It's Written All Over Your Face

Real Insight Into Human Emotions, Revealed by AI

White Paper Series

Sentient Decision Science

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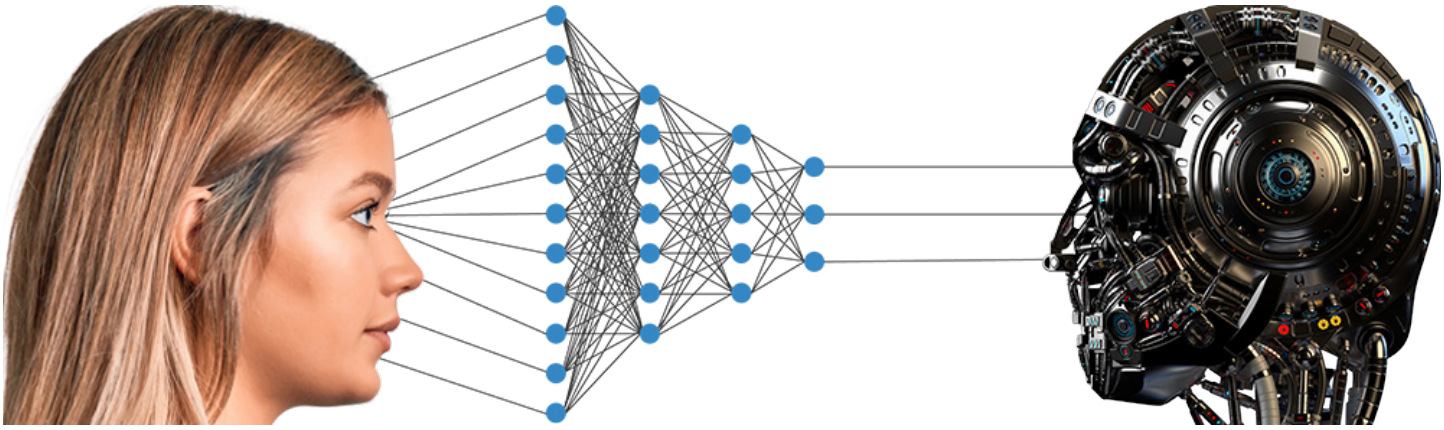
SENTIENT LABS®

Introduction



At Sentient we've found that emotionally evocative narratives generate more online views and greater social engagement. Automated Facial Action Coding allows us to recognize—at scale—when a narrative effectively engages a representative sample of viewers on an emotional level. We can then correlate real-time emotional engagement with measures of advertising's impact including true implicit attitudes toward the brand, brand attribute associations, and emotion-weighted discrete choice models that reliably predict real-world brand preference and willingness to pay. Through this rigorous, multimodal research approach, we get a comprehensive understanding of audience response to creative, allowing us to pinpoint the narrative elements that are changing attitudes and driving advertising effectiveness.

Emotions & A.I.

Today, the universality of facial expressions of emotion, and the use of advanced computer vision algorithms to recognize them at scale is being debated once more, largely due to the sudden emergence of powerful AI systems in everyday life. The emergence of AI has both contributed to excitement for advancements in technology, science, and business, and raised concerns about its potential to disrupt established institutions, economies, and social norms.

In particular, Facial Action Coding at scale, enabled by AI systems, has attracted renewed attention due to both specific concerns about misuse of this technology and widespread confusion about the distinction between the recognition of *facial expressions of emotion*, vs. the *recognition and identification of individual faces*. To understand best practices, appropriate use cases, and exactly what automated measurement of facial expressions of emotion contributes to a comprehensive understanding of human responses to media, let's review what Facial Action Coding is, and what it is not.

WHAT TO LOOK FOR

When applied *correctly*, FACS...

...is adaptable

Under the appropriate conditions, rigorously-trained human FACS coders are equally accurate regardless of the race, gender, etc. of the subject. Sophisticated AFER systems are built to overcome the inherent difficulties posed by the limitations of digital cameras and networks responsible for e.g., the racial biases famously discovered in certain face-recognition systems, and achieve human-level accuracy regardless of demographics.

...provides objective data on real-time emotional reactions and engagement during naturalistic media exposure

FACS technology allows experts to identify and track moment-to-moment emotional reactions to dynamic content, providing scientific evidence of unfiltered audience response to narratives without interference.

