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Neuromarketing: Ethical Implications of its Use and Potential Misuse

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Abstract Neuromarketing is an emerging field in which academic and industry research scientists employ neuroscience techniques to study marketing practices and consumer behavior. The use of neuroscience techniques, it is argued, facilitates a more direct understanding of how brain states and other physiological mechanisms are related to consumer behavior and decision making. Herein, we will articulate common ethical concerns with neuromarketing as currently practiced, focusing on the potential risks to consumers and the ethical decisions faced by companies. We argue that the most frequently raised concerns—threats to consumer autonomy, privacy, and control—do not rise to meaningful ethical issues given the current capabilities and implementation of neuromarketing research. But, we identify how potentially serious ethical issues may emerge from neuromarketing research practices in industry, which are largely proprietary and opaque. We identify steps that can mitigate associated ethical risks and thus reduce the threats to consumers. We conclude that neuromarketing has clear potential for positive impact on society and consumers, a fact rarely considered in the discussion on the ethics of neuromarketing.

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Commercial Alert, a consumer advocacy group, sent a letter to the president of Emory University in 2003 alleging that neuromarketing is a significant risk to consumers and that Emory University should immediately halt all study of neuromarketing (Grey et al. 2003). In the letter, signed by academics and leaders of non-profit consumer advocacy groups, the authors state,

> Emory's quest for a "buy button" in the human skull is an egregious violation of the very reason that a university exists. It also likely violates the principles of the Belmont Report, which sets out guidelines for research on human subjects in the United States.

They go on to note,

> The real risk of neuromarketing research is to the people—including children—who are the real targets of this research. Already, marketing is deeply implicated in a host of pathologies. The nation is in the midst of an epidemic of marketing-related diseases.

The authors then end the letter with this request,

1) Forbid the BrightHouse Institute [a research group affiliated with Emory faculty], or any other entity, from using any Emory University property, equipment, office space or facilities, including its MRI, for the purposes of conducting neuromarketing research; and,
2) Publicly release Emory University's Institutional Review Board reviews of the neuromarketing research.

These risks were claimed to be inherent in the practices of the emergent and burgeoning field of neuromarketing—an area of interest to academicians and industry alike. But, what defines neuromarketing? And, are these or other claims of ethical violation legitimate?

What is Neuromarketing?

We consider neuromarketing to be the use of neuroscience and physiological research techniques to gain new insights into consumers' behavior, preferences, and decision making, as well as other aspects of human cognition and behavior related to marketing. Neuromarketing seeks information and insights beyond that revealed by traditional techniques such as surveys, focus groups, experiments, and ethnography—with the goals of enhancing marketing theory and practice (Plassmann et al. 2015; Yoon et al. 2012) or improving the accuracy of predictions of consumer preferences and behavior when combined with traditional techniques (Boksem and Smidts 2015; Smidts et al. 2014; Venkatraman et al. 2015). Neuromarketing is sometimes distinguished from consumer neuroscience by restricting the former to industry applications and the latter to academic research (Plassmann et al. 2012). For the purpose of this article, however, we will use the term "neuromarketing" generally, and specify when we are referring to differences that are peculiar to academics or industry.

Many techniques are currently in use within neuromarketing. We will offer a brief introduction to some of those techniques and the nature of the data that they provide, starting with techniques that measure some aspect of brain function or activity. Functional magnetic resonance imaging (fMRI) is a neuroimaging technique that measures the amount of deoxygenated hemoglobin (Huettel et al. 2014). That measure is closely linked to aspects of neuronal activity, allowing fMRI to describe brain function with excellent spatial resolution (on the order of one millimeter) and good temporal resolution (second-by-second changes). The capital costs associated with an MRI scanner can run several million dollars, and the marginal costs associated with each person tested typically run into the hundreds of dollars. In spite of the costs, fMRI is used to study marketing phenomena. For example, fMRI was used to record adolescents' brain responses while listening to the music of relatively unknown artists. Three years later, the participants' brain responses to the music from the original listening session were positively correlated with aggregate sales of the same songs during the 3-year period, which suggested that neural responses to music could be used to predict future sales (Berns and Moore 2012).

A less expensive method of measuring brain activity that offers excellent temporal resolution (millisecond changes in brain activity) is electroencephalography (EEG), which can measure changes in electrical activity in the brain through electrodes that are placed on the scalp. Compared to fMRI, EEG has poorer spatial resolution, meaning that it is harder to pinpoint areas of brain activity, and it also lacks the ability to measure brain activity that is significantly distal to the skull—such as in subcortical areas that are commonly of interest to those who study decision making (De Martino et al. 2006). As an example of EEG use in marketing research, Boksem and Smidts (2015) showed that brain responses (measured via EEG) to movie trailers were able to account for significant additional variance above and beyond self-report measures in predicting population-level preferences for the tested movies. Magnetoencephalography (MEG) is related to EEG with similar temporal abilities, but measures changing magnetic fields rather than changing electrical activity; its technical complexity means that it has been rarely used for neuromarketing.

As a group, these brain imaging techniques can also measure changes in brain activity associated with sensory experiences like seeing an ad or tasting a product (Plassmann et al. 2008), with thoughts related to making a financial decision (Kuhnen and Knutson 2005), with spreading information via word-of-mouth (Cascio et al. 2015), and with many other marketing phenomena (Esch et al. 2012; Plassmann and Weber 2015).

