

Neuromarketing: INSIDE THE MIND OF THE CONSUMER

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SUMMARY

Managers today are under tremendous pressure to uncover factors driving customers' attitudes and behavior. Unfortunately, traditional methods suffer from well-known limitations and have remained largely unchanged since their introduction decades ago. As a result, there is growing interest in brain-based approaches that may enable managers to directly probe customers' underlying thoughts, feelings, and intentions. This article provides practical guidance to managers on using these tools, focusing on two distinct uses: validation of existing insights and generation of novel insights. Throughout, we emphasize that managers should see traditional and brain-based approaches as complements, rather than substitutes, in understanding customers.

KEYWORDS: marketing, consumer behavior, marketing research

All the time and money and skill poured into consumer research on the new Coke could not measure or reveal the deep and abiding emotional attachment to original Coca-Cola felt by so many people . . . , and you cannot measure it any more than you can measure love, pride, or patriotism.

—Don Keough (1985)¹

Understanding how customers think, feel, and respond to a company's offerings has always been a tricky business. Surveys and focus groups, the workhorses for generating customer insights in these areas, are fast, inexpensive, and offer tremendous value for marketers. Even in the age of "big data"—where sophisticated marketing mix models can be used to track and predict everything from customer loyalty to returns—self-report measures are still vital for firms that look to understand and measure the forces driving customer attitudes and behavior.

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For many companies, however, acting on insights from these tools can still feel like a matter of faith. The canon, so to speak, goes something like this: customers are assumed to be able and willing to tell marketers what they are looking for; in turn, marketers are assumed to be able to ask the right questions to customers, then code, analyze, and interpret the data correctly, all before generating actionable insights. These shortcomings are well known. The *precision* of measures using introspection is often suboptimal for highly quantitative decisions such as those involving pricing and distribution. The *validity* of self-report measures can be severely compromised by a number of well-known shortcomings. Respondents have imperfect memory. The mere act of asking a question is known to change respondents' behavior. Highly sensitive questions are subject to misinterpretation or outright deception. Perhaps most worryingly, there are few ways to know with confidence when respondents are being truthful versus when they are not, and when marketers ask the appropriate questions versus when they do not. Therefore, despite the many strengths and successes of these tools, many managers may well conclude, as Don Keough did on his reflection on the failure of New Coke, that customer mindsets are simply too difficult to be able to measure with reasonable confidence.

In an increasingly customer-oriented era where business strategy depends upon customer insights to stay ahead of the competition, this lack of confidence poses important challenges for companies. First, rapid advances in measuring marketing return on investment (ROI) have led to a situation where firms prioritize strategies, such as pricing and promotions, that are, or at least appear to be, measured with precision. Amazon and Google, for example, routinely conduct A/B testing and experiments on a daily basis to check managers' intuitions and hypotheses before executing changes on a large scale.² Validation studies, however, remain challenging in many areas of brand and product management dealing with questions, such as about brand image and customer loyalty, that are strategically important but data poor. This had led to an ironic situation where, even as companies increasingly view marketing expenditures as sound long-term investments rather than short-term costs, actual expenditures increasingly emphasize short-term effects at the expense of long-term health.³

Second, the inability to trust customer insights gathered using traditional techniques can result in considerable skepticism and confusion within companies' ranks, often leading to difficult conversations between managers within marketing and those outside. In a recent study from McKinsey & Co.,⁴ one chief financial officer (CFO) was said to have held the sentiment that "[m]arketing has a vague status. We're going to give a certain amount of dollars to those guys. They're going to make ads and do whatever it is they do. And let's hope it generates demand."

Given these challenges, there is growing interest in alternative techniques that can address the inherent limitations of traditional approaches. In particular, recent developments in brain-based approaches have opened the possibility for marketers to directly probe and measure customers' underlying thoughts, feelings, and intentions. However, as is often the case with cutting-edge technology

in industries undergoing rapid transformations, there has been a widespread tendency to overestimate *both* effectiveness and limitations. The goal of this article is therefore twofold. First, it aims to provide managers with some basic knowledge of human neuroscience and brain-based methods. Given the vast scope and technical nature of the scientific literature, however, it will not attempt to provide a comprehensive survey of these topics, which can be found by interested readers in a number of excellent surveys that discuss these topics in greater depth from both neuroscience and consumer research perspectives.⁵ Second, it aims to provide an overall framework and practical guidance on how managers can use brain-based methods to understand customers and generate actionable insights. By viewing traditional and brain-based approaches as complements rather than substitutes, marketers and firms can combine them in novel and innovative ways in order to generate and validate customer insights that are fundamental to strategy formulation.

A Brief History of Brain Sciences in Business

Businessmen will eventually realize that customers are merely bundles of mental states and that the mind is a mechanism that we can affect with the same exactitude with which we control a machine in a factory.

