention. Olfactory marketing deals with producing a unique smell for your brand that the customer can remember. Some businesses are already using olfactory marketing to increase sales. The Hard Rock Hotel at Universal Resort in Florida used a sugar cookie scent to lead guests to an ice cream shop, increasing sales that night by 30% (Hill, 2010). Slot machine players in Las Vegas wagered 45% more in a scented room than players in an unscented room (Hirsch, 1995). 84% of subjects were more likely to buy a pair of Nike shoes in a scented room than an unscented room, with the majority of them indicating they would pay $10 more for the product than those in an unscented room (Hirsch, 1991). While studies on scent and attention have been conducted for decades, it is only recently that universities are looking at how scent relates to marketing.

A study done in 2003 by Rutgers University and the University of Connecticut (Morrin, 2003) wanted to examine if scents enhanced consumer memory for different brands. The experiment was conducted in two stages. In the first stage, subjects were asked to evaluate familiar and unfamiliar brands (see *Figure 18*) while viewing pictures of the products on a computer screen. Some subjects were in a scented room, while others were not. In the second stage, the same participants were brought back into the lab 24 hours later, and were asked to name what brands they saw the day before. The presence of a scent in the viewing room

improved both brand recall and recognition of familiar and unfamiliar brands by up to 80%. While they did not test the likelihood of the subjects to purchase the products, brand recall and brand recognition are states that marketers strive for, and their importance should not be ignored.

Government

Neuromarketing isn't just for academia or business, as a person is just as much a brand as a product. Politicians especially are considered brands to those who are in charge of their public relations team. A large part of politics is being able to "sell" your ideas and image to the public. Political neuromarketing came to light during the 2008 presidential election. Because many candidates using the technique don't want their voters to know about it, a lot of the research is unpublished. However, there are a few studies – both in the United States and abroad – that demonstrate the use different government agencies put to neuromarketing.

One of the first neuromarketing studies to come to light in the 2008 election was during the primaries in 2007 (Iacoboni et. al., 2007). The researchers used fMRI to examine the brains of swing voters as they responded to the presidential candidates. The study did not have a specific hypothesis in mind, but was instead carried out to see how swing voters reacted to different candidates. While watching some of Hillary Clinton's speeches, participants who had indicated that they had an unfavorable opinion of her showed very interesting brain activity. In almost all cases, the participants who stated that they did not like Clinton had their anterior cingulate cortex – a part of the brain that processes conflicting impulses – activate during her speeches (see *Figure 19*). Subjects who rated her more favorably in the beginning showed no activity in this region. This phenomenon, which was not found to occur for any other candidate, suggests that voters who believe they dislike Hillary battle impulses to like her when they hear her speak. Perhaps unsurprisingly, women showed much more engagement with Clinton than

men (see *Figure 20*). What I found to be the most surprising finding was that in late 2007 (when the study was published), swing voters did not have any emotional reactions to the party frontrunners – Obama and McCain (see *Figure 21*), even if they had indicated a strong preference for either candidate in the pre-study questionnaire. When viewing photos and speeches of the two candidates, none of the participants experienced a large amount of thought or feeling. The results, if they had been known by the candidates, could have helped them better understand how to reach out to swing voters early on in the election.

In early 2008, Sands Research – a neuromarketing firm – conducted a study to find which of the democratic frontrunners – Obama or Clinton – developed more engaging video advertisements (Young, 2008). The study included 25 democratic participants, all under the age of 30, who indicated that they were split on which democratic candidate to vote for in the primaries. The participants were asked to view four different videos of the candidates while wearing EEG caps. Two videos were YouTube videos (one for Obama, one for Clinton), and two videos were TV commercials (one for Obama, one for Clinton). The results of the study showed that both YouTube videos had higher brain responses and recall 24 hours and one week later than the standard 30 second TV commercials. While Obama's video was slightly more engaging, Clinton's came in at a close second. The results showed the importance of having an online presence during the election, as opposed to just having television commercials.

A study sponsored by the National Security Network, a non-profit foreign policy advocacy group, wanted to examine the effectiveness of attack ads during the 2008 presidential election (Lucid, 2009). During the fall of 2008, 30 participants (ranging in their political leanings) first performed an image identification task. In this task, the participants viewed pictures of Obama, McCain, and other men who looked similar to the two candidates. The researchers used

EEG to measure how the participants were reacting to each image. Half of the participants then watched hope-oriented, pro-Obama ads created by the Obama campaign, and fear-oriented, anti-Obama ads created by the McCain campaign. The other half of the participants watched hope-oriented, pro-McCain ads created by the McCain campaign, and fear-oriented, anti-McCain ads created by the Obama campaign. After watching the ads, the participants performed the same image identification task as before. The results showed that the participants who viewed both the positive and negative ads about Obama were more favorable towards him than before they had watched the videos, even if Obama was not their preferred candidate. The same results occurred for McCain, with the participants who viewed both the positive and negative ads about him being more favorable towards him than before they had watched the videos, even if McCain was not their preferred candidate. Interestingly, the participants became more negatively oriented towards the candidate who delivered the fear-oriented ads, even if that candidate was their preferred choice. These results showed that fear-oriented advertisements were counterproductive for both candidates. The ads hurt the candidate delivering the message, and actually made the participant more favorable towards the candidate being attacked.

Politicians are increasingly using the subset of neuromarketing called olfactory marketing to increase their campaigns. This phenomenon was first seen in the United States in the mid-2000s, but has since spread around the world.

Carl Paladino, a Republican candidate for governor of New York in 2010, decided to use olfactory marketing in his gubernatorial campaign. According to the New York Times (Chen, 2010), Paladino sent out a brochure to voters in Albany with the heading “The STINK of Corruption in Albany is Overpowering”. Not only did the mailer depict unfavorable images of “tarnished Democrats”, including his competitor, but the paper was intentionally made to smell

like rotting vegetables. The direct mail card concluded his message with the phrase: "Help Carl Paladino turn Albany upside down and take out the trash!" Perhaps if Paladino had studied neuromarketing, he would have chosen a different scent to make his point. As we have seen in the previous studies, fear-ads create an unfavorable feeling towards the attacker, not the attackee (Lucid, 2009); and scents can help increase brand recall by up to 80% (Morrin, 2003). As the attacker, Paladino may already receive negative attention as a result of the mailer, but by adding a foul-smelling odor to the mix, voters may now come to associate the smell of garbage with Paladino, not his opponents. Paladino ended up losing the gubernatorial race to his democratic opponent.

Lee Myung-bak, a presidential candidate in South Korea and former CEO of Hyundai, employed olfactory marketing in his campaign with great success. According to his team of supporters, Lee Myung-bak had volunteers secretly spray a scent he commissioned, called "Great Korea", at all of his rallies (Thatcher, 2007). "It will remind people of the identity of Lee Myung-bak. The concept of the perfume is hope, victory, and passion," said one of his volunteers. In addition to spraying the scent at his rallies, a team of volunteers went to all of the voting booths on Election Day to spray the perfume inside, with the hope that voters would recognize the smell as "his scent" when casting their vote. While the impact of this strategy on his campaign wasn't objectively measured, it is worth noting that Myung-bak's popularity rating was 30 points higher than his closest rival, and he won the election in a landslide with 48.7% of the vote (BBC News, 2007).

