NIELSEN JOURNAL of MEASUREMENT

OCTOBER 2016-VOL 1 ISSUE 2

FROM THEORY TO COMMON PRACTICE: CONSUMER NEUROSCIENCE GOES MAINSTREAM

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FROM THEORY TO COMMON PRACTICE: CONSUMER NEUROSCIENCE GOES MAINSTREAM

BY MICHAEL E. SMITH *VP Consumer Neuroscience*
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INTRODUCTION

On a typical day, the average consumer may be exposed to thousands of commercial messages, yet many of them won't succeed in breaking through the clutter, nor have any discernible impact on that individual's attitudes or behavior.

What separates effective advertising from that which fails to deliver a return on investment? Early thinking was that advertising worked by communicating relevant facts about the benefits of a product or service. Most believed that a rational consumer could then evaluate the value proposition of competing offerings in order to arrive at some welfare-maximizing conscious choice relative to his or her well-defined needs and desires. Large-scale studies of advertising effectiveness now have provided a robust body of evidence strongly suggesting that this is not the case.

What is becoming clear from more recent research is that effective advertising succeeds in eliciting an emotional response from consumers. For example, in a 2009 study reported in the Journal of Advertising Research, Binet and Field reviewed more than 800 ad campaigns in the U.K., each with clearly stated business objectives and "hard" business outcomes (e.g., sales, market share, price sensitivity, profit). To their surprise, the data clearly suggested that the more that emotions were at the center of the campaign, the bigger the business impact, and that the most positive outcomes for

advertising campaigns were often those that included little or no rational content at all. More recent converging evidence for this view has been reported by the consumer packaged goods industry, suggesting that advertising with emotional content is on average nine times as effective at driving sales than non-emotional advertising[1].

Measuring emotion in advertising is challenging, but it's become imperative for brand managers to find tools that dig beneath consumers' conscious responses to advertising, and instead measure their emotional responses. Thankfully, advances in neuroscience now are making this a reality. But as with every new tool, it's only possible to interpret the results properly when a solid theoretical foundation is in place. Before presenting the tools of consumer neuroscience and their practical applications, let's briefly review that theory.

THEORETICAL BACKGROUND

Prominent advertising and branding thought leaders, like Robert Heath, have promulgated a theory of "low attention" processing in advertising effectiveness. In this view, emotional advertising works at a non-conscious level, strengthening implicit associations to a brand that can influence subsequent purchase decisions. In contrast, advertising that requires a high level of attention and conscious thought can actually undermine brand relationships. Similarly, Byron Sharp, director of the Ehrenberg-Bass Institute for Marketing Science, argues in his book *How Brands Grow* (2010) that successful brands are those that enjoy a high level of "mental availability," and that advertising can nurture such ease of access by reinforcing simple, consistent, distinctive, and easy to remember brand cues that elicit an automatic, instinctual emotional response.

The findings of superior effectiveness of emotional advertising are consistent with a broad body of academic research related to the role of emotions in decision-making—work that has emerged in the fields of psychology, behavioral economics, and neuroscience in recent decades. For example, beginning in the 1970s, the psychologists Amos Tversky and Daniel Kahneman initiated a program of investigation that convincingly questioned the notion that humans are rational decision makers. Their research found that framing a scenario in terms that differed in affective or emotional intensity had a significant impact on decision making, despite the equivalent outcomes of offered choices. In *Thinking Fast and Slow*, the Nobel laureate Kahneman builds on this early research and a wide variety of other related work to argue that human decision-making is the outcome of two relatively independent cognitive systems: a "slow" system that is more accessible to consciousness and is deliberate, effortful, and rational versus a "fast" system that is less accessible to consciousness and is more intuitive, automatic, dependent on associative memory, and emotional. He reviews a variety of evidence to suggest that influences from the less accessible "fast" emotional system can have a disproportionate impact on the casual decision-making that is characteristic of everyday judgments and choices.