—Hugo Münsterberg (1913)⁶

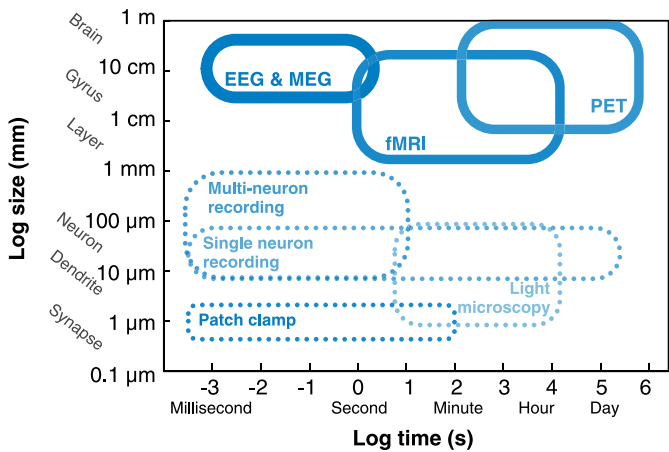
Despite its associations with modernity, the desire to look into minds of customers has a surprisingly long history, as captured in the above quote by Hugo Munsterberg, the father of organizational psychology, in 1913. It was not until nearly the end of the century, however, that biomedical imaging technology finally progressed to the point of allowing researchers to noninvasively measure and track neural activity at a spatiotemporal scale that reflects core features of cognitive and behavioral operations of the human brain (see Exhibit 1). In a relatively short period of time, these techniques have revolutionized basic scientific understanding of a number of fundamental aspects of human cognition—particularly the set of neural circuits underlying perception, attention, and memory (see Exhibit 2).⁷ Indeed, today it would be unimaginable for a researcher working in these areas to be ignorant of the underlying neural mechanisms, which were largely unknown merely a generation ago. Moreover, these findings have had tremendous influence on a number of applied fields—for example, the impact of memory research on eyewitness testimony, and the diagnosis and treatment of attention deficit disorder in psychiatry.

Perhaps surprisingly in hindsight, it was not clear at the time that these advances had much to offer to marketing. Gerald Zaltman at Harvard Business School was one of the first to appreciate this potential, and indeed obtained the first patent on applying neuroscientific methods to marketing.¹⁰ However, it was only when a group of neuroscientists, psychologists, and economists began to unravel the neural basis of financial and consumer decision making did marketing academics and practitioners take notice.¹¹

EXHIBIT I. Methods of measuring brain responses.

Although functional magnetic resonance imaging (fMRI) has garnered the most attention in the popular press, there in fact exist a number of methods to monitor brain activity across a variety of spatiotemporal resolutions.⁸ Unfortunately, the most precise methods—capable of measuring the firing of individual neurons or even the finer cellular and molecular changes within neurons—are almost entirely restricted to nonhuman animal research owing to their invasive nature. The figure below shows spatiotemporal characteristics of techniques measuring neural activity in logarithmic scale. Boxes in solid line represent noninvasive methods used to monitor human brain activity. Those in dashed lines represent invasive methods typically restricted to monitoring brain activity in nonhuman animals.

For studying healthy humans, the three most widely used methods are magneto-encephalography (MEG) and electroencephalography (EEG), the aforementioned fMRI, and positron emission tomography (PET). A common feature of these methods is that they measure brain activity indirectly. MEG and EEG capture electromagnetic effects of neuronal activity across large areas of the brain that propagate through the scalp and have excellent temporal resolution in the milliseconds but poor spatial resolution. In contrast, fMRI captures oxygenation effects of neuronal activation on blood flow and has superior spatial resolution (on the order of mm) but poorer temporal resolution on the order of seconds. PET, which uses radioisotopes to label molecules in the brain, has poor temporal and spatial resolution but can detect specific neurotransmitters of interest.

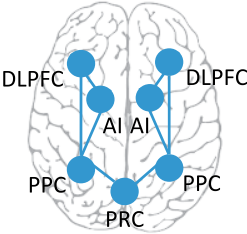
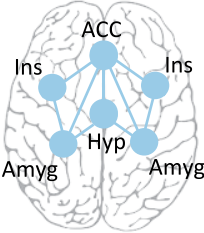


In commercial applications, EEG is currently the most popular method largely due to its being the least expensive method. In contrast, fMRI, which is widely used and more popular in scientific and clinical use, is less often used in marketing and other business-related applications. Finally, because of the high cost and need to inject radioisotopes, there has been little interest in PET for commercial use in neuromarketing.

Specifically, a few pioneering neuroscientists began to investigate the ways in which the brain responded to marketing stimuli, particularly those that are known to exert powerful effects on consumer behavior. An early example of this

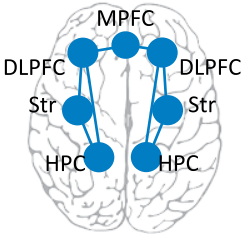
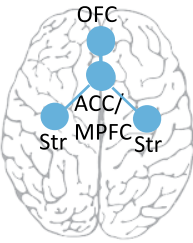
EXHIBIT 2. Functional neuroanatomy of cognitive and behavioral processes.

Each circuit consists of a collection of brain regions, whose coordinated activities are thought to give rise to some set of cognitive and behavioral processes. Although these circuits are abstractions of complex biological processes that have no simple start or end points, they have been invaluable to researchers because they capture and organize scientific knowledge in a parsimonious and tractable manner. We include here some of the basic neural circuits that are of relevance for consumer cognition and behavior. A number of other circuits, such as those involved in language, are omitted for brevity and can be found in cognitive neuroscience textbooks.⁹ For each circuit, we briefly describe what is known about their function and brain bases and their relevance for marketers and what needs to happen to more fully harness their value for marketers.