As an alternative approach to brain imaging, researchers can measure aspects of peripheral physiology such as heart rate, respiration, skin conductance (hand sweating), pupillometry (pupil dilation), eye tracking (recording exactly what a consumer is looking at by tracking their eyes), and more (Reimann et al. 2012; Venkatraman et al. 2014). Researchers can then relate the measured aspect of physiology to consumers' experiences. For example, consumers' pupils may dilate in response to certain goods more than others. Bodily fluid samples (saliva, blood) also contain factors like hormones or genetic information that can be collected almost anywhere (Schultheiss and Stanton 2009), and can also be used to predict consumer behavior. For example, one might measure the relationship between individuals' testosterone levels and their willingness to make risky financial decisions (Sapienza et al. 2009; Stanton et al. 2011a, b).

Neuromarketing can involve more than just measurements of brain activity and physiology; in laboratory environments, direct manipulations of the brain or physiology allow for causal conclusions to be drawn about marketing-relevant processing. For example, it is possible to administer testosterone (v. placebo) to a subject in the lab and measure changes in their decision-making

Table 1 Principle techniques used in neuromarketing research: advantages and disadvantages

Technique	Measure	Advantages	Disadvantages	Examples
Brain imaging				
Functional magnetic resonance imaging (fMRI)	Localized brain areas' oxygen use	Good temporal precision (sec) Excellent spatial resolution	High cost Restrictive environment for subjects	Plassman et al. (2008) (Berns and Moore 2012)
Electroencephalography (EEG)	Localized brain areas' electrical activity	Least expensive brain imaging Excellent temporal resolution (msec)	Limited spatial resolution, especially of subcortical regions	Telpaz et al. (2015) Pozharliev et al. (2015)
Physiology				
Hormones (e.g., testosterone, menstrual cycle)	Hormone concentration in saliva, blood, etc.	Low cost Can be non-invasive Collected in field and lab	Less temporally precise	Stanton et al. (2011a) Durante et al. (2011)
Eye tracking	Target of gaze Pupil diameter	Unique measure of attention Low cost Excellent temporal resolution (msec)	Difficult to attribute valence to eye movements	Venkatraman et al. (2012) Meissner et al. (2015)
Skin conductance	Rate of hand perspiration	Measure of general arousal	Not specific to particular emotions	Reimann et al. (2012)
Interventions				
Transcranial magnetic stimulation (TMS)	Transient inhibition or enhancement of local brain function	Reveals causal role for brain regions	Limited temporal resolution Can only test 1 brain region at a time	Camus et al. (2009)
Drug administration/ neurotransmitter depletion	Transient changes in brain chemistry	Causality with regard to specific neurochemicals	Often requires physician oversight	Lichters et al. (2015)

* This list is not exhaustive. Other measures such as facial EMG, heart-rate variability, pupillometry, MEG, and more will likely be used in research

** All techniques listed require significant training to be used with precision, validity, and reliability

processes (Eisenegger et al. 2010; Lichters et al. 2015). Alternatively, recent advances have made it possible to deplete the body of specific physiological factors; for example, drinking a special sort of protein shake can greatly reduce brain levels of the neurotransmitter serotonin, which is critical for mood (Wang et al. 2009). Similar to administration techniques, assertions of causality regarding subsequent changes in behavior are possible with depletion approaches. Lastly, brain activity can be directly manipulated with transcranial magnetic stimulation (TMS). TMS uses magnetic fields that effectively "knock out" a specific area of the brain, which temporarily reduces the ability for the person to recruit that area of the brain. Once that area of the brain is transiently "knocked out", researchers can measure resulting changes in behavior. For example, using TMS on an area of the prefrontal cortex decreases consumer value for food (Camus et al. 2009). Similar to TMS, transcranial direct current stimulation (tDCS) is a technique that passes direct electrical current into areas of the brain, which subsequently alters blood flow and neural activity in the targeted brain region (Table 1).

Innerscope Research®, a for-profit neuromarketing research company recently acquired by Nielsen, notes that "combining multiple measures means more comprehensive insights (Innerscope 2014)." We agree. In concert, the existing suite of neuroscience methods can add substantial insights and predictive power to marketing research (Plassmann et al. 2015; Venkatraman et al. 2015). Yet, in our view, it is critical to note that neuroscience methods and the data they yield should not receive privileged status as a research method in marketing or any other behavioral discipline. In contrast to our view, neuromarketing companies commonly claim that neuroscience provides a golden key to the brain that can unlock hidden secrets about consumer preferences. They claim to have found what others fear as a "buy button" in the brain. We claim, instead, that neuroscience techniques are but one of the many methods that allow us to refine and improve our predictions of consumer behavior. Surveys, focus groups, experiments, and other traditional research techniques may be more or less valuable depending on the application and research question, but neuroscience techniques should not receive privileged status or be considered incontrovertible (Clithero et al. 2008; Levallois et al. 2012). In many applications, traditional marketing research techniques will still account for the greatest portion of the variance in consumer behavior.