Industry

While neuromarketing is not absent from academia or political atmospheres, it is most commonly seen and used in industry. Neuromarketing is not only used to create new campaigns,

but to evaluate the effectiveness of existing ones as well. The danger with using neuromarketing in industry, however, is that most studies aren't peer-reviewed, and findings are published in press releases rather than journals.

In 2006, a report was released by the Radiological Society of North America (Morley, 2006) that illustrated, through fMRI scans, that known brands activated the nucleus accumbens in the reward pathway, while unknown brands elicited little engagement with the observer. Purchasing behavior was highly correlated with the positive emotions elicited by the known brand image. As a result of this study, well known brands such as Wal-Mart and Pepsi, updated their logos to try and create more positive, initial emotional reactions in their customers. Wal-Mart sponsored a neuromarketing study of their own, and discovered that their logo elicited feelings of "soullessness" in their customers (4imprint, 2010). As a result, the brand redesigned their logo (See *Figure 22*) in 2006 to include lower-case font, a lighter text color, and a yellow star to "help convey the new tagline of 'Save money. Live better'" (Belk, 2009). Pepsi unveiled their new logo in 2008 to much criticism. Many speculated that the new design (see *Figure 23*) came from Barack Obama's campaign logo. While Pepsi countered with a 27-page document of their neuromarketing research, many marketers today feel that Pepsi was trying to associate their new logo with the feelings of "hope" and "change" associated with Obama's campaign.

Logos aren't the only changes companies can make due to the results of neuroimaging studies. Some studies utilize neuroimaging when they want to change their packaging. Executives at Frito-Lay conducted a neuromarketing study to test the effectiveness of their potato chip packaging in the United States and abroad. They discovered that when viewing a bag of Lays potato chips, the participants in the fMRI (especially women) produced a great deal of activity in their anterior cingulate cortex, the area of the brain associated with guilty feelings

(Burkitt, 2009). When they changed the bags from shiny to matte, the activity lessened, and when they replaced the image of chips on the bag with pictures of the "healthy" ingredients (see *Figure 24*), the activity was almost completely erased. As a result of this study, Frito-Lay changed their packaging in February of 2009. Following the study and their packaging change, Frito-Lay reported an 8% revenue growth and 7% profit growth (4imprint, 2010) the following year.

Campbell's soup also employed neuromarketing to test the effectiveness of their packaging and soup labels (4imprint, 2010). Using GSR, EEG, eye-tracking, and fMRI, Campbell's tested 40 participants, both in stores and in the lab, to see how they thought about the soup. The results of the study gave the researchers many different conclusions. For one, they discovered that the Campbell's logo elicited positive emotions in almost all of the participants, indicating that consumers held positive feelings towards the brand. However, eye-tracking showed that the logo on the can was too large, and made it difficult for the participant to locate the actual flavor of the soup, possibly leading to lost sales. Previous focus groups had indicated that the spoon on the can elicited the strongest emotional responses from them, but this neuroimaging study showed that it was actually the bowl people felt positively towards. By adding steam to the bowl, they were able to engage their consumers' attentions more, and elicit stronger emotional feedback. Their new label (see *Figure 25*) was a direct result of this neuromarketing study. As of 2010, Campbell's has issued a statement that the redesign has been successful, but they have not released any data to support this claim.

Neuromarketing is especially important when testing the effectiveness of certain internet marketing techniques. When Google acquired YouTube in 2006, they created InVideo ads, banner-like ads displayed in the video that were meant to be non-intrusive to the consumer.

Google believed these ads served a different function than normal banner ads, and therefore required a new method of evaluation other than click-through rate. Due to their unobtrusive nature, Google worried that respondents wouldn't notice the ads, and they didn't want to continue pouring money into a form of advertisement that wasn't working. In 2008, they hired the neuromarketing firm NeuroFocus to test the effectiveness of the ads in generating attention and emotional engagement with the consumer (Shields, 2008). The massive study used EEG, eye-tracking, and GSR to test both how users were responding to the InVideo ads, as well as how well the ads complemented traditional banner ads. The results showed that the InVideo ads alone scored above average (6.6) for internet advertisements on a scale of 1-10, with attention gaining a measure of 8.5, emotional engagement gaining a measure of 7.3, and effectiveness gaining the average measure of 6.6. When users were presented with both banner and InVideo ads, their scores increased, seemingly proving that the two forms of advertisements complemented each other.

Some companies do neuromarketing research simply to show the effectiveness of their research methods, as opposed to being hired to do research by another company. Since 2008, Sands Research has conducted a Super Bowl Research Project (Sands, 2011) to test the level of engagement each Super Bowl commercial received from the audience. Using EEG technology, Sands analyzes which commercials are the "winners" each year, and which need to work on involving their audience's attention. Each commercial is given a "Neuro Engagement Score" (NES), which shows the ranking of the ad on a scale of 1-7. The NES is comprised of seven different metrics: emotional valence, cognition, attention, visual activity, motor activity, memory, and recognition. Along with publishing the NES of each commercial, Sands Research makes available on their website the movies detailing the neuroimaging responses for the top and

bottom most advertisements (Sands, 2011). In 2011, the ad that produced the most neurophysiological responses in the audience was a 62 second Volkswagen commercial with a child dressed up as Darth Vader called "The Force" (see *Figure 26*). You can view the real-time neuroimaging study on Sand's website, here.

An industry that is increasingly utilizing the techniques of neuromarketing is the auto industry. Chrysler began using fMRI technology in the early 2000s to study the brains of drivers as they interacted with their cars (Wells, 2003). The company first used neuroimaging to improve the vehicles' navigational and warning devices, using eye-tracking to discern where in the car drivers would most likely look for such devices. Chrysler was also the company that discovered consumers were more likely to purchase a car whose front resembled a human face (Wells, 2003). To test the potential success of different car designs, Chrysler employed a study to 12 men with an average age of 31. The men were shown pictures of 66 different cars (22 sports cars, 22 sedans, and 22 small cars). While the subjects were in the fMRI, neuroscientists noticed that looking at some cars caused the participant's fusiform gyrus – the part of the brain that responds to human faces – to become activated. The same designs that were highly rated by the participants were the same ones that more strongly activated their fusiform gyrus. In the same study, Chrysler noticed that sports cars activated the nucleus accumbens (as a reminder, the NA is the part of the brain associated with reward and reinforcement) to a much higher degree than any other models. "Sports cars tend to be associated with wealth and social dominance" (Wells, 2003), which leaves little question as to why the sight of them can be so rewarding. When the study was conducted in 2003, the sports cars that generated the strongest brain responses were the Ferrari 360 Modena, the BMW Z8, and the 2004 Mercedes SLR (Wells, 2003).