Neural Circuit	Description
Attention Circuit 	What is known: Enables the ability to selectively concentrating on a discrete aspect of stimuli, while ignoring other perceivable stimuli. When selection is driven by stimuli from the environment, such as a startling noise, this referred to as bottom-up attention, and it engages regions of the anterior insula (AI) and dorsolateral prefrontal cortex (DLPFC). Top-down attention refers to cases where selection is driven by consumer’s internal goals, such as while scanning a restaurant menu, which engages a set of regions including the DLPFC, posterior parietal cortex (PPC), and precuneus (PRC). Relevance for marketers: Consumer attention is one of the most valuable commodities in current competitive landscape, but remains difficult to measure. Moreover, existing marketing theories either assume no constraints on consumer attention, or lack the ability to make specific quantitative predictions necessary for practical use. Brain-based tools have the opportunity to improve precision and validity of existing measures, which can be used to measure marketing outcomes as well as to discipline theory.
Emotion Circuit 	What is known: Enables subjective feelings of emotional states such as fear, anger, joy, and sadness. Basic emotions such as fear and anger are thought to be shared with other mammals, and are known to depend on regions involving the hypothalamus (Hyp), amygdala (Amyg), as well as insula and ACC. More complex emotions such as shame and guilt remain little understood. Relevance for marketers: Emotions are one of the most powerful forces driving behavior. Not surprisingly, marketers have long sought to maximize positive emotional associations consumers have with a firm’s product offerings while minimizing negative associations. Unfortunately, scientific understanding of emotion remains fragmented and surprisingly contentious. We still lack scientific consensus on how to define and measure emotions, as well as how they affect choice. Substantial advances in conceptualization and measurement of emotional processes are thus highly needed.

(continued)

EXHIBIT 2. (continued)

Neural Circuits	Description
Memory Circuit  The diagram shows a top-down view of a human brain. Four blue circular nodes are placed on each hemisphere. On the left hemisphere, the nodes are labeled from top to bottom: MPFC, DLPFC, Str, and HPC. On the right hemisphere, the nodes are labeled from top to bottom: MPFC, DLPFC, Str, and HPC. Lines connect the MPFC nodes to each other, the DLPFC nodes to each other, the Str nodes to each other, and the HPC nodes to each other. Additionally, lines connect the MPFC node to the DLPFC node, the DLPFC node to the Str node, and the Str node to the HPC node on both sides.	What is known: Enables retention and retrieval of facts and events, including one’s autobiographical history and knowledge of the world (declarative memory) and execution of integrated procedures such as riding a bike (procedural memory). Formation of declarative memory traces depends on integrity of the hippocampus (HPC), whereas procedural memory depends on striatum. Upon consolidation, long-term memory is thought to be widely distributed across the cerebral cortex, and retrieved by prefrontal cortices, including DLPFC and MPFC. Relevance for marketers: Consumer memories of a firm’s brand and product offerings form the basis of all subsequent interactions between firm and consumer. Marketers invest substantially in shaping these memories across touch points. An immense amount is known about different forms of memory, the distinct ways in which they form and degrade over time, as well as how they interact and compete with each other. This knowledge remains largely untapped by the marketing literature.
Valuation Circuit  The diagram shows a top-down view of a human brain. Three blue circular nodes are placed on each hemisphere. On the left hemisphere, the nodes are labeled from top to bottom: OFC, ACC/MPFC, and Str. On the right hemisphere, the nodes are labeled from top to bottom: OFC, ACC/MPFC, and Str. Lines connect the OFC nodes to each other, the ACC/MPFC nodes to each other, and the Str nodes to each other. Additionally, lines connect the OFC node to the ACC/MPFC node, and the ACC/MPFC node to the Str node on both sides.	What is known: Enables the ability to make cost-benefit tradeoffs and decisions. Valuation circuit is the critical link between upstream processes such as attention to actual choice. Depends critically on the neurotransmitter molecule dopamine, which is released from the ventral tegmental area (VTA) and transmitted to the broader reward circuit including striatum, anterior cingulate, medial prefrontal cortex (MPFC), and orbitofrontal cortex (OFC). Relevance for marketers: Progress in understanding the human valuation circuit has come largely in the past decade, and has been instrumental in the application of brain-based approaches to marketing. There are two directions that can in particular further benefit marketers. First, examining the structure of neural computations in the context of choice behavior can improve existing models, for example by providing a mechanistic explanation for “irrationalities,” such as choice overload, the role of default options, etc. Second, a better understanding how different circuits interact would allow marketers to map whether and how channels and actions take differential routes to influencing consumer choice, and to optimize the marketing mix as a result.

is a now classic study patterned after the Pepsi Challenge in the lab of Read Montague.¹² In the study, participants were given either Coca-Cola or Pepsi while undergoing functional neuroimaging. When judgments are based solely on sensory information such that brand information was removed, brain activity in the orbitofrontal cortex, a key part of the valuation circuit, predicted participants’ preferences. Importantly, as in the Pepsi Challenge, brand knowledge for Coca-Cola, but not Pepsi, biased preferences and was associated with increased activity in parts of the memory circuit, including the hippocampus. Together, this and subsequent studies provided some of the first convincing evidence that, far from a mishmash of random brain regions, marketing stimuli and actions produce

systematic and interpretable effects on the brain. Most importantly, they captured the imagination of marketers and opened their eyes to a future where marketers can have direct access to customers' internal mental states.