Growing evidence from neurobiology also provides convergent support for the notion that emotional responses play important roles in routine decision-making. In this view, emotional responses are automatic, coordinated, brain and body reactions to events in the mental environment. The emotional system is always on and always working. While in general the environmental event stimulus could be internal (e.g., a thought or memory) or external (i.e., as experienced by one of our five senses), marketers and market researchers are mostly concerned with responses to external stimuli (e.g., brands, products and their related consumer touchpoints). Emotional responses work by tagging sensory information for relevance, signaling importance and directing attention, memory and decision-making resources in the brain that ultimately impact some future behavior. When an individual is confronted with a stimulus that elicits an emotional response, information about that response is manifested in the body and is stored as a "somatic marker" in the prefrontal cortex (and several other parts) of the brain. This view is expressed, for example, by neurologist Antonio Damasio in *Descartes Error: Emotion, Reason, and the Human Brain*. The prefrontal cortex is one of the most highly evolved parts of our brains, and it has many connections with areas of the brain involved with emotions and valuation of information. When an individual is later confronted with a future similar experience, relevant prior emotion-based somatic markers are accessed from memory centers and provide non-conscious feedback to help inform decisions.

In the context of consumer behavior, such somatic markers may become integrated with the constellation of associations in the brain that constitute the individual's "brand knowledge." In marketing, an emerging goal of communications is thus to better leverage such emotional responses to create and amplify "meaning" and trigger emotional "approach" (as opposed to "ignore" or "avoid") motivations in consumers. Successful advertising is that

[1] *Source: WARC event report, "Procter & Gamble Validates Emotional Marketing," by Steven Whiteside, March 2015*

which can lead consumers toward lasting connections through memory associations with positive sentiment, and ultimately an endorsement or purchase of a brand, product or service.

This evolving understanding of the psychological and neurological bases of consumer decision-making presents a measurement conundrum. Traditional approaches to consumer insights have in part relied upon measurement of overt consumer purchase behavior in panels or at a point of sale, and in part on evaluating consumers' self-reports about potential motivational drivers of such behavior through focus groups and surveys. However, limits to the reliability of self-report measures of behavioral drivers have long been a concern, as they elicit only consciously accessible information from consumers. Obviously, when asked, people can usually provide "explanations" for their behavior. But the accuracy of such reports is compromised inasmuch as people lack direct introspective access to many of their internal cognitive and emotional processes.

A large body of research has demonstrated a lack of reportable subjective awareness of mental drivers of judgments and decisions. This limitation of self-report methods would appear particularly acute when trying to understand emotional factors in decision making, since much of the influence of emotional response occurs during non-conscious processing. But if self-report has serious limitations as an approach to understanding consumer behavior, what are the alternatives?

THE EMERGENCE OF CONSUMER NEUROSCIENCE AND ITS METHODS

Advances in basic and applied research on human behavior and neural information processing are not just providing new insights into the drivers of consumer behavior. They also are yielding new neuroscience-based tools that can help design more powerful communication approaches. Over the last decade, a growing consensus has emerged that measurements of brain and body physiology as well as rapid implicit response methods are now able to provide valuable information for understanding consumer behavior. Innovative creative teams and brand marketers have been leveraging such advances to improve their odds of winning in an increasingly complex and cluttered media environment. It has been our experience that at this point, most of the top consumer-facing marketers in the world have at least experimented with such methods, and several key leaders have begun to employ them on a routine basis.

The growing use of such methods in the commercial sphere has evolved into the market research sub-discipline of consumer neuroscience, an approach that is yielding new insights for evaluating and optimizing the effectiveness of marketing communications. Neuroscience-based approaches to consumer insights hold promise to help fill the knowledge gaps left by more traditional market research methods. By measuring relatively automatic behaviors and capturing physiological responses, the limitations and biases encountered in self-report surveys and focus groups are partly circumvented. As a result, adoption is growing quickly and becoming more mainstream. One reflection of such growth is the fact that, over the past several years, marketing departments at prominent business schools have begun to add scholars with expertise in consumer neuroscience to their marketing department faculty, and to add related courses to their graduate and undergraduate curriculums. In parallel, content related to consumer neuroscience has also been playing an increasingly prominent role in the conferences of long-standing market research industry organizations such as the Advertising Research Foundation (ARF) and ESOMAR. The field has even spawned its own nascent professional society, the Neuromarketing Science & Business Association, which already has over 1,600 members from more than 90 countries.