The techniques described above vary not only in the nature of the data they provide and the brain functions they track but also in terms of their frequency of use by

academics and industry. This variability is principally driven by a cost-benefit analysis. Generally speaking, neuromarketing research is expensive to conduct. Set-up costs are very high for fMRI (millions of dollars), but are much lower for eye tracking and endocrinology (tens of thousands of dollars). The measurement of hormones is currently being used by academics (Durante and Arsena 2015; Durante et al. 2011; Saad and Vongas 2009; Stanton et al. 2011b), but is not widely used in industry. By contrast, eye tracking has become quite popular in industry as a function of its low cost, its ability to be done in a wide variety of locations, and its close tie to advertising since it directly measures at what consumers are looking with high temporal resolution. NeuroFocus, a neuromarketing company, employs a wireless EEG that consumers can wear in naturalistic settings; this system omits some of the procedures of laboratory EEG studies (e.g., using a gel to improve contact with the scalp) in order to increase convenience and portability. New companies are emerging to offer low-cost neuromarketing tools for industry uses, but the validity of the data emerging from these tools is highly contingent on the training and competence of those collecting and interpreting the data.

Neuromarketing research also varies in the marketing goals that it pursues. Market segmentation is a functional way of dividing consumers into groups with shared needs and preferences. This is often done via demographics like age or psychographics like impulsivity, but it may be possible to segment consumers by brain differences that do not directly map onto demographics or psychographics (Venkatraman et al. 2012). Pricing strategy is another area in which neuromarketing can prove useful (Karmarkar et al. 2015). Plassmann et al. (2008) demonstrated that fMRI can be used to show differences in brain activation in response to drinking the same wine at different price points, suggesting that the hedonic experience of drinking wine changes based on its price.

Product and brand development are also fertile ground for neuromarketing (Esch et al. 2012; Plassmann et al. 2012; Pozharliev et al. 2015; Reimann et al. 2012). In one of the earliest consumer neuroscience studies, McClure et al. (2004) demonstrated that brain activation in response to drinking Coke vs. Pepsi was heavily influenced by brand activation, particularly in regions associated with determining the value of a stimulus. Studies such as this could examine the effectiveness of both sensory information (flavor) and brand information (label) on consumer choice via brain activation in areas associated with reward and valuation. Once a product is developed, numerous decisions are made regarding how to position, promote, and advertise the product. Academic research has also provided evidence that neuromarketing can effectively enhance such promotional practices (Reimann et al. 2010). For example, Stallen et al. (2010) showed that the medial orbitofrontal cortex, an area associated with coding value, was more active when products were paired with celebrities, offering neural evidence for the transfer of positive information from celebrities, models, etc., as is commonly conferred through classical conditioning in advertising. Considered together, the studies described above offer specific examples of neuroscience-derived insights into consumer behavior that can advance academic research and lead to novel manipulations of the marketing mix in industry.

Ethical Issues in Neuromarketing: Perception or Reality?

The canonical criticisms of neuromarketing—which arose at its inception and have remained prevalent today—include unethical research practices, unethical applications of technology, and manipulations of consumers. Yet, despite these criticisms, the volume of academic research in neuromarketing and related areas has grown steadily and now over 200 neuromarketing research and consulting firms have been founded across the globe (Plassmann et al. 2012). With the growth of the field, criticisms and fears of neuromarketing's purported power have not yet subsided—if anything they have grown.

As our opening quotations illustrate, most ethical objections to neuromarketing refer to risks of harms and violations of rights. The relevant harms include both immediate effects on individual consumers and long-term effects on society as a whole. The purported rights include positive rights to privacy, autonomy, and dignity as well as negative rights not to be deceived, subjected to experiments without consent, or used as a means only. Some of these rights are widely recognized and even codified in generally accepted principles for research practice, such as the Belmont Report (1979). The objections to neuromarketing (as well as our responses) do not depend on any particular ethical theory but, instead, appeal to what are supposed to be commonsense ethical restrictions that apply to neuromarketing. Future ethical analysis of neuromarketing has the potential to utilize the lens of specific ethical theories.

Some of these fears regarding neuromarketing are widespread, and they carry the trappings of an ethical challenge, but we will argue that most of them do not raise distinctive or realistic ethical issues. Some of these fears are not distinctive of neuromarketing, because they do not involve any new controversy beyond that attributable to traditional marketing (Nill and Schibrowsky 2007). Most of the new ethical dangers that are attributed to neuromarketing turn out to be unrealistic, because they assume

that neuromarketing has powers that it cannot obtain in the near future. Only a few ethical issues arise that are both distinctive and realistic, and we will discuss solutions that could mitigate those concerns.

Predicting Consumer Choice

The first commonly perceived, potential ethical issue is the fear that neuromarketing may render consumers' choices completely predictable. Notably, similar criticisms regarding the prediction of consumer choice have been applied to traditional marketing research and practice, but are perhaps most accentuated in neuromarketing (Wilson et al. 2008). Recent and provocative research seems to herald the power of neuromarketing, as when fMRI has been used to predict individuals' choices and purchase decisions (Knutson et al. 2007; Smith et al. 2010; Soon et al. 2013), as can EEG (Telpaz et al. 2015). Knutson et al. (2007) demonstrated that brain activity could predict a consumer's choice (for food goods) above and beyond self-report information about preferences, which indicates that neuromarketing can add important contributions to traditional marketing research methods (Venkatraman et al. 2015). Despite the narrowness of the conclusions drawn from this or any other one study—each of which provides information about brain predictors of choice in a single context—some critics see such studies as a potential violation of consumers' rights to privacy (Murphy et al. 2008). If neuroscience methods offer a portal into consumers' minds and extract information that consumers themselves do not know, it is argued, then neuromarketing provides a tool that can identify our choices even before we make them.