As of this writing, there are over a dozen companies that use brain-based approaches as part of their primary product offering (see Exhibit 3). In addition to these companies, some of which are still in embryonic stages, brain-based approaches have attracted the interest of the mainstream marketing research industry—in particular, the Nielsen Corporation (which acquired Neurofocus, one of the first neuromarketing companies, in 2011), followed by Innerscope Research in 2015. While there is substantial diversity on the technological side, conceptually current offerings have in common that they focus on using brain states to infer hidden information that respondents are thought to be unwilling or unable to articulate to researchers armed with traditional self-report measures. These include using brain-based methods to capture, among other things, consumers' emotional responses to product design and advertisements, purchasing likelihood, and brand loyalty.

What Brain Sciences Can Do for Marketing

I don't ask why patients lie. I just assume they all do.

—Gregory House, MD (fictional character)¹³

Despite its intuitive appeal, there has been skepticism from the beginning about our ability to directly extract hidden information from neural data that are of interest to marketers.¹⁴ The reason is twofold. The first concerns the many functions a brain region may contribute to. Much ink has been spilled on the difficulty of inferring mental states from brain activity, often referred to as the “reverse inference” problem.¹⁵ For example, that a specific TV ad activates parts of the emotion circuit does not necessarily provide strong support for the ad being highly “emotionally engaging.”¹⁶ Insofar as these circuits as abstractions of biological processes, a single brain region can be grouped to belong to many circuits. For example, the amygdala can be variously classified as being part of the emotion, attention, memory, and valuation circuits (Exhibit 2). Such skepticism is even more pronounced when it comes to commercial applications, which are by and large based on proprietary data that have not been subject to peer review.

Although this complexity is sometimes seen as a drawback, it in fact serves an important purpose, and it underscores the interrelationship between these processes. For example, that the amygdala has functions critical for fear and alerting responses to novel or dangerous stimuli puts it at the core of the emotion circuit, but such functions are also critical for attending to, encoding and recall of, and weighting costs and benefits of such stimuli.¹⁷ That is, the complexity of the nervous system is such that, outside of basic sensory inputs, there is rarely a one-to-one correspondence between specific brain regions and mental states. This is particularly true for insights regarding abstract concepts such as “loyalty,” “love,” and “attachment” that are prized by marketers.

EXHIBIT 3. List of Neuromarketing Companies and Their Product Offerings.

Company	Product Offering	Data Sources
Brain Intelligence	Quantify emotions, moods, and perceptions in response to all forms of stimuli: media ads, products/packages	Eye Tracking; EEG; Galvanic Skin Response; EMG; Implicit Association Test
Buyology	Provide quantitative evidence of emotions, moods, and perceptions in response to all forms of stimuli: media ads, products/packages, shopper/user experience	Go/No-Go Association Task, Implicit Association Test, EMG, fMRI, EEG, Eye Tracking
FKF Applied Research	Analyzes emotions in real time through reaction to stimuli to help marketers understand customer attitude	fMRI
Forebrain	Analyzes implicit responses consumers have to marketing stimuli and how companies should use this for effective communication	EEG; Eye Tracking
Innerscope Research ^a	Analyzing conscious and nonconscious responses to media and packaging	Facial Coding, Eye Tracking, Biometrics, EEG, fMRI, Voice Analysis
Institute of Sensory Analysis	Determine emotions triggered by advertising; optimize user interface and physical consumer experience	Eye Tracking, EEG, EMG, fMRI, GSR
Keystone Network	Analyzes different aspects of consumer experience to understand unconscious behavior	Eye Tracking/Observation Cameras, EEG, GSR
Merchant Mechanics	Explain what customers think, feel, say, and do and the scientific underpinnings behind the differences in these actions	Eye Tracking, EEG, EMG, fMRI, Biometrics
Mindlab International	Examine nonconscious attitudes to find what underlies consumer motivations and decision making; how consumers connect with marketing and intended messages	Implicit Association Test, EEG, Eye Tracking, Biometrics, EMG, GSR
MSW Research (MSW/Lab)	Provides research and consulting based on neuro and other types of research specifically to create effective advertising messages and more long-lasting profitable brands	Facial Coding, Eye Tracking, GSR, EEG
Neurensics	Generate insights into consumer motivation by measuring brain activity from all sensory marketing stimuli	fMRI, Eye Movements
Neuro-Insight	Specialize in how the brain responds to communications through branding and the media	EEG/SST
NeuroFocus ^b	Measure real-time subconscious and conscious responses to understand response to marketing	EEG; Eye Tracking
Neurosense	Provide online consumer tests that allow for analysis of nonconscious thought processes as well as consulting based on these tests	Implicit Reaction Speed Tests; fMRI

(continued)

EXHIBIT 3. (continued)

Company	Product Offering	Data Sources
NeuroSpire	Examines the neural basis of attention, memory, emotion, and decision	EEG; Eye Tracking
Nielsen Neuro	Capture nonconscious aspects of consumer decision making with neuroscience tools	EEG; Biometrics; Facial Coding; Implicit Association Testing; Eye Tracking; fMRI
One-to-One Insight	Uses EEG to gain insights into how consumers respond to media at no prior engagement	EEG
SalesBrain	Focuses on using neuromarketing research to improves sales process	EEG, Eye Tracking, Facial Imaging, Biometrics
Sands Research	Generates neurological data in a marketing environment to measure emotional engagement	EEG, Eye Tracking, Biometrics

^aAcquired by Nielsen in 2011.
^bAcquired by Nielsen in 2015.
Source: neurosciencemarketing.com.
Note: EEG = electroencephalography; EMG = electromyography; GSR = Galvanic skin response; SST = steady state topography; fMRI = functional magnetic resonance imaging.