One of the most surprising neuromarketing studies in industry, and one that shows the problem of relying solely on personal testimony, is related to cigarette warning labels. Martin Lindstrom, author of the neuromarketing-centered book Buyology, conducted a study to test the effectiveness of warning labels placed on cigarette packages (Miley, 2008). The United States was the first country to require a health warning on cigarettes, with a Surgeon General's warning in place since 1985 (Wilson, 2011). When Lindstrom and researchers showed the subjects (all smokers) a warning label, they asked them if the warning labels deterred them from smoking as often as they would like to. Almost all of the subjects said that the labels made smoking aversive. However, when shown the label in an fMRI, all of the subjects' nucleus accumbens became activated, indicating that they were now craving cigarettes. The warning labels were extremely ineffective, and actually made the smokers want to smoke more, not less, as they had consciously indicated. As a result of this survey, and a few others like it, graphic warning labels will be placed on cigarette packages starting in 2012, in the hopes of deterring more people from smoking than a simple warning text did (Wilson, 2011). The images, chosen by the Department of Health and Human Services, will cover the top half of every cigarette box (see *Figure 27*). It can be argued that without the neuromarketing studies, it would not have been possible to know that the labels were triggering smoking, rather than curbing it, and no action may have been taken to revise the look of the warning labels.

Moral Debates

The act of using primarily medical-industry technology for market research purposes has obviously triggered a debate regarding the ethics of the practice of neuromarketing. "The introduction of neuroimaging into an environment in which the ultimate goal is to sell more products to the consumer may raise ethical issues" (Ariely, 2010). On the one hand, some in

favor of neuromarketing argue that the practice benefits the consumer, because the research shows what the consumers really want and/or need, as opposed to what they think they want/need. On the other hand, some think that looking inside of someone's head is a breach of their privacy rights, and that neuromarketing will be used to brainwash consumers by appealing to their subconscious desires.

Arguments Against Neuromarketing

One of the most well-known oppositions to marketing in general is that companies are only concerned with making money, and have no concern for the best interest of their customers (Ariely, 2010). The same concerns are expressed by those who oppose neuromarketing, but their concerns seem much greater. Companies and consumers have always held a complex relationship with each other; while some of their goals are attuned, others are very much in conflict with each other. On the one hand, companies need to sell products that consumers want to buy. This aspect of business usually results in benefits for both parties. However, some businesses focus solely on maximizing profit, either short or long-term, sometimes to the disadvantage of their customers. As with any type of marketing, knowing your customer's preferences can be used to their benefit or detriment. When looking at neuromarketing in this light, it is important to look at what the goals of the companies are, and to make sure they are held to the same accountability as their non-neuroscientific counterparts.

A common belief among those who oppose neuromarketing is that companies will be able to use the neuroimaging technologies to "read consumers' minds" (Ariely, 2010). They worry that marketers are trying to get inside the consumer's head by actually getting inside of it. This concern deals with the privacy of the consumer's thoughts, and the rights consumers have to protect that privacy. For example, what would happen if the neuroimaging revealed a private

preference the subject did not want to expose? While all subjects have willfully volunteered, researchers must be careful to make very clear to the subjects what kind of research question is being asked, and what exactly is being asked of them as participants.

Along the same lines as "mind reading", some opponents of neuromarketing see the technique as a type of "neural manipulation" of the consumer (Wilson et. al., 2008). Many opponents express concern that they are being manipulated without their "awareness, consent, and/or understanding" (Wilson et. al., 2008). Similar to "neural manipulation", some dissenters believe that neuromarketing is a new form of subliminal advertising, and it will be used to unfairly persuade consumers (Karlinsky, 2011).

Their argument is that using neuroimaging in market research leads to the potential for marketing to threaten free will by negating the consumer's ability to follow their own preferences. Some consumer advocates go so far as to refer to neuromarketing as "brandwashing" (Singer, 2010).

A huge problem emerging in the neuromarketing community is the fact that there are no current industry standards (The Neurocritic, 2011). As mentioned previously, neuromarketers do not have to publish their findings in peer-reviewed journals, but can instead merely issue a press release. More often than not, this lack of regulation leads to faulty science and inaccurate data interpretation. For example, a study was previously mentioned (Knutson et. al., 2007) where an active insula was concluded to indicate that subjects felt pain and negativity towards unfair prices. However, peer-reviewed research published in *Nature* this year (Yarkoni et. al., 2011) found that the insula was "one of the most highly activated parts of the brain, showing activation in nearly 33% of all imaging studies". The study found that the insula was activated for such behaviors as executing speech, feeling physical pain, cognition, memory, reasoning, and feeling

emotion (see *Figure 28*). Because the results were not subject to regulation, erroneous conclusions were drawn from the fMRI scans.

In addition to drawing inaccurate conclusions based on neuroimaging studies, neuromarketers indicate that because their studies are not typically viewed as "experimentation", they have not had to contact the institutional review board (IRB) for permission or regulation (Ariely, 2010). Most researchers in any field have to contact the IRB for any study they want to conduct, without question. The IRB is responsible for evaluating a study before it occurs to make sure the paradigm the researchers are operating under makes sense, and that there are no ethical concerns in the experiment. In addition, MRI scans have to be approved by the US Food and Drug Administration (FDA) for clinical use. Because neuromarketing research is not being done for clinical or medical reasons, these researchers are able to circumvent the FDA as well.

Without scientific or ethical regulations in place, there are very real concerns as to the direction neuromarketing could take. Institutions across the United States are taking up arms against the industry, citing many of the above examples as reasons neuromarketing should be subject to regulation or termination.

Commercial Alert – an organization that defends consumers against commercialism, advertising, and marketing – was one of the first organizations to ask Congress to investigate neuromarketing (Ruskin, 2004). Executive Director Gary Ruskin sent a letter to Senator John McCain, chairman of the Senate Commerce Committee, in 2004. The question they asked in the letter was: "In a democracy such as ours, should anyone have such power to manipulate the behavior of the rest of us?" (Ruskin, 2004). The letter also expressed three major concerns Commercial Alert found with neuromarketing: 1. Harmful companies, such as the tobacco industry, using neuromarketing to better sell their products, 2. Neuromarketing could lead to

more effective political propaganda, and 3. Neuromarketing could lead to more effective promotion of degraded values, such as materialism, addiction, and violence (Ruskin, 2004). The letter concluded with a request for neuromarketing to be included as an unfair or deceptive act or practice under the Federal Trade Commission Act.

The Federal Trade Commission (FTC), which deals with consumer protection and competition jurisdiction in the United States, has pursued legal action against a variety of firms using neuromarketing for online health and pharmaceutical information (Levine, 2011). The FTC argued that companies such as Google, WebMD, and Microsoft were using neuromarketing to "drive interest in prescriptions, over-the-counter drugs, and health remedies, and to influence their subconscious perceptions" (FTC, 2010). While no implications seem to have befallen the companies in question, the FTC raised awareness to the public of the possible dangers of unchecked neuromarketing research.

The Center for Digital Democracy (CDD), which works to "protect digital privacy, promote consumer rights, and ensure corporate accountability" (Singer, 2010), has taken up arms against neuromarketing. Jeff Chester, executive director of the CDD, believes that neuromarketing is designed to bypass the defense mechanisms that help consumers distinguish between the truth and lies in advertising. In a statement to Congress, Chester said the following:

> "We believe it's time for the Federal Trade Commission (FTC), Congress, and the European Union (EU) to enact safeguards to govern the use of neuromarketing. When combined with personalized data profiling, tracking and targeting – along with sophisticated methods to create and deliver digital ads to a user – neuromarketing requires attention from policymakers" (CDD, 2011).