Consumer neuroscience, both as a commercial market research activity and a field of academic research, employs a wide range of measurement methodologies that originate in traditional experimental psychology and biomedical research settings. Here, we briefly describe some of those tools. We have categorized them based on what they are measuring, and how directly (or indirectly) they are indexing brain activity:

1. Tools that measure observable behavior

A first set of tools measure various aspects of observable behavior rather than a physiological response. Because it is relatively simple and inexpensive to implement them, they are among the more commonly used techniques in the commercial world. They are included here as consumer neuroscience techniques because, unlike traditional articulated survey responses, these types of behaviors are rapid and can be immediately influenced by factors outside of conscious control. Examples include:

Implicit Response Testing. This technique can be used to try to understand information—specifically semantic associations or "feeling states"—that individuals are unable or unwilling to verbalize. Consumers are provided a simple stimulus such as a word or picture to react to, and precise measurement of the timing of the responses (in the form of a rapid key press or other simple finger movement) can show non-conscious associations with brands and products. This technique has been widely used for understanding branding, brand and message positioning, ad messaging and responses to packaging, but is limited by the need to take measurement after exposure to the test stimulus.

Facial Coding. With advances in camera technology and computer vision methods, this methodology has recently been automated with near real-time software measuring the emotional facial expressions of consumers as they experience marketing content. Involuntary facial movements occur when a person experiences emotional states, and facial expressions are frequently viewed as near universal across cultures. The technique can be a useful diagnostic tool to understand whether a stimulus has elicited a specific facial expression (e.g., a positive smile or a negative frown) and is increasingly used as an aid to evaluate ad effectiveness. It must be kept in mind, however, that facial expressions evolved to communicate our feeling states in a social context and therefore occur at relatively low levels in the context of the passive media upon which the vast majority of marketing communications occur (i.e., television, internet, out of home signage).

Eye Tracking. Infrared cameras are used in eye tracking to monitor the direction of a consumer's gaze and eye movements and pinpoint where they are looking —whether on screen, on a store shelf or elsewhere. Screen-based studies often employ fixed-position cameras for eye tracking whereas ambulatory studies (e.g., in-store shopper studies) and studies of mobile devices usually employ head-mounted eye-tracking equipment. While eye tracking in isolation can provide specific feedback about whether consumers are noticing specific elements of advertising creative, packaging, or product placement in the way marketers intended, the approach often is used in combination with other technologies. The technique provides no information about the nature of the brain's emotional or memory response to the object of gaze.

2. Tools that measure some aspect of autonomic nervous system activity

Other common methods in consumer neuroscience use a variety of techniques to measure aspects of autonomic nervous system (ANS) activity. The ANS serves to regulate peripheral body organs in a largely automatic and non-conscious fashion, and thus includes control of heart rate, respiration, sweating and salivation, digestion, and a variety of other functions. Such measures are often collectively referred to as "biometrics," and they have been employed for decades in psychophysiology laboratories to observe changes in individuals in response to stimuli that are emotionally arousing, or tasks that require variations in mental effort.

Pupilometry. One long-standing biometric technique is to measure momentary changes in the diameter of the pupil of the eye in response to some brand communication, often performed in conjunction with eye-tracking studies. Pupil diameter is under ANS control, and small dilations in pupil diameter occur in response to presentations of increasing cognitive load or emotionally arousing stimuli. One challenge in pupilometry studies is that it is often difficult to differentiate what is causal, as the size of pupil dilation in response to changes in cognitive or emotional inputs is small relative to changes associated with variations in light intensity.