This fear is not substantiated on multiple levels. First, most consumers do not have their brains scanned or give hormone samples to researchers; that only happens in the context of experimental research studies. Thus, an individual consumer is not the direct subject of a privacy violation. Instead, conclusions are drawn based on generalization to the public from a small experimental sample, as in existing marketing research (and biomedical and behavioral research). Second, those who do participate in academic research go through an informed consent process in which they are informed of the risks of participating and the goals of the study. For those who participate in research conducted by a neuromarketing company, there may arise privacy issues that we will discuss later, but for everyone else, privacy concerns do not seem to be a major ethical obstacle to neuromarketing.

Another fear is that companies who predict consumer choices will see and treat their customers as mere robots or automata without freedom or dignity. The public sometimes seems to interpret neuromarketing results as deterministic predictors of their behavior derived from hard science. This perception may be enhanced in cases where findings are overstated as is common for neuromarketing firms.[1] Many people find this view of consumers as determined mechanisms to be demeaning, dangerous, and immoral. The charge, then, is that neuromarketers treat consumers as if consumers were only things to be used as mere means to the neuromarketers' ends. This kind of mistreatment is the very essence of immorality, according to the moral philosopher Immanuel Kant:

> Beings whose existence does not depend on our will but on nature, if they are not rational beings, have only a relative worth as means and are therefore called 'things'; on the other hand, rational beings are designated "persons" because their nature indicates that they are ends in themselves, i.e. things which may not be used merely as means. (Kant, 1785/1959, p. 46)

Thus, this objection has deep roots in history and culture.

Neuromarketing does not depend on this disreputable view of consumers for at least two reasons. First, neuromarketing predictions are probabilistic rather than deterministic. Neuromarketing firms need not claim that consumers' behavior is completely determined; rather, they can admit that consumers are free to stop themselves from buying the products. All neuromarketing firms need to claim is that consumers are more likely to buy certain products in some circumstances than in other circumstances, which is the overarching goal of marketing research regardless of technique. Consumers can be predictable to this extent even if they are free (Suhler and Churchland 2009). Perhaps, if consumers' choices were totally predictable through either traditional or neuromarketing research, then consumers might come to be seen as mere things with only relative worth rather than as persons (in Kant's sense). This result might undermine their dignity and respect for them as persons. However, the field is not remotely close to this level of prediction, and it is unlikely to ever achieve such certainty in practice.

Second, even when neuromarketing firms predict consumers' choices, they need not treat consumers as mere means (in Kant's terms). Instead, they can help consumers obtain the products that those consumers want, and have reason to want, in a more efficient manner, which is a positive practice and common goal in marketing (Keller 2000). Predicting behavior is very different from coercing consumers against their wills, so prediction need not deny

[1] We are not highlighting the practices of specific neuromarketing firms. Rather, in our survey of websites, the vast majority of neuromarketing companies described their capabilities in a manner more generous than would be reasonable, given the published state-of-the-art in the academic literature.

or undermine the rationality or the dignity of the people whose behavior is predicted.

Influencing Consumer Choice

A second commonly perceived, potential ethical issue is the fear among consumers that neuromarketing can be used to go beyond prediction and *influence* consumer choice. Successful neuromarketing, it is argued, might rob consumers of control and make the marketed goods irresistible. Of course, shaping consumers' choices is the goal of marketing generally, but does neuromarketing offer firms a unique and novel ability to find a "buy button" in the brain?

While neuroscience might help improve predictions of consumer choice, there is no current evidence of a "buy button" in the brain. There are areas of the brain that code for value and reward (Clithero and Rangel 2013), particularly anticipation of reward (Knutson et al. 2001). Things that are more rewarding or more valued activate these areas more intensely, but this is not equivalent to a "buy button". Neuromarketing provides no special path—even in principle—for optimizing a marketing message to render consumers unable to control their actions; for example, neuromarketing could not create a menu description of an entrée that compels patrons to purchase that item, any more than traditional marketing techniques could. Moreover, even if this were possible, it would be impractical to target an individual to determine the optimal stimuli for their choices.

Critics might reply that, even if neuromarketing cannot force consumers to buy certain products, they can still influence purchases, and there is something unethical when the influence works below the level of consciousness. This fear is to some extent not new or distinctive of neuromarketing. James Vicary popularized the concept of subliminal marketing in the 1950s (Rogers 1992). Vicary claimed to be able to enhance sales of movie theater concessions by subliminally embedding marketing messages into the movie footage. In response, notable outlets such as *The New Yorker* argued that consumers' minds were being broken into (Moore 1982). Vicary admitted to fraud years later, but the concept of subliminal marketing was broadly absorbed by the public, which created fears of usurping consumers' control over their decisions.

