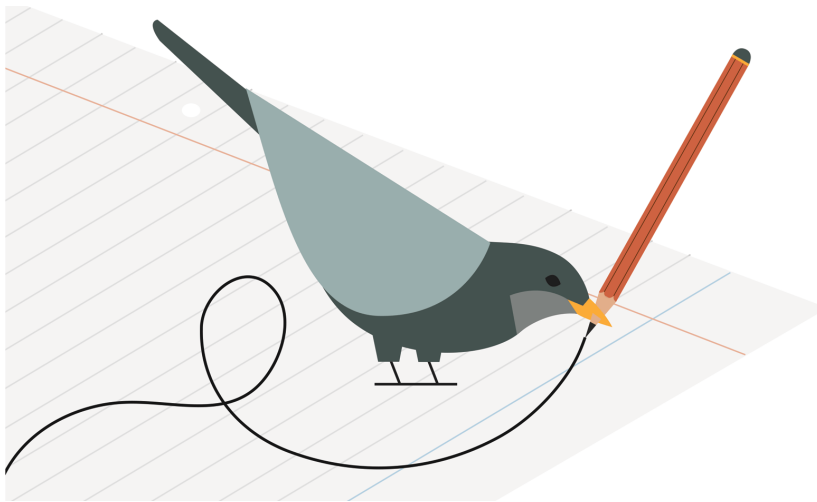


Neuromarketing: What You Need to Know

by Eben Harrell

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Summary. The field of neuromarketing, sometimes known as consumer neuroscience, studies the brain to predict and potentially even manipulate consumer behavior and decision making. Over the past five years several groundbreaking studies have demonstrated its potential... [more](#)

Nobel Laureate Francis Crick called it the *astonishing hypothesis*: the idea that all human feelings, thoughts, and actions—even consciousness itself—are just the products of neural activity in the brain. For marketers the promise of this idea is that neurobiology can reduce the uncertainty and conjecture that traditionally hamper efforts to understand consumer behavior. The field of neuromarketing—sometimes known as consumer neuroscience—studies the brain to predict and potentially even manipulate consumer behavior and decision making. Until recently considered an extravagant “frontier science,”

neuromarketing has been bolstered over the past five years by several groundbreaking studies that demonstrate its potential to create value for marketers.

But even as the validity of neuromarketing becomes established, marketers still struggle with it: Is it worth the investment? What tools are most useful? How can it be done well? To answer these questions, marketers need to understand the range of techniques involved, how they are being used in both academia and industry, and what possibilities they hold for the future.

The Tools of Neuromarketing

“Neuromarketing” loosely refers to the measurement of physiological and neural signals to gain insight into customers’ motivations, preferences, and decisions, which can help inform creative advertising, product development, pricing, and other marketing areas. Brain scanning, which measures neural activity, and physiological tracking, which measures eye movement and other proxies for that activity, are the most common methods of measurement.

The two primary tools for scanning the brain are fMRI and EEG. The former (functional magnetic resonance imaging) uses strong magnetic fields to track changes in blood flow across the brain and is administered while a person lies inside a machine that takes continuous measurements over time. An EEG (electroencephalogram) reads brain-cell activity using sensors placed on the subject’s scalp; it can track changes in activity over fractions of a second, but it does a poor job of pinpointing exactly where the activity occurs or measuring it in deep, subcortical regions of the brain (where a lot of interesting activity takes place). An fMRI can peer deep into the brain but is cumbersome, and it tracks activity only over the course of several seconds, which may miss fleeting neural incidents. (Moreover, fMRI machines are many times more expensive than EEG equipment, typically costing about \$5 million with high overhead, versus about \$20,000.)

Tools for measuring the physiological proxies for brain activity tend to be more affordable and easier to use. Eye tracking can measure attention (via the eyes’ fixation points) and arousal (via

pupil dilation); facial-expression coding (reading the minute movement of muscles in the face) can measure emotional responses; and heart rate, respiration rate, and skin conductivity measure arousal.

Interest in consumer neuroscience took off in the mid-2000s, when business school researchers started to demonstrate that advertising, branding, and other marketing tactics can have measurable impacts on the brain. In 2004 researchers at Emory University served Coca-Cola and Pepsi to subjects in an fMRI machine. When the drinks weren't identified, the researchers noted a consistent neural response. But when subjects could see the brand, their limbic structures (brain areas associated with emotions, memories, and unconscious processing) showed enhanced activity, demonstrating that knowledge of the brand altered how the brain perceived the beverage. Four years later a team led by INSEAD's Hilke Plassmann scanned the brains of test subjects as they tasted three wines with different prices; their brains registered the wines differently, with neural signatures indicating a preference for the most expensive wine. In actuality, all three wines were the same. In another academic study fMRI revealed that *when* consumers see a price may change their mental calculation of value: When price was displayed before exposure to the product, the neural data differed from when it was displayed after exposure, suggesting two different mental calculations: "Is this product worth the price?" when the price came first, and "Do I like this product?" when the product came first.