While traditionally focusing on digital marketing, the CDD is now turning to face neuromarketing, as the practice becomes more widespread as a tool for market research.

Arguments In Favor Of Neuromarketing

While the use of neuro-scientific methods is relatively new, the concept of using psychology in marketing and advertising is quite old. In the early twentieth century, Sigmund Freud's nephew, Edward Bernays, employed techniques that appealed to the public's subconscious desires in order to sell his products. Known as the "father of public relations" (Bernays, 1928), Bernays eliminated the social taboo of women smoking in public by positioning the act as a sign of women's liberation. In order to increase sales of bacon for a client, he surveyed physicians and passed on their recommendation that people eat heavy breakfasts to other physicians across the country. The result was that people now ate their eggs (previously eaten alone) with bacon, as we still do today. While some would argue that these results were unfavorable, they were by no means illegal, and much of modern-day market research is done for the same effect.

What we already know from traditional marketing is that people are remarkably bad at predicting their own behavior (Williams, 2010). Those in favor of neuromarketing claim it is just a different way of collecting consumer data, as marketers have done for decades. Because there are "inherent limitations of self-report methods, inaccurate reports, and interviewer bias" (Wyatt, 2009) present in traditional means of market research, neuromarketing is an attractive alternative. While self-reporting is subjective and often unreliable, many people see neuromarketing as the objective alternative.

Many people in favor of neuromarketing reject the notion that those against it feel that the research is just another form of brainwashing. "While there's no doubt it [neuromarketing] uses information obtained from the subconscious mind, neuromarketing is not about controlling the consumer so much as it is about controlling a message or, rather, developing one that is most effective" (4imprint, 2010). One of the main arguments in favor of neuromarketing is that it can

more accurately give consumers what they actually want, and provide them with the best products for them. Dan Ariely, a neuroeconomics professor at Duke University, expressed his view of neuromarketing with the following analogy: Doctors look inside the brain to see what "medicine" will most "benefit" the patient; neuromarketers look inside brain to see what "products" will most "benefit" the consumer (Ariely, 2010).

Rather than only focusing on finding the "buy button" in the brain, some argue that neuromarketing can greatly benefit consumers when it comes to advertising. Nick Lee, a marketing professor at Aston University in the UK, provides examples of how neuroimaging can contribute to better ethics in marketing, rather than hinder them. He believes that by exploring exactly what elements of an advertisement consumers attend to, companies will be able to reduce their reliance on the "blunt instruments of blanket coverage" advertising (Lee, N. et. al., 2007). Lee also believes that neuromarketing studies could lead to discoveries of what kind of advertisements trigger negative effects, such as overconsumption, in their consumers. Companies don't want their customers to consistently pay with credit what they can't consistently pay back, because then they will have to eventually stop making purchases altogether. It is more beneficial to build brand loyalty and equity with someone who maintains more appropriate levels of spending, because the theory is that they will be able to continue making purchases in the future. One of the characteristics of a target market is that they are able to (have the funds to, are the correct age to, have the authority to) make purchases. With neuromarketing, companies may be able to identify different locations or times when compulsive over-purchasers spend, and lessen or eliminate their advertising during this time (Lee, N. et. al., 2007).

One advantage of neuromarketing that researchers are citing is the amount information that can be gained per cost. While the technology isn't cheap, many leading neuromarketing

researchers claim that companies using neuroimaging to test a product only have to test a tenth of the people that they would have to survey in a traditional focus group (Kaufman, 2010). The firms who pioneered the use of neuromarketing had advertising budgets of $30-$100 million dollars, but now an increasing number of small businesses are using the technology. Dr. A. K. Pradeep CEO of the neuromarketing firm Neurofocus, expressed his belief that when a company has a smaller budget, every dollar should count, and neuromarketing makes it count (Kaufman, 2010).

The Future of Neuromarketing

While neuromarketing is still a relatively new technology, an increasing number of businesses are turning to it when traditional forms of market research aren't producing results. Based on its young history, speculations can be made as to where neuromarketing is and should be heading.

In order to become more legitimate, neuromarketing needs to establish some kind of checks and balance system for itself. The lack of peer reviews in the industry hurts not only the consumer, but the business as well, as faulty neuroimaging conclusions can lead to poor products and wasted money in advertising dollars.

In addition to creating regulations, neuromarketing should expand more into academia so those who go on to do neuromarketing in industry are better prepared to create effective methods of collecting research data and analyze the results. There are currently a handful of neuroeconomics and decision-making labs in the United States (CalTech, George Mason University, Duke, Stanford, NYU, and Berkeley), but there are no neuromarketing labs. Many neuromarketers agree that the field has firm roots in human decision-making (Lee, N. et. al.,

2007), but many of the neuroscientists working in marketing now come from alternate backgrounds.

The future of neuromarketing will most likely see a drop in the price of different neuro-scientific technologies, making it more affordable and accessible to small businesses. NeuroFocus is one of many neuro-engineering firms currently developing affordable EEG headsets for distribution. On March 21, 2011, NeuroFocus unveiled the first ever wireless EEG headset, Mynd (Robbins, 2011). While it was developed for use in market research, the European Tools for Brain-Computer Interaction consortium (TOBI) purchased the rights to use Mynd for medical research with patients with different neurological disorders. Further collaborations are going on to develop software that will make better sense of the data to those researchers who are not neuroscientists (Williams, 2010).

While there are no neuromarketing labs in academia, the practice has a clear presence in industry. Neuroimaging has the potential to help companies "create, refine, and test hypotheses about what makes effective marketing" (Page, 2006). If companies choose to use neuromarketing in the future, they should use it in tandem with subjective measures as well. While focus groups and surveys inherently contain bias, neuroimaging results can be unclear, and the best results will come from an array of sources. The most effective marketing campaigns utilize more than one means of collecting data. Evidence suggests that when executed with other traditional marketing tactics, neuromarketing is successful and the return on investment is high (Williams, 2010). A problem with just using neuromarketing to collect data is that – while good at measuring the effectiveness (or ineffectiveness) of existing campaigns – it is difficult to come up with a new campaign based solely on neuroimaging results (Kaufman, 2010).

Based on current studies, I believe an untapped branch of neuromarketing that should be explored is olfactory marketing. As the industry stands today, only 3% of Fortune 1000 firms have distinct scents for their brands (Hill, 2010), meaning the market is wide open for new entrants to gain an advantage. If one company has a unique scent tied to its product, and another does not, consumers are much more likely to remember the scented product, and perhaps even purchase it. An advantage to using olfactory marketing in the United States is the fact that scents can be trademarked, so competitors would not be able to use a similar scent if a company has gained an advantage in the marketplace. Some companies abroad are already using scent to improve sales, with sales nearly doubling in Finnish restaurants when a unique scent was placed nearby (Dooley, 2010). After only smelling something once, people can remember the scent and its corresponding memory with 65% accuracy one year later (Engen, 1991). The finding was contrasted with visual memory and recall, which returned 50% accuracy after only four months. Based on the current climate, I believe olfactory marketing is something more companies should explore sooner rather than later, to ensure a competitive advantage.