Second, unlike basic scientists, practitioners rarely have the luxury of controlling for the scores of confounding factors that academics take for granted. In fact, it is likely the case that the effectiveness of many marketing actions comes from the coordinated activation of multiple circuits. For example, highly successful ads are typically at once eye-catching, emotionally rich, and make for pleasurable viewing. In these cases, the urge to reduce the effectiveness of the ad to a single cause may well be both scientifically and commercially wrongheaded.

Trust, but Verify: Asking the Brain to Validate Customer Insights

One reaction, common to those skeptical of brain-based approaches in the first place, is to declare that unless and until these limitations are overcome, marketers have little to learn by looking into the brain. Although seemingly reasonable, this view overlooks the many possible ways that technology can be used to address real-world problems.

To illustrate this, consider the role of deoxyribonucleic acid (DNA) profiling in forensic science, in which variations in the genetic code are used to identify individuals. Like marketing researchers, forensic investigators deal with “messy” real-world settings that involve a mix of qualitative and quantitative data as well as randomized control trials that are challenging if not impossible to conduct. Both fields go through a set of stages consisting of problem identification (a death is reported, sales are down), evidence gathering (crime scene analysis, observational research), and actionable recommendations (arrest suspect X, increase advertisement to segment Y). Finally, and perhaps most importantly, both fields

involve a number of biases that affect the judgment on the part of the investigators, and variation in the ability and willingness to tell the truth on the part of responders.

Rather than being used to generate a profile of the suspect, however, DNA profiling has been revolutionary in its ability to test whether the suspect is the source of the crime scene DNA. As opposed to marketing, the importance of *validation* was taken for granted from the very beginning in forensics, perhaps because people are better advocates of their own innocence than marketing programs. This is so despite the fact that even today it remains extremely challenging to extract even basic physical traits, such as height or weight, from human DNA. That is, the inability to reconstruct the suspect profiles from DNA evidence alone has not made the impact of genetic testing on forensics any less profound. In the same way, the fact that brain sciences cannot as yet pinpoint the precise cause of a customer's behavior does not render it unusable for managers.

Recently, Chen et al. conducted a study showing how marketers can apply the same principles to customer insights generated using traditional self-report methods.¹⁸ The central idea of the approach is that, rather than taking the participant's response at face value, one can see whether what they say corresponds to what they are thinking. This approach is not new. In fact, it follows a long history in psychology where researchers submit introspective insights to critical testing by matching them to their neural signatures.

Specifically, the study used functional magnetic resonance imaging (fMRI) to test a classic conjecture in marketing that consumers anthropomorphize brands by attaching to brands a set of human-like characteristics, such as "down-to-earth," "exciting," or "rugged." Like most other intangible attributes of brands and products, these associations, referred to as brand personality, exist purely in the mind of the customer. Traditionally, they are measured using a scale developed by Stanford professor Jennifer Aaker, which has been highly influential in shaping how marketers think about how consumer relate to brands.¹⁹

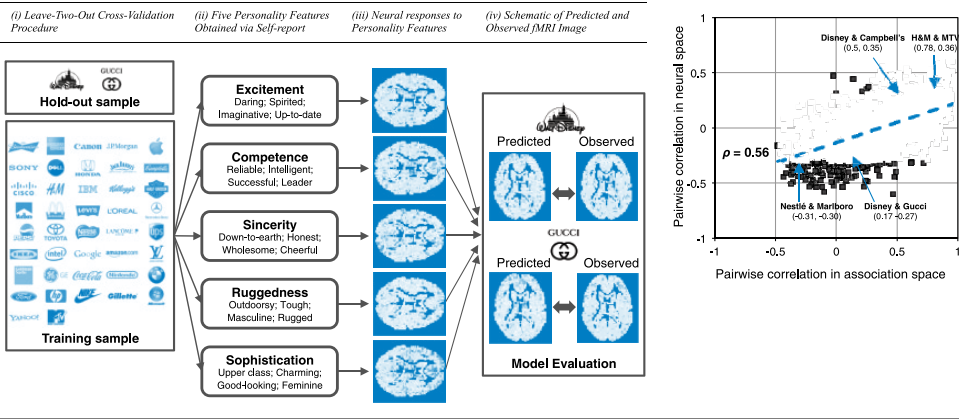
But do people actually think of a brand as "down-to-earth" when there are no market researchers around to ask? To see this, the authors asked whether participants' brain activities were consistent with their self-reported thoughts (see Exhibit 4). First, participants were scanned while they passively viewed four dozen or so of the most iconic global brands, including Apple, Disney, IKEA, BMW, and Nestlé. Following scanning, they rated the extent to which they thought each brand was associated with human-like characteristics, such as "sincere," "exciting," or "competent." Critically, participants were not made aware of the questions the experimenters would ask following the scan, nor were they presented with any explicit questions during the scan. This way, one can be confident their thoughts were not affected by the questions.

Next, using a set of data-mining algorithms, the authors related participants' patterns of brain activity to subsequent survey responses. That is, one can assess whether thoughts of "exciting" and "competent" crossed the mind of

EXHIBIT 4. Validating self-report measures using brain imaging.