Heart Rate. An additional commonly employed biometric technique is the measurement of changes in the frequency and variability of heart beats. Heart rate can provide a robust measure of variations in arousal due to exposure to a stimulus of interest, or engagement in some task of interest. Inasmuch as variations in heart rate (and respiration) can be strongly affected by physical exertion, relying on it as a measure of emotional arousal in isolation can be difficult. However, with the trend toward wearable devices, heart rate is increasingly collected outside of controlled lab spaces and used in environments such as in-store and in-home studies.

Skin Conductance. Probably the most commonly employed biometric technique in consumer neuroscience is the measurement of electrodermal changes, or "galvanic skin response" (GSR). Skin conductance is a measure of electrical conduction from the ANS – typically measured on the palms or fingertips due to high concentration of special perspiration cells. When experiencing a fight-or-flight response, stress, emotional engagement, or other factors, skin conductance increases

from phasic changes in specialized glands and can be measured as an indication of arousal. As for heart rate, the trend toward wearable devices is making it possible today to collect skin conductance outside of controlled lab spaces.

3. Tools that measure changes in brain physiology

The most detailed and informative pictures of the consumers' internal brain response to marketing materials are those provided by measurements of the central nervous system (CNS), comprised of the brain and spinal cord. And, in particular, by methods that directly index changes in brain physiology. Although a variety of methods have been developed for measuring CNS activity, two in particular have played an important role in the field of consumer neuroscience:

Functional Magnetic Resonance Imaging (fMRI). Magnetic resonance imaging is a technique from neuroradiology that uses strong magnetic fields produced by large magnetoms, radio waves, and variable field gradients to non-invasively create highly detailed images of internal anatomy. Initially introduced in the 1990s, this technique is used to identify the level of oxygenation of blood in different regions as it changes over time. Active areas of the brain require more oxygen for metabolic purposes; by measuring localized changes in the oxygen level of the blood, inferences can be made about the relative functional activity of specific areas of the brain. By registering such activation maps with maps or atlases of structural anatomy, it is possible to make inferences of relative activation of specific brain structures.

Studies using fMRI methods have been used extensively in academic consumer neuroscience to understand mechanisms of memory, valuation, reward, and decision-making, among other interesting topics. Several factors have limited more routine commercial application of the technology, including the size and complexity of the equipment installations, the per-participant operational expense of the equipment, and the time needed to execute fMRI experiments and analyses. Furthermore, participants must lie very still on a horizontal gurney while their head is surrounded by the magnetom, which can cause claustrophobia and limit the types of behaviors participants may engage in.

At a more basic level, measuring brain blood oxygenation levels is an indirect measure of brain activity. Brain cells or neurons communicate through electrochemical signaling that occurs on a millisecond timescale. However, with fMRI, several seconds may elapse before enough brain activity occurs to induce an observable change in regional brain blood oxygenation. Most studies that have utilized fMRI to study materials such as television commercials produce a single brain map to characterize the ad as a whole. This, in turn, makes it difficult to gauge scene-level impacts over the course of the ad. Despite excellent spatial resolution, fMRI provides poor temporal resolution, making it difficult to pinpoint which second of an advertisement renders a specific response.

Electroencephalography (EEG). An alternative approach to assessing variations in CNS activity is the measurement of EEG (or "brain waves"), a technique that has now been widely adopted for routine commercial use. Typically observed at a distance from the brain by placing sensors on the scalp, EEG measures the mass effect of rhythmic current flowing between brain cells. EEG is typically sampled at a rate of hundreds of times per second. Abnormalities in the expected patterns of EEG rhythms are the clinical "gold standard" for diagnosing epilepsy, and changes in EEG patterns are commonly used for identifying levels of alertness during surgery and for understanding stages of sleep. Task-related changes in the EEG occur on a sub-second time scale, and thus brain responses to marketing materials can be captured with a high degree of temporal precision. However, EEG is not a true 3D imaging technique, and, as a result, pinpointing the sources of the signals to particular brain structures is generally not possible when the signal is recorded from the scalp.