Fading Pessimism

Despite these promising academic findings, marketers have been slow to use EEG and fMRI devices. In a survey of individuals from 64 neuromarketing firms, for example, only 31% reported using fMRI machines. "I know of three or four vendors who have made fMRI their main service offering, and they've all failed," says Carl Marci, the chief neuroscientist at Nielsen Consumer Neuroscience.

This reluctance is due in part to an overall pessimism regarding the technique's ability to generate useful insights beyond those offered by traditional marketing methods. In a 2017 article in the *California Management Review*, Ming Hsu, a marketing professor at UC Berkeley, wrote: "The prevailing attitude...can be summarized as... 'neuroscience either tells me what I already know, or it tells me something new that I don't care about.'" For example, brain scanning can show that the same beverage with different price tags may produce differing responses in test subjects, but so can simpler methods: A 2005 behavioral study found that people were worse at problem solving when they were served an energy drink with a discounted price than when they were served the same drink at full price. And do marketers really need to be told that people's brains react differently to Coke and Pepsi to understand the importance of branding?

Pessimism about brain scans hasn't been eased by infighting between cautious academics and enthusiastic marketers. In 2011 the branding consultant Martin Lindstrom published an editorial in the *New York Times* suggesting, on the basis of fMRI data, that the way iPhone users felt about their phones was akin to romantic love. Forty-four academics cosigned a letter to the *Times* pointedly critiquing the editorial.

This skepticism may soon fade, however, for two reasons. First, the science has advanced rapidly in the past five years and has begun to validate some of the audacious "mind reading" claims of Lindstrom and neuromarketing's other early proponents. Michael Platt, the director of the Wharton Neuroscience Initiative, says a team at the University of Pennsylvania is on the verge of demonstrating that at a neural level, people actually *do* love their smartphones the way Lindstrom claimed. As the science becomes more settled—and as more neuroscience PhDs leave academic labs for industry—brain scans are likely to become more popular with marketers.

Neuromarketing Techniques: An Overview

Neuromarketing requires specialized equipment and skills that are beyond the reach of most companies themselves. When executives are looking to engage one of the many suppliers of neuromarketing services, they should understand the most important features and differentiators of the techniques available.

	fMRI (functional magnetic resonance imaging)	EEG (electro- encephalogram)	Eye tracking: gaze	Eye tracking: pupilometry	Biometrics	Facial coding
How it works	detects blood flow in the brain associated with increased neural activity	records electrical signals on the scalp from neurons inside the brain	detects exactly where subjects direct their gaze	measures whether subjects' pupils are dilated	measures skin conductance, heart rate, and respiration	identifies facial expressions
What it reveals about consumers	<ul style="list-style-type: none"> detailed emotional responses level of engagement recall 	<ul style="list-style-type: none"> level of engagement recall 	<ul style="list-style-type: none"> what grabs their attention what confuses them speed of recognition 	<ul style="list-style-type: none"> level of engagement 	<ul style="list-style-type: none"> level of engagement whether their response is positive or negative 	<ul style="list-style-type: none"> general emotional responses: happiness, surprise, fear, anger
Uses	<ul style="list-style-type: none"> set pricing improve branding 	<ul style="list-style-type: none"> improve ads and branding 	<ul style="list-style-type: none"> improve website design, ads, and packaging 		<ul style="list-style-type: none"> improve ad content 	
Pros and cons	<ul style="list-style-type: none"> most expensive and invasive method less detailed than EEG but considered the gold standard for measuring specific emotions must be performed in a lab 	<ul style="list-style-type: none"> more expensive and invasive than many other methods not as precise as fMRI, but can measure changes over smaller increments of time 	<ul style="list-style-type: none"> relatively inexpensive and easy to administer best used in conjunction with biometrics does not measure emotions 		<ul style="list-style-type: none"> best used in conjunction with other methods, such as eye tracking 	<ul style="list-style-type: none"> relatively inexpensive

Note Prepared with assistance from Moran Cerf, of Northwestern University; Carl Marci, chief neuroscientist at Nielsen; and the Advertising Research Foundation