(A) Schematic of analytical approach used to validate self-report measure of brand personality. (i) For each iteration, two brands were held out of the training set (e.g., Disney and Gucci), and model calibration was done using the remaining 42 brands in the training set. (ii) Neural signatures of brand association were estimated using brands' personality features derived from participants' self-reported ratings. (iii) Coefficients for the five personality features are depicted on a representative brain. (iv) Cross-validation is completed by using trained neural signatures to predict observed neural responses to holdout brands. The predicted image for the holdout brand is calculated as a linear combination of the personality features of the holdout brands, weighted by the estimated coefficients associated with each feature.

(B) Correspondence between neural and self-reported brand personality. For each brand pair, the correlation between predicted and observed brain images as evaluated from hold-out sample (y-axis) against similarity in brands' psychological properties as measured using correlation of self-reported trait ratings (x-axis).²⁰



participants when they thought about Google, which scored high on these traits, and whether thoughts of “sincere” but not “sophisticated” occurred to participants for Campbell’s Soup, which scored high on the former and low on the latter.

Good news for marketers using the brand personality framework: the study found that it has a good deal to offer in terms of uncovering how participants think about different brands. Specifically, neural data confirmed that when participants thought of Campbell’s Soup, traits like “sincerity” or “down to earth” were present in their brain activity, consistent with participant self-reports. In contrast, this would not have been possible if participants systematically thought about features that are unrelated to brand personality traits. This can be seen by comparing the performance of the brand personality scale with other scales that have similar statistical properties but do not contain information about brand personality. The brand personality scale performed significantly better.

Validation and hypothesis testing are the hallmarks of evidence-based management. In medicine, all diagnostic tools must undergo a rigorous process to ensure that they conform to the latest scientific knowledge. That is, these tools must capture some underlying characteristic—for example, cell type, protein level—which the medical community believes to be an important marker of health status. Without the ability to submit our hypotheses and tools to critical inspection, poor and sloppy practices go unchecked. Physicians take such procedures for granted. Marketers should accept no less.

Generate or Refine: Asking the Brain to Produce Novel Insights

In addition to validating insights from traditional methods, brain-based methods can be used to generate novel insights by providing new or improved measures for marketers. One particularly salient category concerns items that respondents are poorly equipped to provide the level of accuracy and precision that marketers desire. Consider the example of “engagement,” roughly defined as the ability of marketing content to capture the interest of customers. Prior research has explored a variety of techniques—for example, repetition, endorsements by popular figures, and testimonials—to measure engagement.

However, aside from being widely criticized for being inefficient and expensive, these measures suffer from an additional weakness in terms of their temporal precision. For example, in a TV commercial, marketers may wish to identify which are the moments of maximum engagement and which are lulls, or how different sections of the commercial play off of one another. These require a level of temporal resolution that would be extremely difficult to achieve with self-report.

In light of this, the fact that brain activity can be tracked without the need to ask subjects provides a means to address these challenges. First, it allows measurement of the entire consumption experience. In contrast, traditional self-report methods offer incomplete coverage and have unclear temporal resolution. Second, the fact that subjects are not interrupted during the consumption experience provides an additional degree of confidence that measurements are invariant to the subjectively perceived experience.

At first blush, using the brain to track something as abstract as engagement seems like a daunting task. Recent work from neuroscience, however, has discovered a class of brain-based measures with the potential to serve as a marker of engagement. The intuition of these measures is that, as engaging content triggers similar behavioral and psychological responses across individuals, this will be reflected in similar neural responses across people. Most importantly, these measures have been found to be highly predictive of subjective measures of engagement and memorability for a variety of stimuli. Thus, like validation studies, this class of measures obviates the need to pinpoint a precise “engagement” module of the brain, and instead focuses on complementing and building upon existing measures.

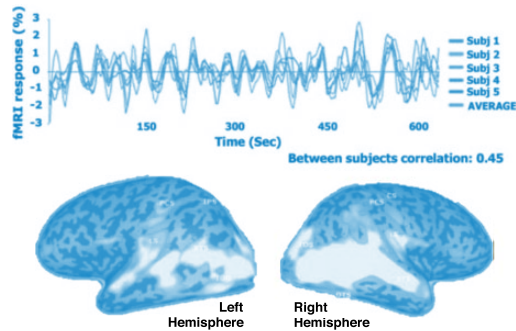
EXHIBIT 5. Using neural synchrony to track engagement.

(A) Neurosynchrony is measured using ISC, defined as the pairwise correlation between brain responses of all participants over the course of an experience, such as movie viewing. (B) Higher ISC captures moments where brain responses of participants change in similar fashion, and are distributed over multiple brain regions.²² (C) ISC can be used to capture moment-to-moment changes in engagement and segment differences, such as a Coca-Cola ad in the example.²³