In an irony, recent research has shown that supraliminal but unattended primes can have significant effect on consumer behavior (Ferraro et al. 2009; Fitzsimons et al. 2002). There is growing evidence that marketing information to which consumers are exposed to can strongly influence their choices, even when the consumers had no conscious awareness that their choices were being influenced or that they were exposed to brand information. For example, a study by Ferraro et al. (2009) manipulated the number of times consumers were exposed to photographs of Dasani bottled water. At the end of the experiment, consumers were able to choose bottled water of one of four brands, including Dasani. The consumers who had repeated exposure to Dasani, but had no conscious awareness of the brands to which they were exposed, were much more likely to pick Dasani water rather than the competition (Ferraro et al. 2009). Experiments can clearly and causally demonstrate the power of marketing manipulation on consumers' behavior that operates outside of conscious awareness. These studies demonstrate that behavioral research can elucidate strategies to influence consumers' choices outside of their awareness. They also show that neuromarketing does not deserve any special moral opprobrium and is certainly not the only way to influence consumers outside of their conscious awareness (Chartrand 2005).

Critics might respond that all such unconscious influences—whether neuroscientific or not—remove control, but this reply conflates consciousness with control (Suhler and Churchland 2009). The fact that a consumer is influenced by repeated pictures of Dasani water does not prove that this consumer had no control over which water she picked. If she had not wanted Dasani, or if she had had a strong enough reason to pick another kind of water, then she might have picked another kind. Consumers might have more control when they are consciously aware of what influences them, but that does not mean that they lack all control when they are not consciously aware of what influences them.

While neuroscience techniques are not necessary to influence consumers outside of their conscious awareness, recent research demonstrates that the field is close to being able to use uncontrollable physiological factors to predict a consumer's preferences and willingness to purchase goods. This is not merely a hypothetical scenario looming in the far future. A recently published study showed that a woman's menstrual cycle predicts her likelihood of wanting "sexy" clothing and accessories compared to "non-sexy" clothing and accessories. When women were near ovulation, they were more interested in buying "sexy" clothes and accessories (Durante et al. 2011). Women's menstrual cycles have also been shown to predict preferences for goods that increase a woman's status relative to other women, like diamond rings and automobiles (Durante et al. 2014), as well as interest in food consumption and other appearance-related products (Saad and Stenstrom 2012). The menstrual cycle is an aspect of physiology that women cannot control and that also predicts shifts in their preferences as a consumer (Durante and Arsena 2015).

A company could incorporate such information into a forecast model of purchasing behavior. For example, take an online clothing retailer who can track the purchases of a repeat customer and look for trends in purchases that cycle around a 27–30 day window. Email advertisements could promote sexy clothes at strategic times (periovulation)

enhancing the likelihood of purchase as predicted by the consumer's menstrual cycle. Similarly, goods that Amazon offers or promotes to a specific female customer could subsequently be tailored to some inferred knowledge of that consumer's menstrual cycle, which enhances that consumer's likelihood of purchase.

The measurement of physiological factors, such as hormones or hormone cycles, is much less expensive and sometimes more applicable in today's research environment compared to fMRI or other forms of neuroimaging. Some companies have already used related approaches. For example, Target® intentionally developed strategies to discern when pregnant women are at certain stages of pregnancy to capture them as customers through tailored advertising (Duhigg 2012), which they believe to be a key period transition during which customer can be swayed to purchase a whole host of child-related goods via targeted advertising and promotion. Since Target sells a wide variety of goods, they can then transition consumers through subsequent life stages with targeted incentives, thus developing a consumer with high likelihood of repeat purchases.

Such physiology-based marketing allows consumer choices to remain free, even if they are significantly influenced by physiological factors that consumers cannot control. Moreover, this ability to predict and influence via physiology is not distinctive of neuromarketing, because the same ability is provided by behavioral studies that also reveal ways to influence consumer choice outside of the conscious awareness. In both cases, consumers are unaware of factors that influence their choices, but they still make free choices.

Ethical Issues Associated with Introducing Neuroscience into Marketing

Academia versus Industry (Consumer Neuroscience vs. Neuromarketing)

Neuromarketing is an area of active research among academics, and it is also a source of profit to over 200 neuromarketing companies worldwide, a number that has grown from just a handful 5 years ago (Plassmann et al. 2012). Academic and industry neuromarketing have very different goals. For academics, a primary goal is public dissemination of knowledge, as seen in the publishing of protocols and data in peer-reviewed journals. For industry, a primary goal is to develop a comparative advantage of one's competition, which leads to private collection of data and development of proprietary analysis approaches. Academics and industry also have different approaches to interpreting and implementing results in guiding future practice. Academics tend to run experiments and evaluate their results using stringent thresholds that protect against the possibility that their findings occurred by chance and are not representative of a truly significant result (for example, a tolerance of less than a 5 % chance that the experimental result is untrue is commonly used). In contrast, in industry, forecasting is key, and a 75 % likelihood of predicting an outcome can be a gamble worth taking when a managerial decision involves millions of dollars. As a function of these different sets of priorities and approaches, both academic and industry neuromarketing researchers may be prone to significant ethical challenges.