Future neuromarketing studies need to start taking cultural differences into consideration as well. Not everyone will look at an advertisement the same way. As advertising campaigns become more global, it is important for researchers to realize that different cultural groups may process the same image in very different ways. While large subject pools are a form of eliminating cultural differences, I believe that better understanding different cultures' reactions to a company's marketing strategy can help that enterprise more effectively segment their target market. Two studies led by the University of Alberta's Takahiko Masuda (Masuda et. al., 2008) demonstrated the difference between East Asian and North American subjects' in judging the emotions of others. In the first study, subjects viewed different cartoons (see *Figure 29*), and

were asked to identify the emotion of the central figure. In all of the cartoons, the central figure was surrounded by other people who were expressing either the same emotion as the central person, or a different one. The results of this first session showed that the surrounding people's emotions influenced Japanese, but not Westerners', perceptions of the emotion of the central person (Masuda et. al., 2008). In the second study, the subjects were asked to complete the same task, but were wearing an eye-tracking headset. The same results occurred, but this time the researchers could conclusively attribute the reason for the discrepancy in the subjects to their attention (or lack thereof) to the background characters. Japanese subjects attended to the surrounding people more often than Westerners. The researchers concluded that Japanese judge people's emotions based on the social context of the person in question, while Westerners judge people's emotions from their facial expressions. This could have a huge impact on advertising if an enterprise didn't pay attention to the facial expressions of any characters in the background, as it could potentially confuse members of their target market. If neuromarketing is going to be effective in the future, more studies need to be done that distinguish subjects based on the culture in which they live.

Conclusions

While neuromarketing is slowly emerging out of its infancy, it still has quite a way to go before it is a common practice among market researchers. From its history in academia to its current uses in industry, neuromarketing came onto the scene in response to researchers' frustrations with conclusions drawn from self-reported data. While neuroimaging has its own set of problems for data interpreters, when multiple data collection tools are used, the results benefit both the company and the consumer. Consumers are given a product that better suits their needs – such as an easier-to-read soup can label – and executives see an increase in profit. Current

ethical debates raise the issues of the lack of accountability and potential privacy rights violations with the use of neuromarketing, which I'm sure will evolve into more publicized debates once/if the practice becomes more mainstream. The future of neuromarketing is unclear, with cheaper technology currently acting as a barrier to more entrants. However, new innovations in technology, and untapped marketing techniques, leave plenty of room for neuromarketing to evolve.