While the field of consumer neuroscience is relatively new, studies of how EEG changes in response to mental stimulation have been conducted for over 90 years, and measurements of EEG in the context of advertising research have been conducted for more than 30 years. Most studies that use EEG methods to analyze advertising content use one or more spectral features of the ongoing EEG to determine whether that content requires effortful attention, is emotionally engaging, and is memorable. The corresponding metrics are benchmarked against an extensive library of basic and applied research literature.

For example, the shifting of attention in response to environmental cues, or the deliberate focusing of

attention in response to manipulations of task demands, are reliably associated with a reduction in the amplitude of certain types of EEG oscillations. Conversely, increases in the amplitude of those same oscillations are often seen during lapses of attention and boredom. There is also an extensive literature using EEG metrics to index emotional motivation or engagement. For the past 20 years, we have known that asymmetries of EEG indices of activation of the left versus right prefrontal cortices are associated with emotional experience. In particular, EEG indices of relatively greater left-hemisphere activation are associated with approach motivation (or being drawn towards a stimulus), whereas relatively greater right-hemisphere activation may be associated with avoidance motivation (that is, the withdrawal of engagement with a stimulus). Accordingly, frontal EEG asymmetry metrics of approach motivation have been shown to increase with arousing static images and engaging video advertising content. Such measures have also been used to predict virtual purchase decisions in laboratory settings.

The benefits of EEG are not limited to emotions: With respect to memory activation, changes in parameters of EEG during the viewing of television commercials have been shown to be correlated with increased likelihood of post-viewing recognition or recall of individual scenes, or brand and product information. Activating memory during marketing communications enables learning by creating and reinforcing connections to existing brand or product representations, so that the information can be utilized in future interactions, and it drives behavior such as future purchasing decisions. With measurements that can be made at a sub-second level, these dimensions of brain response can provide highly insightful scene-level diagnostics to help guide creative development.

The technical challenges and equipment expenses associated with EEG are relatively modest compared to those for fMRI. However, significant care and expertise are still required to draw meaningful insights. Foremost, EEG signals can be readily contaminated by non-brain and non-physiological artifacts from a variety of sources. To obtain the most reliable results, most routine testing must be conducted in highly-controlled laboratory environments, and sophisticated signal-processing methods must be employed to eliminate residual contaminants from recordings. Moreover, to make meaningful inferences from the EEG, the signals must generally be recorded from sensor arrays that cover the entire scalp, and applications are limited to static imagery (e.g., print ads or packaging) or short-form video (e.g., video advertising). Measurements obtained with highly-reduced sets of electrodes, or with equipment that is not medical-grade, or that are performed by personnel without significant training in the associated methodologies, have a high likelihood of being unreliable.

Broadly, the technologies used in consumer neuroscience can help explain and interpret brand performance more effectively than ever before. To date, these tools have perhaps been most extensively applied to the evaluation and optimization of early and late stage advertising. They have been widely used to inform package design and shelf assortments, as well as other aspects of the retail experience: point-of-sale materials, design of merchandising displays and aisles, pricing, and online experiences. In our own laboratories, neuroscience-based tools frequently have been used to evaluate product experiences, new product concepts and designs, and brand and product positioning. Finally, neuroscience-based tools are now starting to be used more frequently to explore the impact of full-length content experiences —whether in video format, print, or as web-based entertainment.

FROM LABORATORY OBSERVATIONS TO MARKETPLACE DYNAMICS

How do measurements made with such tools relate to broader-scale, real-world behavior? Can findings from small sample studies, typically performed in rarefied laboratory environments, predict how consumers might perform in the marketplace?

There are a growing number of studies in which small, laboratory-based samples have been used to predict population-level activity in the market. For example, using fMRI to measure fluctuations in regional cerebral blood oxygenation, Falk and colleagues (then at UCLA, now at the University of Pennsylvania) found that call-center volume for different public health direct-response advertising campaigns could be predicted by measures of brain reactivity in a small "neural focus group" of participants exposed to public service advertisements (PSAs). Interestingly, while measures of changes in activity from different brain regions—including the ventromedial prefrontal cortex—were found to be significant predictors of call center volume, the participants' subjective ratings of the relative persuasiveness of different pieces of copy were not significantly related to the outcome.