Methodological Rigor

The goal of profit maximization might not lend itself thorough scientific practice. Scientific results are worthwhile only if the methods used to collect the data are sound. Yet, industry clients who hire neuromarketing firms are not likely to have sufficient background knowledge to evaluate the methods used to collect and analyze neuroscience data. Neuromarketing firms may be incentivized to utilize poor research methods, gather insufficient sample sizes, hire undertrained personnel, and so on, if they can still convince the client that the data are useful. In addition, neuromarketing firms are incentivized to exaggerate their capabilities and potential deliverables to attract clients. Unlike the academic world, neuromarketing firms lack peer review when they report results to clients, and peer review protects against the risk of overstating of results. While peer review may not currently be a part of conventional marketing practice in industry, neuromarketing firms are new in the marketing landscape and the established rules for quality work and deliverables are not as clear as with traditional methods for market research. Moreover, neuromarketing firms tend to maintain proprietary control of data they collect. Neuromarketing firms also do not tend to publish or share their data collection protocols. This opacity means that the extent to which neuromarketing companies' data are valid, or in correspondence with their promotional claims, remains unclear. Ideally, neuromarketing firms that do not produce deliverables derived from rigorous methods would eventually be overtaken by firms that gain competitive advantage through using rigorous methods and producing valid and reliable data. Such firms will better aid their clients in making accurate predictions in the marketplace through their higher quality research.

In response to the potential issue of lacking methodological rigor in industry and the difficulty for corporate clients to evaluate the quality of the data they are purchasing, the Advertising Research Foundation (ARF), an

industry network of marketing research companies and professionals, has launched 2 initiatives within the last five years: Neurostandards 1.0 and Neurostandards 2.0. Through these initiatives, the ARF is collaborating with several for-profit neuromarketing research companies in an effort to validate research methods, develop a more standardized set of research practices, and create more digestible ways for businesses to be informed consumers of neuromarketing research that focuses on evaluating advertising. The ARF is also offering academic peer review of methods and results to the industry participants in the Neurostandards initiatives; this has the potential to enhance the quality of research in the field. Yet, only a handful of neuromarketing companies are participating in the ARF's initiatives. As such, these potential issues regarding methodological rigor remain important in moving forward as more neuromarketing companies continue to join the industry.

In contrast to industry, the overstatement of results or capabilities is less likely within academia, since the peer-review publication system that is applied to published research is designed to ensure methodological rigor and accurate interpretation of results. In that sense, academic science utilizes peer review as a self-correcting feature. Yet, academics are not free from performance incentives that can compromise data quality—there are numerous cases of academic researchers who published completely fraudulent data in a quest for tenure, promotion, and other incentives, which upon discovery has led to the retraction of many published journal articles. Thus, overstatement is still possible within academia, as in industry.

Transparency

In an effort to address the greater risk regarding neuromarketing in industry, we propose that there would be benefits to clients and consumers if neuromarketing companies adopted policies of data and protocol transparency. Some firms have made efforts in this direction, for example, Innerscope has released excerpts of several of its studies (Innerscope 2014), albeit only short synopses of the goals of the projects and cursory summaries of the findings and conclusions. Also, those companies participating in the ARF's Neurostandards 1.0 and 2.0 (which includes Innerscope) are also moving toward transparency via peer review of their methods and reporting of results by academics on ARF's review panel. Yet, it remains unclear whether all participating companies will fully share the reviews that they receive from ARF. These are steps in the right direction, but remain below the level of transparency that would be ideal.

What would such transparency entail? Key aspects would include information regarding the Institutional Review Board (IRB) that oversaw the study and the IRB protocol associated with the study as well as procedures for gaining informed consent. In addition, the full publication of all data collection protocols, raw data, and data analyses would allow for independent replication of results, which would approach the standards used in clinical trials. While we anticipate that virtually no neuromarketing firms would agree to this, we contend that full transparency would be the single best way to convey the highest level of research competence—and could lead to a shift in the market such that firms attract clients because of the rigorous and thoughtful way they use well-validated experimental procedures, not because they have developed new (and often questionable) unique methods for measuring brain function.

In spite of the potential benefits, neuromarketing firms are unlikely to move to full transparency. A first step would be to adopt science advisory boards composed of scientists trained in the techniques that the company employs. This approach would allow neuromarketing companies to maintain proprietary control of the data and method protocols, while reaching a higher level of methodological scrutiny. The flaw with this approach is that the members of scientific advisory boards (of any company, not just neuromarketing) are often monetarily incentivized, which can lead to captured boards. In other words, the scientific review boards are not truly independent from the company. Independent scientific review boards would reduce the potential for bias derived from compensation directly from the company.

Quality Certification

In response to the ethical issues raised, the neuromarketing industry may also benefit from third-party quality certifications that ensure ethical treatment and protection of subjects as well as methodological rigor are being strictly employed. To some extent, the ARF Neurostandards initiatives are a first step in this direction, but more could be achieved. We believe that a third-party group could be organized with the goal of delivering a quality certification that would allow consumers of neuromarketing research to make a more informed choice regarding the product that they are purchasing. The need for this may be unique to neuromarketing research compared to traditional marketing research, because neuromarketing research methods are technically sophisticated and lack the tractability of traditional marketing research methods. Energy Star certification in the appliance manufacturing industry and Leadership in Energy & Environmental Design (LEED) certification in the construction industry are analogous to what we propose. For both examples, the certification is a marker of specific performance standards, is evaluated by a

third-party group, and is optional to firms in the field—but has nevertheless attracted significant interest because it is seen as a competitive advantage in a crowded marketplace.