Appendix

Figure 1

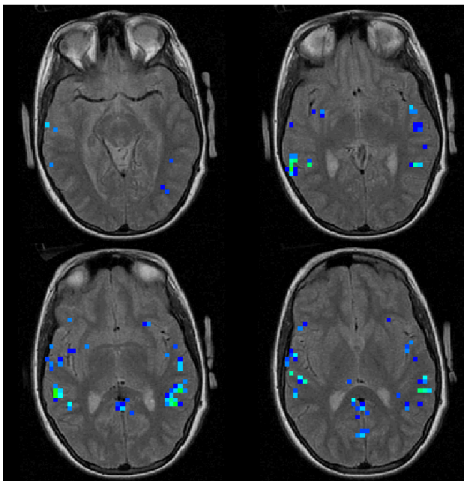


Figure 2

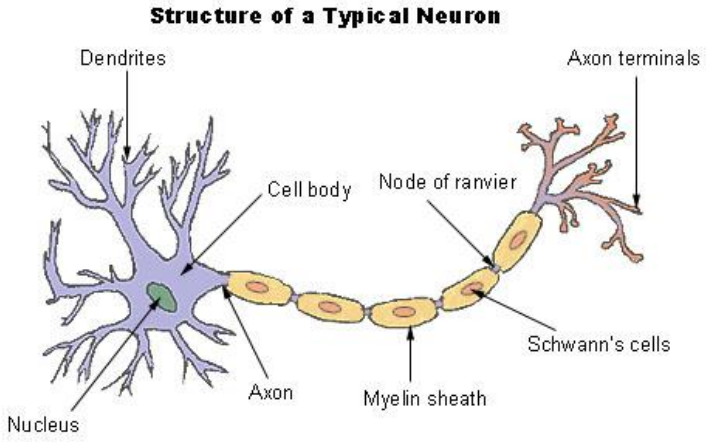


Figure 3

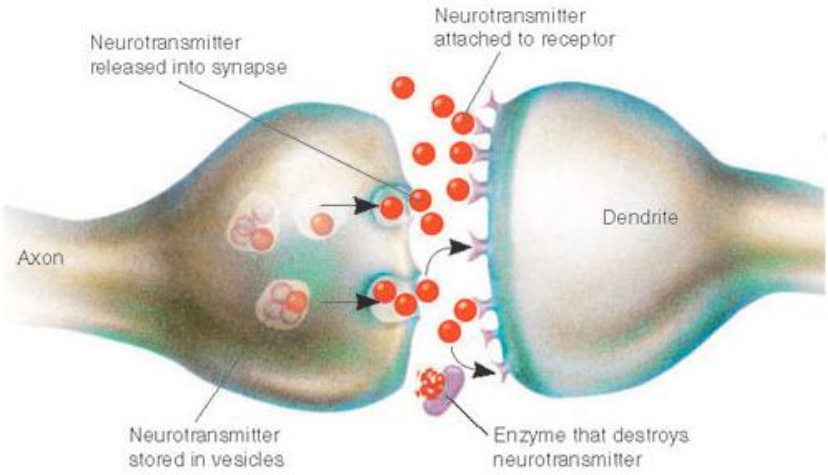


Figure 4

Figure 5

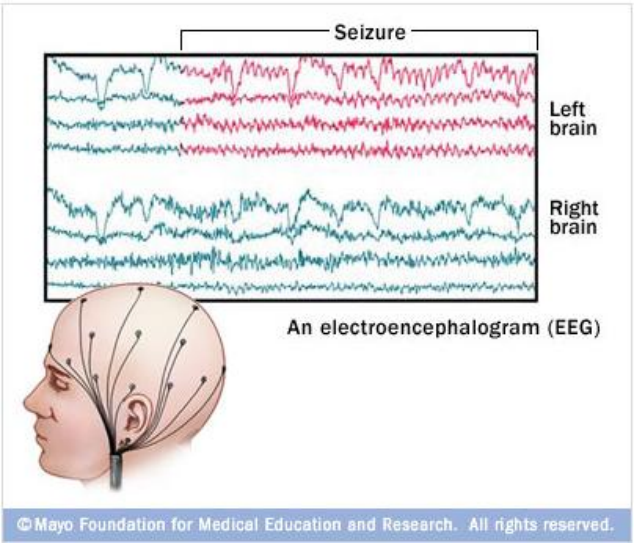


Figure 6

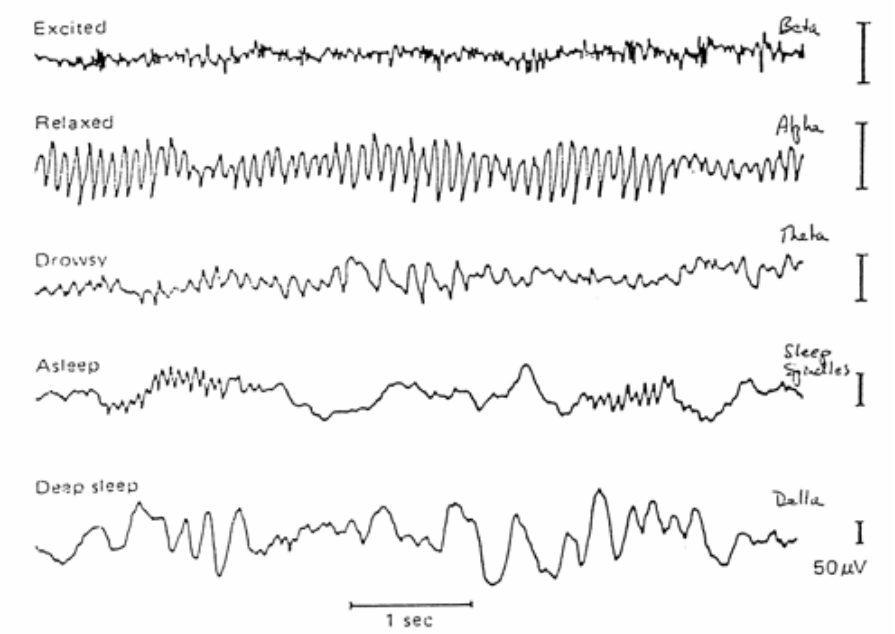
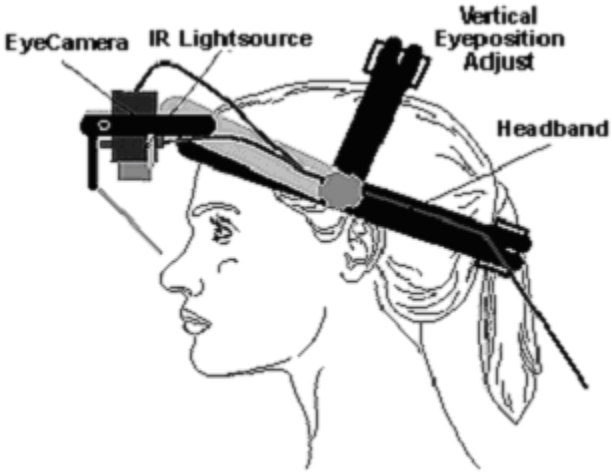


Figure 7



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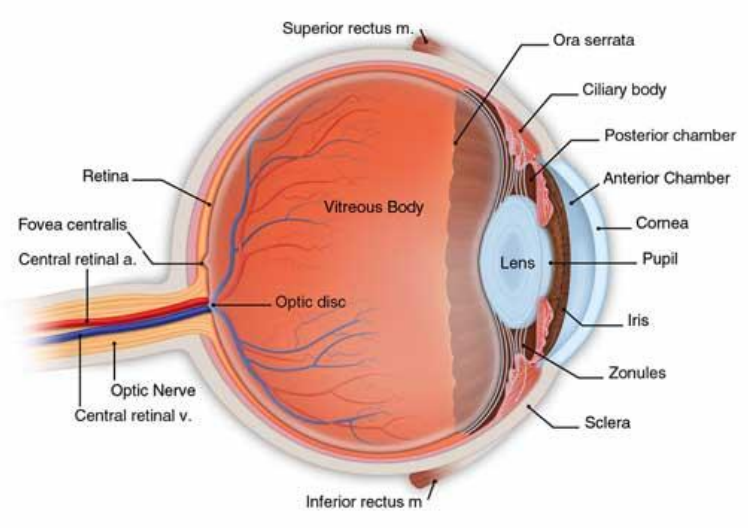

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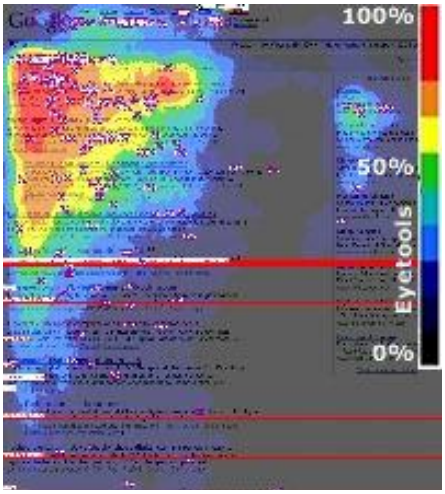