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Second, a series of academic studies have demonstrated that brain data can predict the future success of products more accurately than can traditional market research tools such as surveys and focus groups. For example, in 2012 researchers at Emory found that activity in a specific brain area, measured by fMRI while people were listening to music, significantly

correlated with a song's future popularity as measured by sales data three years later. But when participants were asked how much they liked the songs they heard, their responses did not predict sales. Studies have also found that brain scans taken while participants watched antismoking advertisements predicted the call volume to smoking-cessation hotlines, whereas traditional surveys of ad effectiveness did not. A team at Stanford University used fMRI to predict the success of microloan and crowdfunding appeals on the internet better than traditional surveys could. A team led by Moran Cerf, a neuroscience and business professor at Northwestern, predicted the success of movies with more than 20% greater accuracy than traditional methods can by using the synchronicity of EEG readings of audience members as they watched movie trailers.

These experiments show the benefits of neuromarketing over traditional approaches, which have significant inherent weaknesses: For example, respondents aren't always forthcoming about their memories, feelings, and preferences. People have flawed recall; they lie when they're trying to please or are embarrassed; their perceptions can be influenced by how a question is asked. "What comes out of our mouths is not always a perfect rendition of what's going on in our brains," Platt says. Market testing can overcome these shortfalls, but it can also be expensive to run, risks alerting competitors to innovations, and can be performed only late in the development process, when production and distribution systems are already in place. Compromise approaches, such as simulated markets and conjoint analyses, all involve some trade-off between cost and quality. "Neuroforecasting," as the Stanford neuroscientist Brian Knutson has dubbed the predictive power of brain data, seems to sidestep these problems.

Eye tracking and facial coding help improve the impact of creative content.

Still, these techniques have yet to work their way into standard marketing tool kits, because they're expensive and technically difficult to administer. Nonetheless, Uma Karmarkar, a neuroeconomist at UC San Diego, believes that in certain high-stakes situations—such as a major product launch by a giant consumer goods company—the incremental benefit over traditional methods makes brain scans worth the price. “What should be particularly exciting to marketers is the possibility that only a small number of people may be able to [accurately] predict how a large customer base will respond,” she recently argued. Cerf agrees: “When accounting for all the time, effort, cost, and quality concerns of the traditional ways of getting at the individual's views, neuroforecasting is actually a viable competitor.”

Measuring Physiological Signals

These advances notwithstanding, neuromarketers have been quicker to embrace less costly tools, such as eye tracking and facial coding. For example, Nielsen, one of the leading consultancies in a crowded field, says it uses eye tracking to help brands ensure that customers' attention is focused at the right moments and on the right things (a logo when it appears, for example), and facial coding to help ensure that an ad actually triggers the response it was designed to elicit (though Nielsen rarely uses any of its tools in isolation).

Indeed, the insights that physiological tools typically offer—whether, given a certain stimulus such as an ad, someone is feeling a strong emotion, is paying attention, and remembers the content—are particularly useful for designing advertisements. “Nothing is more important for advertising effectiveness than good creative,” says Horst Stipp, of the Advertising Research Foundation. “And there's clear evidence that neuroscience-based marketing research methods can indeed make advertising more effective.”

Many academics, however, prefer brain scanning to physiological proxies for their research. “My general view is that the further you get from the actual brain, the worse your measurements will be,” says Knutson. Nonetheless, physiological measuring techniques will most likely remain popular in industry, because they have

been around longer, are less expensive, require less technical expertise to administer, and can easily be paired with more-traditional marketing research tools, such as surveys, focus groups, and so-called implicit association measures (for example, the time it takes to respond after being asked a question).

The Neuro Sell

So should companies invest in neuromarketing—whether through brain scans or cheaper techniques? Some already have: NBC and TimeWarner have operated neuromarketing units for years; technology companies such as Microsoft, Google, and Facebook have recently formed units. Karmarkar says that in-house neurocapability is still out of reach for most organizations simply because of the expense but that smaller companies can look to partner with specialist consulting firms.

However, she and other experts warn that the field is plagued by vendors who oversell what neuromarketing can deliver. “There’s still a lot of snake oil out there,” Cerf says, adding that he has been approached by more than 50 companies with a “neuroscience offering” looking for his endorsement. “I only found six that meet a basic standard I would consider helpful for managers,” he says.

Industry groups are attempting to help marketers assess the value of various neuromarketing methods. For example, in 2017 the Advertising Research Foundation published a large-scale academic examination of whether neuroscientific tools were better at predicting market-level behavior than traditional techniques such as focus groups and implicit association measures: Scientists at Temple University and NYU tested traditional marketing studies against a variety of “neuro” methods, including eye tracking, heart rate, skin conductance, EEG, and fMRI. Subsequent analysis showed that fMRI provided the most significant improvement in predictive power over traditional methods but that other methods were useful for improving ad creativity and effectiveness.