This suggests that the participants did not have accurate conscious insight into the relatively non-conscious, neural impacts of the PSAs. This same group of researchers have reported similar results for the predictive validity of neural measurements made for a variety of communications campaigns.

In one of the largest studies of this nature completed to date, researchers at Temple University collaborated with the ARF in a study sponsored by large advertisers and media companies to investigate the relationship between a wide variety of consumer neuroscience technologies and in-market sales lift, as estimated by market mix modeling. In that study, an area of the brain called the ventral striatum (typically associated with emotional or behavioral reward) was the strongest predictor of real-world, market-level response to the advertising tested. The team at Temple University also partnered with a team of researchers led by one of the authors (Marci, then at Innerscope Research) on a Super Bowl study that combined biometric responses with fMRI results. Results showed that ads that had very high levels of emotional response as measured by the biometrics also showed increased activity in the ventral striatum, as well as in other important emotional and memory centers—such as the prefrontal cortex, amygdala and hippocampus.

At Nielsen, in the context of collaborative client work, we have also conducted laboratory measurements of changes in emotional response and memory activation in response to exposure to television commercials. In particular, we've been able to model the sales lift associated with hundreds of television advertisements for which EEG-based measures of ad performance had been obtained in the laboratory, and found a close correlation between the two. That is, other factors being equal, creative executions that are significantly more neurologically engaging tend to yield above-average in-market sales lift for their brand. Specifically, creative executions that were above-average in the degree to which they engaged viewers were responsible for approximately 25% greater sales lift, whereas ads that scored below average on the EEG measures were associated with below average sales lift.[2]

In addition to advertising effectiveness, researchers have examined the degree to which laboratory studies of neural responses to entertainment content can generalize to population-level behavior. For example, several years ago, a group of researchers led by Gregory Berns at Emory University reported results from a study where they measured the fMRI response of a small group of participants who were scanned while they listened to 15-second clips of music. Ratings of subjective liking of those clips were not found to be linked to the sales potential of the music. However, neural measurements from regions of the brain associated with reward processing were found to be significantly correlated with the subsequent overall cultural appeal and commercial success of those songs (as measured by Nielsen Soundscan).

In another study recently reported in Nature Communications, a group of researchers using EEG-based methods examined similarities between lab participants who were asked to watch an episode of primetime television programming. They reported that between-subject similarities in EEG patterns were significant predictors of both variations in population-level program viewership (as measured by fluctuations in Nielsen TV ratings data), as well as variations in population-level Twitter activity related to that program (as measured by Nielsen Social).[3] Our own independent research has demonstrated similar predictions of Twitter activity from EEG-based measures of high-engagement segments of television programming across a range of programming genres.[4]

These are just some of the recent industry initiatives that provide strong support for the notion that laboratory measurements of consumers' responses obtained using neuroscience-based techniques can be robust predictors of population-level marketplace dynamics.

INTEGRATION OF METHODS

Fueled by early success stories, the discipline of consumer neuroscience developed rapidly over the past decade. As exciting new techniques were being developed or adapted from medical research to the commercial sphere, many neuroscientists and other research practitioners saw a chance to put them to use to answer a wide variety of marketing questions. In their enthusiasm, they sometimes failed to recognize that each of the various techniques in consumer neuroscience research has limitations as well as strengths, and that the most appropriate tool to use will be in large part defined by the nature of the problem to be solved.

By applying these tools too broadly, or by relying on one technology to answer too many questions, researchers

[2] *http://www.nielsen.com/us/en/insights/news/2016/were-ruled-by-our-emotions-and-so-are-the-ads-we-watch.html*
[3] *"Audience preferences are predicted by temporal reliability of neural processing". Nature Communications, July 29, 2014, 5: 4567*
[4] *http://www.nielsen.com/us/en/insights/news/2015/social-tv-a-bellwether-for-tv-audience-engagement.html*

sometimes ended up oversimplifying problems and overpromising solutions. That is, much like the old parable about a group of blind men and an elephant, the different measurement methods commonly used in consumer neuroscience research can each provide useful insights into how audiences respond to marketing messages. But no one approach provides a complete picture of the nature of the beast.