Privacy

One might also consider how close neuromarketing data are to private health information, which implies a different type of privacy threat. Consider the typical approach of collecting data about brain function using, say, fMRI. As already discussed, the fMRI data extracted from a neuromarketing experiment are highly contextualized and specific to the experiment at hand. In contrast, structural MRI, which creates a structural map of one's brain but does not measure brain activity, is more closely equated to other clinical private health information (such as HIV status, pregnancy, mental illness, cancer, terminal illness, and so on), in that structural MRI can contain information regarding pathology, tumors, and structural malformations in the brain. Such information could potentially be used to discriminate against individuals. Structural MRI is always acquired in conjunction with fMRI, and participating in neuromarketing studies using fMRI would mean that companies have access to one's structural MRI data. In the absence of informed consent, which is a significant problem in industry, the ways in which such data could be used or sold to other companies would be unclear to research participants and to some extent unregulated.

Notably, even the broad ethical issues in this present section can be generalized to marketing research. For example, privacy violations could occur in traditional marketing research if participants divulge private health information on a survey (instead of through fMRI), and that information was then used to harm or discriminate against those participants in the future. Herein, we focused on specific ethical issues that derive directly from the neuroscience techniques in use in current neuromarketing research.

Shared Ethical Issues for Both Marketing and Neuromarketing

After highlighting the ethical issues that are more specific to neuromarketing, it is critical to be clear about the issues that are shared in both marketing and neuromarketing. If ethical issues are not specific to neuromarketing, they may still be ethical issues that are equal problems for both marketing and neuromarketing.

One problem for consumers that could arise from marketing and neuromarketing might be increasing prices. Consumers may have to pay more for a product if it costs more either because of the expenses of neuromarketing or because the neuroscience research gives greater pricing power to the company (Plassmann et al. 2008); market solutions are likely to suffice for such problems, since neuromarketing will exist within a landscape dominated by traditional marketing methods for the foreseeable future. A second problem might be fueling consumerism. Imagine that neuroscientists test potential advertisements to find out which designs have the desired effects on attention and motivation to buy. Again, that seems fine if the only effect is for consumers to choose one equally good or better product instead of another. However, more powerful advertisements can be harmful if they create new desires for products that are inferior or that the consumer does not really need. Similar problems arise if advertisements increase desires beyond what is good for the consumer, because then the consumer might be induced to pay much more for as product that does not do much good at all for the consumer. The basic fear, then, is that neuroscience might make advertisements much more powerful and might thereby create new desires or strengthen existing desires in ways that are detrimental to the lives of consumers. These fears may also be attributable to effective use of traditional marketing research techniques.

Another problem at present is that both marketing and neuromarketing companies are often not subject to oversight by an Institutional Review Board (IRB) to ensure ethical conduct of research. The extent to which companies can conduct behavioral research without IRB oversight has long been a subject of debate and continues to be contentious even outside neuromarketing (Joffe 2014; Maschke 2008; Wagner 2003). For example, Facebook® recently coupled with academic researchers to conduct a study that intentionally manipulated nearly 700,000 users' mood states without users' consent (Kramer et al. 2014). The company received significant public backlash for not acquiring users' informed consent in advance of participating in the study (BBC 2014). Informed consent is a standard practice for academic research involving human subjects, but it is not always used by for-profit research firms. Compared to other industry-related ethical violations [e.g., drug testing in the developing world in which pharmaceutical companies have hidden adverse events related to experimental drugs (Kelly 2013)], the Facebook study was innocuous, but note that it was held to a higher level of ethical scrutiny than most industry research precisely *because* the results were published in a transparent manner in an academic journal (Kramer et al. 2014). This transparency is exactly what firms avoid altogether by keeping data and protocols proprietary. That practice thereby poses potential harm to consumers and clients of neuromarketing research firms.

The ability of marketing or neuromarketing to exacerbate poor decision making or to enhance the likelihood of

purchasing goods that do not benefit the consumer is also a legitimate concern. Consider smokers or others who have a dependence on cigarettes—and for whom smoking cravings enhance brain responses to smoking cues, such as pictures of cigarettes (McClernon et al. 2005). In product development, fMRI could allow cigarette manufacturers to test new varieties of cigarettes or advertising materials that could engage brain systems associated with reward and reinforcement that could have higher addiction profiles. Such practices would be questionable ethically because of the links between cigarette smoking and cancer as well as other negative health outcomes. When marketing techniques, including product development, increase purchases of harmful products, the marketing itself can be harmful. Notably, this ethical problem arises just as much for traditional marketing as it does for neuromarketing, and regardless of approach, consumer harm could result (Nill and Schibrowsky 2007).

The issues of predicting consumer choice and influencing consumer choice also remain potential ethical issues in the future for both marketing and neuromarketing. Open questions in this domain are: To what extent do consumers need to be influenced or predictable before an ethical violation has occurred? In addition, what is the best recourse—regulation of industry, consumer education? For example, in the United States, television and radio advertising for cigarette manufacturers has been governmentally limited since 1970 by the Public Health Cigarette Smoking Act, as cigarettes were perceived as a sufficient threat to public health. In addition, subliminal advertising remains illegal in the United States under regulations outlined by the Federal Communications Commission as a measure of consumer protection. To what extent does a product have to be harmful to be restricted from advertising or a research technique too effective before intervention is necessary? As noted with the examples specific to the United States, different countries or cultures may have different answers to these questions. Thus, solutions to these issues will likely remain a topic of debate for decades to come.