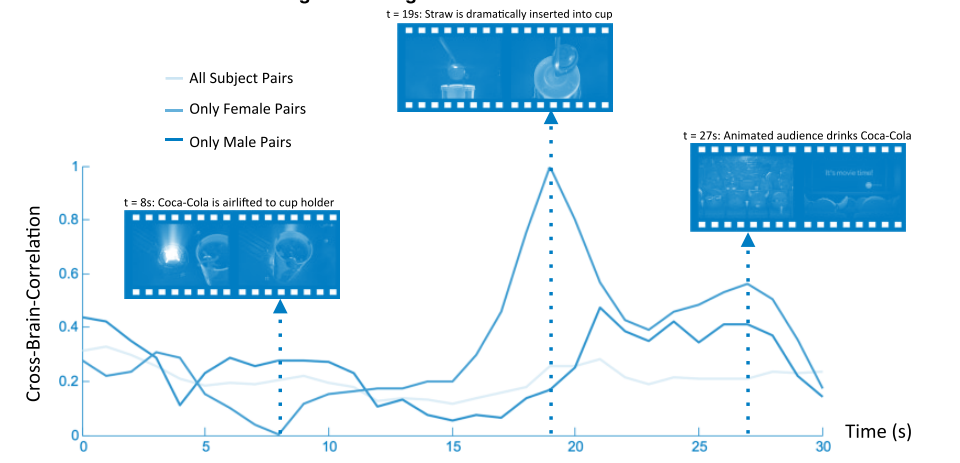
A. Schematic of Cross-Brain-Correlation



B. Neural Synchrony during Movie Viewing



C. Cross-Brain-Correlation during Ad Viewing



Referred to as intersubject correlation (ISC), these measures exploit the high temporal resolution of neural data to measure neural synchrony within groups of individuals.²¹ This refers to the similarity, typically measured in pairwise correlation, between multiple brains at a particular moment in time (see Exhibit 5). While brains might have lower activity in certain regions and higher in others at a given moment, this collective pattern could in fact be indicative of the effect of external content if it is influencing multiple brains in the same fashion.

Building on these measures, Barnett and Cerf were able to use an EEG to probe engagement during movie viewing experience in an AMC theater.²⁴ Unlike fMRI, the cost and portability of EEG measures provide a means to investigate experiential engagement in the field. Specifically, the researchers asked the extent

to which ISC predicted self-reported engagement and memorability of different ads and movie trailers, and the specific events and timeframes that drove engagement. Of the 13 movie trailers assessed, they found that the ISC was highly correlated with trailer recall ($r = .66$), as well as the specific time windows in which content was maximally engaging.

Although still in experimental stages, such measures can have a number of important managerial applications, ranging from segmentation and targeting decisions (when combined with clustering algorithms) to budgeting and expenditure decisions (for example, by quantifying the engagement value of one celebrity versus another). Barnett and Cerf found that subjects who prefer action films showed heightened ISC during scenes involving weapons compared with those who prefer drama or comedy genres.

Beyond engagement, a cursory look around the marketing landscape reveals a number of such widely used but hard to quantify concepts, including “top-of-mind,” “consideration,” and “awareness,” which can all benefit from increased precision in their measurement. Even in the area of sales forecasting, the traditional stronghold of marketing analytics, there is evidence of the utility of brain-based approaches. In a recent study involving the Advertising Research Foundation (ARF), teams of independent academic researchers compared the effectiveness of various methods of forecasting, including both traditional and brain-based approaches. Their results indicated that even though traditional measures provided good predictors of commercial effectiveness, fMRI measures were nevertheless able to improve the predictive accuracy significantly.²⁵

Learning New Tricks: Using the Brain to Advance Marketing Theories

Perhaps the most overlooked potential contribution of neuroscience to marketing lies in advancing current theories and frameworks of consumer behavior. Although the specific details are necessarily speculative due to a lack of historical contact between the two fields, consumer researchers stand to gain a great deal by simply noting the insights from cognitive neuroscience that have transformed our understanding of basic psychological and behavioral processes foundational to theories of consumer behavior. In a number of cases, core assumptions underlying theories of consumer behavior, including those pertaining to memory, attention, emotion, and valuation processes, have already been superseded by the aforementioned revolution in cognitive neuroscience.

In branding, for example, beginning with seminal works of David Aaker²⁶ and Kevin Lane Keller,²⁷ conceptualizations of brand knowledge and their constituent parts are based largely on models of associative memory developed in the 1970s and 1980s. Such models have been highly useful at generating novel and sophisticated theories of mental processes and explain a number of important facts about brand associations and managerial implications, such as brand extension.

This unitary model of consumer memory, however, ignored the now-consensus view that memory is not a monolithic faculty, but rather a collection of

relatively independent systems characterized by different patterns of learning, unlearning, and biases.²⁸ Memories for experiences, referred to as episodic memory, are fast-forming, context-dependent, and prone to distortions and degradation, whereas semantic memories, which contain facts and concepts that we know, are slower forming but extremely robust. There also exist a number of evolutionarily ancient systems such as those related to fear and reflex responses that play a still-mysterious role in human behavior.

Another example concerns the growing evidence that there are two interacting brain systems responsible for our decisions: a more evaluative, deliberative goal-directed system that corresponds closely to standard models of decision making used in marketing and economics, and a more automatic, reflexive habit system consisting of action tendencies that are largely prepotent and slow-to-modify.²⁹ Similar to consumer memory, these systems likely evolved to address different adaptive demands in our evolutionary history. As anyone who has held a conversation while driving a car can attest to, the two systems can operate independently but are also interacting or interfering with potentially important consequences. Similar examples exist for attentional and emotional systems, as well as less well understood but profoundly important biological processes such as those governing childhood development and aging, sleep, and stress.