In order to circumvent the limitations imposed by individual measurement methods, we have been experimenting with a more holistic approach—one that combines a variety of methods to evaluate marketing communications. Our initial focus for this integrated approach has been on video advertising. Video advertising remains a powerful way for marketers to reach large audiences and to drive ROI. While the landscape for video advertising has changed dramatically in recent years (especially with digital providers creating avenues beyond traditional television), one truism remains: Executed well, video advertising is one of the most trusted advertising formats around, in both traditional and digital media[5]; Executed poorly, video ads just contribute to a cluttered media landscape.

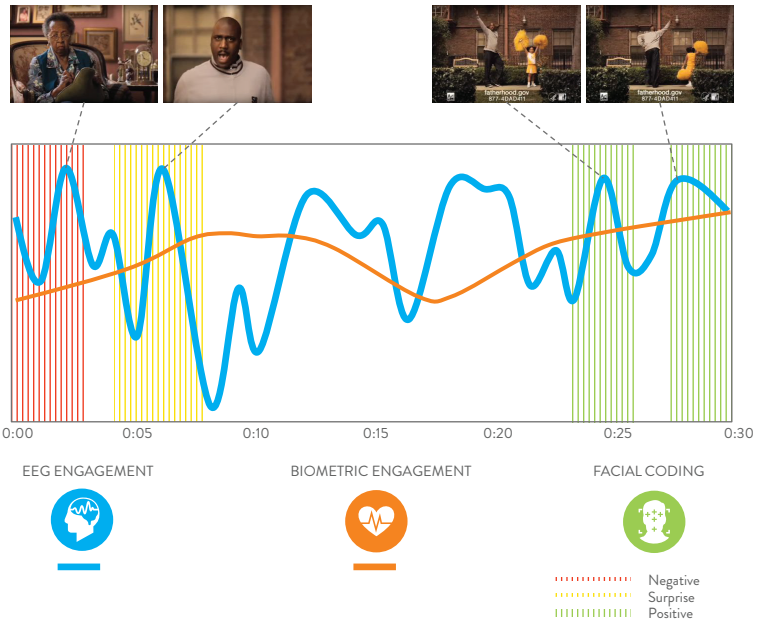
In an effort to improve consumer insights for video advertising and help advertisers increase ROI, Nielsen has been developing breakthrough methods for combining neurometric, biometric, eye-tracking, facial-coding, and self-reports into one comprehensive assessment tool. This integrated measurement approach, called Video Ad Explorer, recently has been implemented in Nielsen's global network of neuroscience laboratories, and is becoming the "new normal" for applications like video advertising. The quality of the diagnostics is beyond anything we had been able to achieve before, and the initial response from clients from a variety of advertising verticals has been very encouraging.

To illustrate this integrative approach, let's outline how we applied it to a particular public service advertisement. This was part of a study conducted recently in collaboration with the Ad Council[6]. For this project, we applied a full suite of diagnostic tools to past advertisements from the Ad Council's "Fatherhood Involvement" campaign, a long-standing and very successful campaign that seeks to inspire and support men in their commitment to responsible fatherhood.

The example case is from a 30-second PSA entitled "Cheerleader."[7] This was a humorous ad showing a father running through his grade-school daughter's cheerleading routine to help her to practice. While participants (all fathers) viewed the ad, a variety of measurements were made, including measurements of central (whole-head EEG recordings) and autonomic (GSR and heartrate) nervous system responsivity. Measurements of overt behavior including eye tracking and facial coding were also recorded, and participants also provided self-reports about the ad.