In addition to the issues regarding the prediction and influence of consumers' behavior raised heretofore, we will offer a hypothetical example that some consider possible to arise in the future of neuromarketing. An example of a potential future problem might be that neuroscience could give salespeople an unfair advantage. Suppose that a lab study with eye tracking is used to guide jewelers on how to lay out their wares in a display or car dealers on how to design their showrooms so as to maximize sales. Here the target is customers in general. Contrast this possibility with another that is further off in the future (if it ever becomes practical). Imagine that a car dealer, rare art dealer, real estate agency, or jewelry store installs an eye tracker system that monitors pupil dilations in individual customers in order to discover how attracted each customer is to individual items for sale. This information is then secretly supplied to sales people, who use that information surreptitiously in negotiations over prices. When the jeweler finds out through the customer's involuntary eye movements that this particular customer is strongly attracted to a particular necklace, then this information could signal the jeweler to negotiate hard and thereby enable the jeweler to sell the necklace for a much higher price. The jeweler benefits, but the customer gains nothing, assuming that she would have bought the necklace at a lower price if she had been able to hide her preferences. Moreover, the new source of information might seem unfair if the customer does not know that the jeweler has access to it, and if the customer does not know how to hide or mislead, as many customers can in traditional negotiations.

While this scenario raises ethical problems, are those problems particular to neuromarketing? We cannot yet manipulate negotiations with eye trackers as the preceding scenario imagines. To do so would require not only new technology but also expense too great for all but the most expensive items. In the meantime, experienced sales people are already able to use body language, gaze, and voice modulation to detect preferences that customers do not know that they are revealing. Yet, we allow sales people to negotiate hard when they know that a customer strongly desires a necklace, car, sculpture, or house. We also allow advertisements that create new desires or strengthen desires so that consumers buy products that do not improve their lives. Thus, even if some of these problems do raise moral qualms about neuromarketing, those same qualms should exist just as strongly in reference to marketing that has nothing to do with neuroscience (Nill and Schibrowsky 2007).

The ethical issues we raise are not easily addressed by future research as the issues themselves arise from research. However, there may be utility to be extracted from future research on consumers' perceptions of neuromarketing. Many alleged concerns emerge from consumer advocacy groups. In contrast, concerns regarding neuromarketing practices in the general population are not presently characterized, and if characterized may offer a roadmap for consumer education a regarding neuromarketing practice, both in academia and industry.

Counterpoint: Benefits to Consumers via Neuromarketing

The arguments that we have put forward have focused mainly on the risk and potential for negative outcomes as a function of neuromarketing. This emphasis misrepresents the full implications of neuromarketing's future, so we want to close by balancing the scales. Neuromarketing, if

used responsibly, has the potential to enhance consumers' experiences as well.

A fundamental goal of marketing is to understand and address consumers' needs. As a function of the deeper understanding of consumer needs that can emerge from neuromarketing research, firms may be able to produce more desirable products, create more enticing promotional marketing materials, and enhance consumers' experiences (Plassmann et al. 2008; Reimann et al. 2010). While it is true that enhanced product development through using neuroscience methods can give firms added potential for profit, it is also true that consumers are likely to benefit by receiving products that are more well-suited to their needs. Advertising frequency and total quantity could be reduced by two positive deliverables of neuromarketing. The first is that more effective ads are created, reducing the need for high ad volume (Stallen et al. 2010). The second is that new segments of consumers are identified via neuromarketing intelligence, and those consumers can be targeted more directly and selectively (Venkatraman et al. 2012).

Another potential advantage from neuromarketing concerns treatment for addiction. Compulsive buying disorder is an affliction for a small group of consumers (Black 2007). Some critics fear that neuromarketing might spread and worsen this disorder. On the other side, however, it has been proposed that neuroscience techniques can help us gain deeper insights into neurobiological mechanisms of compulsive purchasing. These insights could in turn enable us to develop medical and pharmacological treatments to help those with problems (Black et al. 2000; Fortunato et al. 2014). The idea that neuroscience techniques could illuminate clinical pathologies related to compulsive buying may lead academics in the area of neuromarketing to pursue research funding from the National Institutes of Health based on its clinical relevance to a recognized behavioral disorder. This application would not only increase the research capacity of neuromarketing, but also ensure that neuromarketing approaches could be used to benefit consumers and buffer against the potential for negative outcomes mentioned earlier in this article.

Lastly, neuroscience techniques can also be used to enhance public safety campaigns, which are essentially marketing campaigns in the interest of the public. For example, Falk et al. (2013) used fMRI to study which areas of the brain were most active in response to messages that were most likely to be socially spread. From this research, future public service announcements and campaigns could be assessed and filtered based on their likelihood of transmitting the core content of the public safety campaign. Through such positive uses, neuromarketing has significant potential for good, despite its ethical dangers. Nonetheless, the aforementioned concerns—regarding the protection of subjects, methodological rigor, and so on—still need to be accommodated for the pro-social benefits of neuromarketing to be fully realized.

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