Figure 10

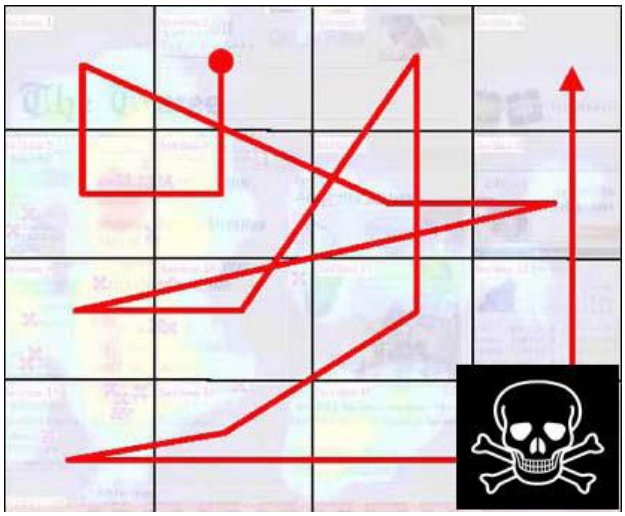


Figure 11

Figure 12

Figure13

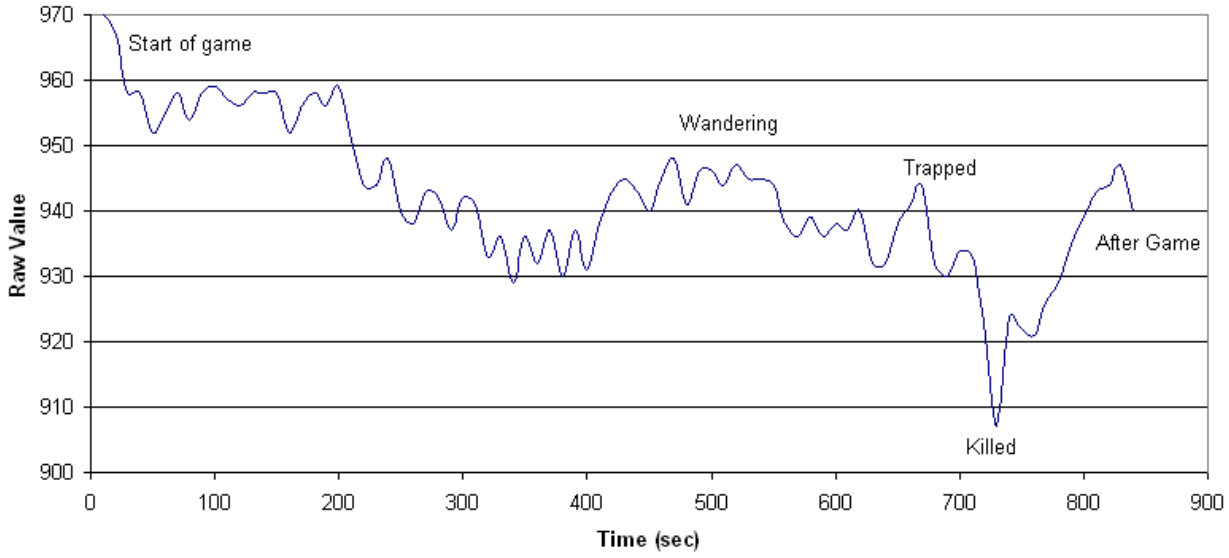


Figure 14

Figure 15

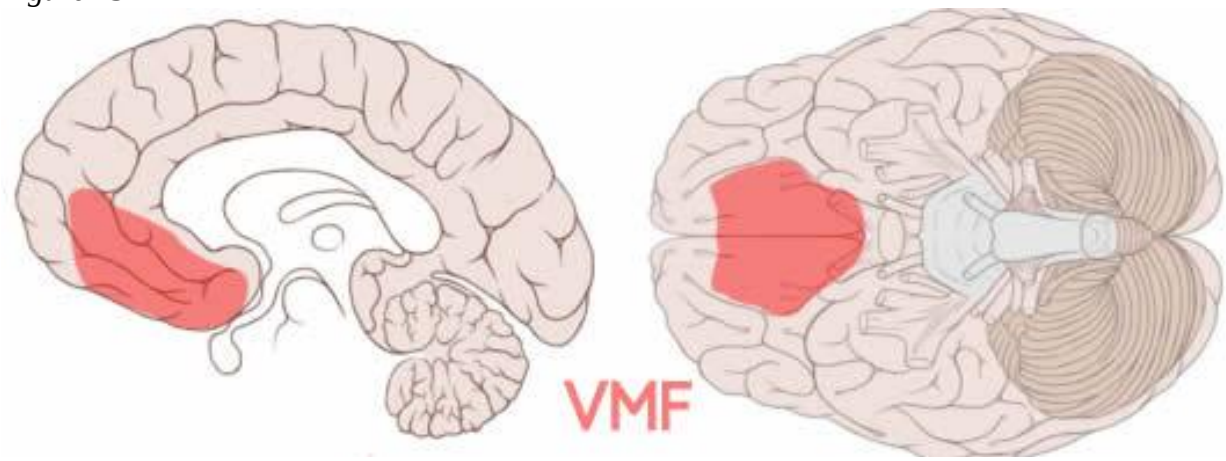


Figure 16

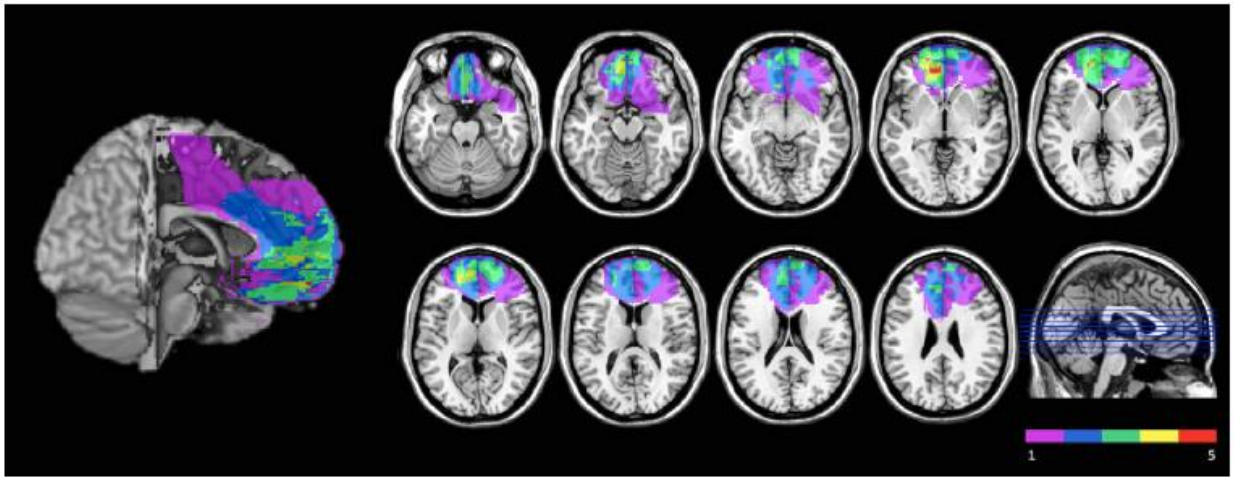


Figure 1. Location and overlap of brain lesions of the nine subjects with VMF damage, projected on axial slices of the MNI brain. Different colors indicate the number of subjects who had damage involving a particular area in common, as indicated in the color key.