The PSA begins with an older woman sitting by herself in an apartment, scowling as she hears loud noises from outside. The camera pans outside to reveal a man enthusiastically engaged in a cheerleader song-and-dance, and then pans out more to reveal his small daughter following her father's example. After the midpoint, a voiceover intones "the smallest moments can have the biggest impact on a child's life." The pair repeats the cheer and the voiceover segues to a call-to-action that invites the viewer to call a number or visit a website for parenting tips and other resources.

FIG. 1: ANALYZING THE CHEERLEADER AD WITH EEG, BIOMETRICS AND FACIAL CODING



While subjective reports, in the form of a questionnaire, indicated that viewers enjoyed the ad, the neuroscience measures of viewer response painted a more complex picture of engagement (see Fig. 1). The biometric engagement trace revealed peaks of autonomic arousal during the reveal of the cheerleading father and daughter, and for the closing

[5]*http://www.nielsen.com/us/en/insights/reports/2015/global-trust-in-advertising-2015.html*
[6]*The Ad Council is a US-based non-profit organization that marshals resources and volunteer talent from advertising and media to create and deliver PSA campaigns*
[7]*The ad can be seen here: https://www.youtube.com/watch?v=hTIzjVxvV2U*

sequence. The EEG engagement trace (computed from EEG-based measures of emotional motivation, memorability, and attentiveness) showed a much more complex series of peaks while the viewers built a mental model of the ad narrative in response to momentary scene-level changes. Facial coding further suggested that the participants first mirrored negative emotion from the woman in the apartment, were then surprised when the father/cheerleader was revealed, and were amused/happy during the closing sequence. Eye tracking (not included in the figure above) provided further diagnostics by revealing competition between the actors and other key information (such as the dial-in number) during the closing sequence—suggesting a clear opportunity for optimization.

Differences between methods were of particular interest. The biometric results identified that there were two non-conscious focal points in the ad. The faster changes in the EEG provided a more granular basis to recommend scene-level adjustments. And the directionality of emotional expression provided by the facial-coding results allowed us to improve our interpretation of the EEG and biometric responses. However, it is important to also note that we recorded responses in the EEG trace in the absence of systematic changes in facial expressions, suggesting that facial coding in isolation would have missed significant neural changes. The level of details and insights gained from this multi-layer analysis made a big difference for the client and the agency that made the ad.

Collectively, what is emerging from such integrated results is the fact that they provide different and unique information about the patterns of consumer response associated with viewing video content. Taken together, the techniques of consumer neuroscience are helping overcome the shortcomings of earlier frameworks, and offer a remarkably accurate and detailed "read" of whatever combination of features a marketer wants to test.

FROM THE HALLS OF ACADEMIA TO THE CMO'S DESKTOP

It's a real breakthrough: From the halls of academia to the CMO's desktop, neuroscience-derived measurements are providing new insights into the how and why of effective marketing communications. And from video ads to in-store displays, from product packaging to emerging forms of marketing outreach, consumer neuroscience's much-improved diagnostics capabilities are rapidly making it an essential part of the creative process.

Does it mean that we have all the answers now? Of course not. Human beings are complex. We don't necessarily respond to the most obvious stimulus in an advertising message. We sometimes avoid the things we like, and seek out the things we don't like. The way we consume content is changing all the time, and competition for the hearts and minds of consumers is stronger than ever. We watch more and more content on small-screen mobile platforms, and we multi-task more and more. Our brain states in these situations are unlikely to be the same as when we're watching content on a big screen, or sitting down by ourselves in the comfort of our living rooms. Neuroscience tools need to be fine-tuned to capture consumers' reactions when they're on-the-go or being distracted. And more and more advertising campaigns are multi-platform efforts where it can be difficult to tease out the effect that each platform contributes to the overall impact of the campaign.

But progress is being made. In the coming years, a more comprehensive theoretical understanding of media consumption will emerge, and we will roll out new measurement tools and techniques to address new marketing challenges. Consumer neuroscience is not just a powerful research discipline today: it will play an integral part in defining the measurement solutions of the future.

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