Although these ideas have only started to infiltrate the mainstream marketing literature, it is not difficult to appreciate their potential implications for how marketers think about and measure concepts such as brand value. For example, that different components of brand knowledge are associated with distinct memory systems has implications for when and how often brand managers should measure these components of brand knowledge as well as the types of brand-building activities necessary to consolidate these memories. Likewise, the presence of these two behavioral systems may improve marketers' understanding of the development and breaking of consumer habits. Branding and marketing strategies that are ineffective may only appear to be so because they have not had sufficient time to break previous consumer habits. Likewise, encouraging current retention statistics may belie weaknesses in future retention, as when habits break, they may be difficult to rebuild.

What Is the Role of Brain-Based Approaches in Marketing?

Economists have the least influence on policy where they know the most and are most agreed; [and] the most influence on policy where they know the least and disagree most vehemently.

—Alan Blinder (1988)³⁰

The application of neuroscientific methods to marketing has a history that is brief in existence but long on controversy. In a particularly high-profile incident, the *New York Times* published an op-ed titled “You Love Your iPhone,

Literally,” by the brand consultant Martin Lindstrom,³¹ which prompted a group of 44 neuroscientists to co-sign a response letter condemning the article.

Whatever the scientific merits of the claims, and indeed the data have never appeared in a peer-reviewed format, at the heart of the study lies a set of questions of great interest to marketers, consumer researchers, and the lay public alike. Namely, what are the set of thoughts and feelings that occur when people think or interact with the products that they own or are considering purchasing?

Unfortunately, in our rush to debunk unscientific claims, we academic researchers have largely offered practitioners a list of what neuroscience cannot do for marketers. As can often be the case, we are more than capable of offering a list of “worst practices” to be avoided, but at the same time leave practitioners twisting in the wind when it comes to “best practices” that should be encouraged. The truth is that in any field, the wants and needs of practitioners far outstrip the ability of scientists to satisfy them. This is as true in marketing as it is in climate change, cancer treatment, or macroeconomics.

In an analogous way to the above quote from Alan Blinder, the prevailing attitude toward brain-based approaches in marketing in academic marketing can be summarized as one where, “neuroscience either tells me what I already know, or it tells me something new that I don’t care about.” This criticism, reasonable sounding as it is, is not so much misguided as incomplete. It implicitly pits traditional self-report and brain-based approaches in opposition to each other, and it overlooks the considerable complementarities that they have. Here then, is a belated list of what brain-based approaches can do for marketing (see Exhibit 6).

More broadly, by curbing the impulse to silo each tool within its own domain of application, an approach focused on maximizing the total value of one’s entire toolkit has the potential to substantially extend the strategic impact of marketing research as a whole. To illustrate this, consider the classic thought experiment in branding where managers are asked what would happen to a company like Disney if all its physical assets around the world were to disappear overnight, versus if all of its customers were to wake up without any memory of the company or its associations.

Widely used to demonstrate the importance of “intangible” assets in branding, there is typically little follow-up discussion of how a manager might practically measure these intangible assets, which are of course taken for granted in the case of physical assets. For example, what is the magnitude of the total loss? Which intangible assets are easier or more difficult to rebuild? Are there any hidden opportunities in having a blank slate? In these cases, what managers need is not only thought experiment that demonstrate the *existence* of value, but tangible tools that can be used to guide and formulate strategic actions. Given the scope and importance of these long-standing concerns, even a small step forward would constitute a productive and substantial advance.

EXHIBIT 6. Framework for using brain-based approaches in marketing.

Use brain-based methods to address high-level strategic questions, such as brand positioning, where uncertainty is often greatest and mistakes are most costly. Like other successful technology, brain-based approaches enable marketers to ask questions that were not previously feasible.

First, like A/B testing, brain-based approaches in marketing allow managers to take a scientific and hypothesis-driven approach to strategy formulation. Under this view, insights that are previously taken for granted as basis for actionable recommendation may now be critically tested as any other piece of raw material. Second, together with traditional techniques, they provide increased flexibility and allow marketers to ask how to maximize the joint value of the family of techniques available. Finally, as with other powerful technological advances, it will be critical for managers to take a customer-centric approach and employ brain-based tools to maximize customer value as opposed to short-term profitability. There is a long history of technological advances in marketing being met with suspicion, particularly in areas such as pricing where interests of firms and consumers are often in conflict and ethical issues abound. Only by aligning the interests of the many stakeholders will we collectively realize the potential of brain-based methods in revolutionizing how firms understand and serve their customers.

CUSTOMER INSIGHT GENERATION		CUSTOMER INSIGHT VALIDATION	
Goal Formulation & Conduct Research	Formulate Recommendations	Validate Critical Insights	Make Actionable Recommendation
What actionable insights are needed for decision-making? <i>Do tools provide the desired qualities for generating insights?</i>	What insights can be drawn from the data? What recommendations could be made based on the current insights?	What are the key insights that support recommendation? <i>Treating insights as hypotheses, how can they be validated?</i>	If yes, proceed with recommendation. <i>If no, trace problems through research goals, data collection, or data analysis.</i>

- Use brain-based approaches to complement traditional approaches, not to supplant them or silo each in its own application domain.
- Subject customer insights from focus groups, surveys, or ethnography to critical testing using brain-based methods.
- Use brain-based measures to improve precision and temporal resolution of traditional measures.

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Notes

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