Neural manipulation may seem creepy, but consumers are already being influenced.

Companies that are looking to partner with specialists to take advantage of these tools should manage those engagements carefully. To ensure quality input from neuromarketing consultants, Karmarkar recommends hiring in-house neuroscientists to oversee the work. Cerf says that a checklist can help in achieving high quality: Are actual neuroscientists involved in the study? Are any of the consultancy's methods, data, or tools published in peer-reviewed journals? Is the subject pool representative (a question that is particularly important for global brands)? Do the consultants have marketing expertise along with scientific knowledge? Do they have a track record of success? And can they prove that they will offer insights beyond what can be gleaned through traditional methods?

Changing Minds

Traditionally, marketers are concerned with more than simply measuring consumer preferences; they also try to change them. Neuroscience researchers are beginning to probe whether the brain can be used to influence purchases—an area of study that generates excitement and also ethical concerns. Here are some ways neuroscience might be used in the future to influence consumer behavior:

- *Better segmentation.* Marketers want to know which portions of a population are most open to their advertising and branding efforts. This segmentation is traditionally performed according to demographics (age and wealth, for example) or psychographics (impulsivity). It may be more fruitful to segment consumers by brain differences: A study by neuroscientists at INSEAD found differences in the brains of people who are easily influenced by marketing cues.
- *Sleep nudging.* Neuroscientists have learned that we are susceptible to influence during windows in our sleep. A 2015

study found that exposing smokers to the smell of cigarettes mixed with rotten eggs during “phase 2” (when the body prepares for deep sleep) led to a reduction in smoking for several days. Since then similar work has shown the ability to increase preference for certain products or promote certain behaviors.

- *Hormone manipulation.* Brain activity is influenced by neuromodulators—brain hormones (such as testosterone, cortisol, and oxytocin) and neurotransmitters (chemical messengers) that allow brain cells to communicate with one another. Researchers are currently investigating how consumer behavior changes when these neuromodulators are altered. In 2015 they found that dosing consumers with testosterone increased their preference for luxury brands; the researchers hypothesized that luxury goods represent social markers and that testosterone makes people more sensitive to status.
- *Temporary neural inhibition.* Transcranial magnetic stimulation (TMS) machines use magnetic fields to stimulate or depress nerve cells in the brain, temporarily “knocking out” certain areas in much the way a brain injury does. In 2011 neuroscientists used TMS to repress activity in the posterior medial prefrontal cortex—and found that doing so reduced the degree to which people exhibited socially conforming behavior. Moran Cerf has worked with individuals whose fear and disgust were suppressed or amplified to see whether they exhibited differences in their response to things that might normally be frightening (insects, say, or long-term disasters) and to learn what can be done to make people more susceptible to messages encouraging them to engage with those things—for example, to eat food made from insects, which are a good source of protein with low environmental impact.

Although neural manipulation may strike some as creepy, even dystopian, defenders point out that marketers already use tactics to influence consumers without their knowledge. “If a man sees an advertisement for a truck with a sexy woman standing in front

of it, he will be influenced by the extraneous model, even if he doesn't realize it," says Michael Platt, whose group recently organized a conference on neuroethics. "We should engage people in law and consumer protection to have these conversations. But I'm not terribly alarmed at this point." He and others point out that it's currently almost impossible to use neuroscientific tools to *physically* manipulate people's brains without their consent.

But other forms of manipulation are subtle. Cerf says his biggest concern is a lack of transparency around what's happening in neuroscience labs at major companies, particularly tech giants such as Facebook, Google, and Amazon. Some companies are already under scrutiny for running experiments without user consent—such as when Facebook manipulated nearly 700,000 users' mood states in 2012 by altering their newsfeeds without informing them. "My concern is if these companies go rogue," Cerf says. "Already they are hiring neuroscientists from my and others' labs, and yet I and others in academia have very little insight into what they are working on. I'm only half joking when I tell people that the moment a tech company introduces an EEG to connect with their home-assistant device—that's when we should all panic."

Even as marketers grapple with the ethical ambiguity, several start-ups in Silicon Valley are working to make brain imaging, in particular, more nimble and less costly. "A portable, affordable fMRI would be a total game changer," Cerf says. In the meantime, he and others say, the quest to understand the minds of consumers continues at a rapid pace, and marketers should at the least stay abreast of the basic science. "I look at how far the science has come in the past 15 years, and I'm astonished," Brian Knutson says. "We've come so far, so fast. And I really do feel like we're just scratching the surface."

Eben Harrell is a senior editor at Harvard Business Review.

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