Figure 17

EXPERIMENTAL STIMULI

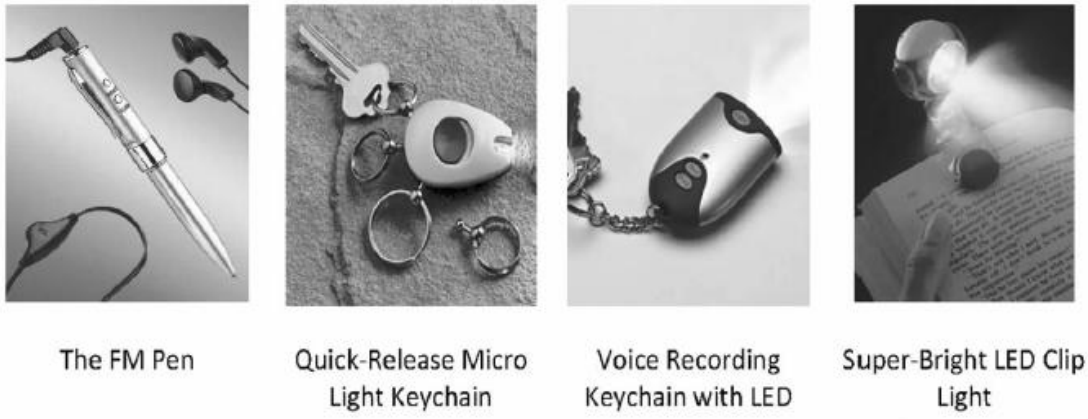


Figure 18

EXAMPLES OF FAMILIAR AND UNFAMILIAR BRAND STIMULI

Figure 19

Figure 20

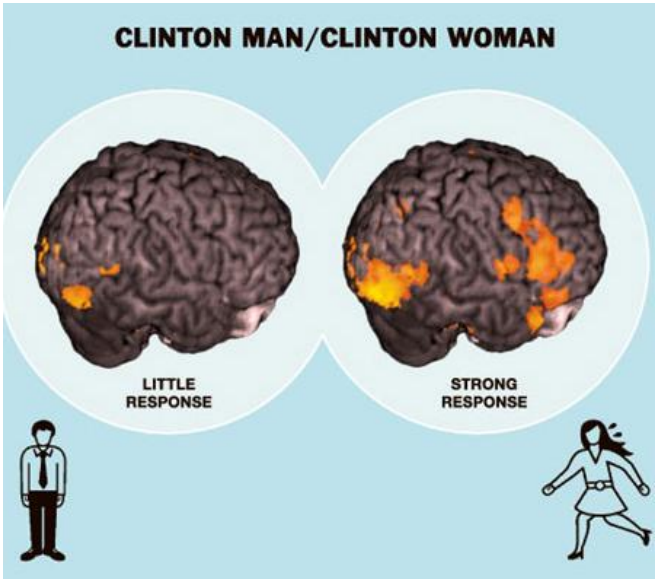


Figure 21

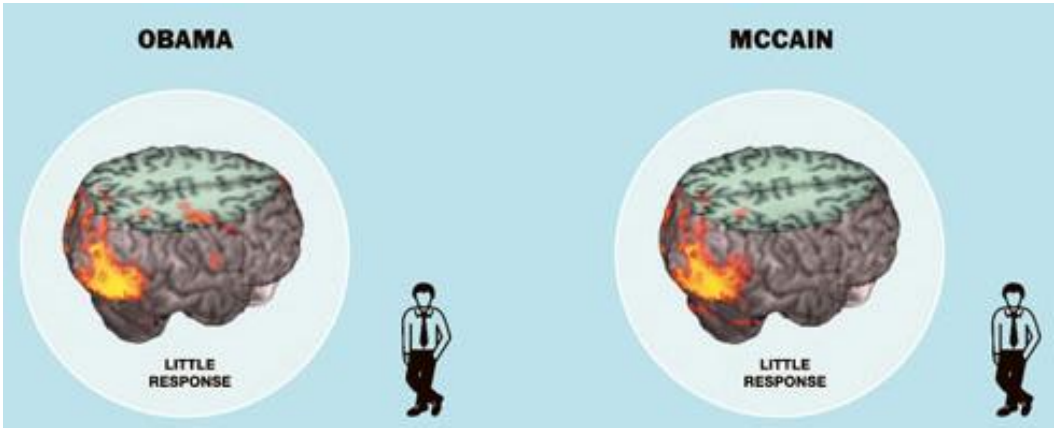


Figure 22

Figure 23

Figure 24

Figure 25

Figure 26

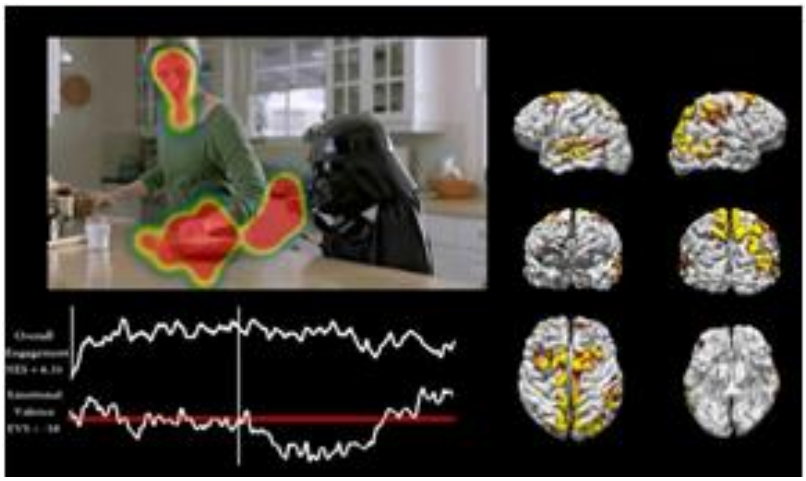
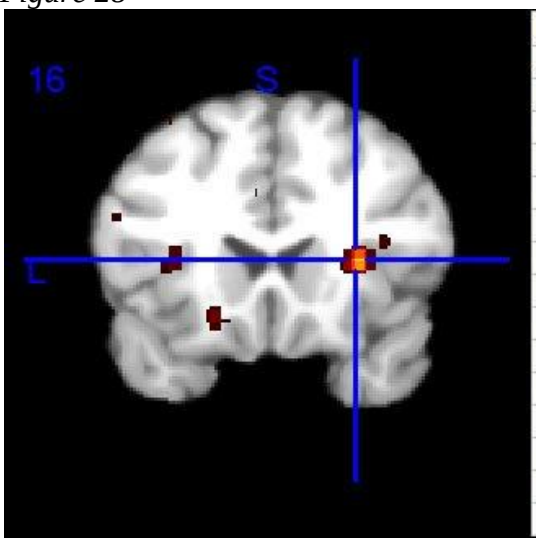


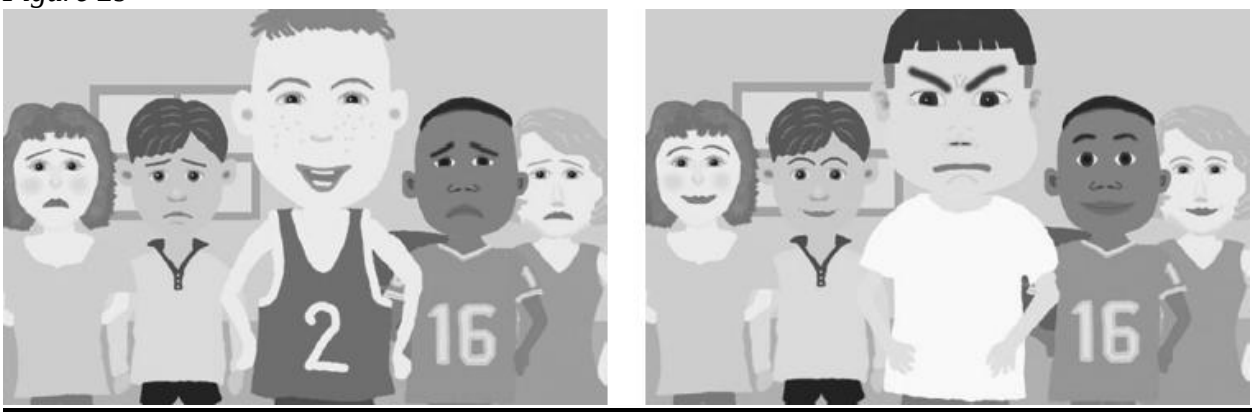
Figure 27

Figure 28



Behavioral Domain
Action.Execution.Speech
Action.Execution.Speech,Cognition.Language.Speech
Cognition.Attention,Perception.Somesthesis.Pain
Cognition.Language
Cognition.Language.Orthography
Cognition.Language.Semantics,Cognition.Language.Speech
Cognition.Language.Speech
Cognition.Language.Speech,Cognition.Language.Semantics
Cognition.Memory.Explicit
Cognition.Memory.Working
Cognition.Reasoning
Perception.Audition,Emotion
Perception.Somesthesis.Pain
Perception.Somesthesis.Pain,Cognition.Attention

Figure 29



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