...is complementary to other metrics

For a comprehensive understanding of behavior and decision-making, FACS adds critical insight when combined with other approaches such as Implicit Priming, Discrete Choice, eyetracking, etc. Only Facial Action Coding can pinpoint the moments during real-time media exposure that explain changes in attitudes, preferences, and other KPIs recorded by other methods.

...uses sample sizes equivalent to any other quantitative method

Regardless of the methods used, the data collected from a very small number of individuals cannot be reliably projected out to a large population. As with any other research method, FACS requires sample sizes that are statistically representative of the population of interest to produce reliable results. Sentient does not endorse the use of FACS or AFER to interpret the reactions of any single individual to any particular stimulus in any context.

The Automation of Facial Action Coding

The Facial Action Coding System provides a systematized and exhaustive account of all possible changes in facial appearance produced by each of the 43 muscles of the face. The Facial Action Coding System (FACS) was developed in 1978 by Dr. Paul Ekman[1] and colleagues, and is the product of decades of quantitative scientific research. The behavioral science of facial expressions was founded on a global-scale investigation of human facial anatomy, physiology, and appearance, including methodologies as diverse as electrical stimulation of individual facial muscles, and collecting extensive videographic evidence of the influence of individual facial muscles on the appearance of the face.[2]

Investigations of changes in the appearance of the face caused by the contraction of individual facial muscles by Duchenne[3]—which had limited scientific value at the time—inspired generations of scientists to systematize the study of facial expressions of emotions.

Through this research, more than 40 unique facial Action Units (AUs) have been identified. Scientific analysis of facial expressions—whether manual or automated—has been used for a variety of purposes from marketing research to film animation[4]. Recognizing changes in the appearance of the face and determining which specific changes in facial appearance (AUs) are caused by each of the many individual facial muscles requires extensive training and significant time-consuming labor, performed either by professional FACS-trained coders, or automated through Artificial Intelligence. Accurate FACS-based coding of facial expressions is far more reliable than the untrained eye at identifying specific emotional states regardless of cultural norms and customs, gender, race, or ethnicity.

A handful of researchers have leveraged the dramatic improvements in computing power over the last decade to automate Facial Action Coding. A few early Automated Facial Expression Recognition (AFER) systems built with Machine Learning (ML) techniques[5] produced accurate results, but only performed well under nearly ideal or laboratory conditions. Over the last five years, a handful of researchers have developed AFER systems using Deep Learning (DL) methods that produce accurate results under a broader range of real-world conditions. As with any Artificial Intelligence system, Facial Expression Recognition is only as "intelligent" as the people who created it, and only as accurate and unbiased as the expertise and data guiding its development. While several companies have attempted to commercialize "face reading" applications, creating a *scientifically sound, FACS-compliant,* scalable Automated Facial Expression Recognition system, such as Sentient Expression, remains one of the most advanced and demanding challenges in computer vision.

WHAT TO AVOID

FACS is *NOT*...

...for amateurs

The Facial Action Coding System is detailed, rigorous, and applied meticulously. For example, FACS contains strict rules defining an array of conditions that may produce false or misleading changes in facial appearance such as motion, lighting, chewing and talking, or medical conditions that alter the appearance of the face, such as Bell's palsy.

...a 100% reliable indication of every individual's emotional state at every moment in time

Facial Action Coding does not assert a 1-1 correspondence between facial expressions and emotions, however a small number of distinct facial expressions common to all humans do communicate internal emotional states accurately most of the time. Contextual factors—such as responding to stimuli in a social context—can strongly modify human behavior, including facial movements. However, when responding to stimuli in private or amongst trusted friends, facial expressions of emotion are extremely similar regardless of an individual's social-cultural background.

...appropriate in many use cases that might intuitively seem reasonable

For example, experts can't accurately determine someone's guilt or innocence on the basis of facial expressions produced during high-stakes interactions with law enforcement. Likewise, the universal facial expressions identified by FACS are not necessarily present each and every time an emotion is internally felt–therefore AFER systems on their own do not make good substitutes for input devices like computer keyboards.

...the same as *facial recognition*

The analysis of facial expressions does not rely on or necessitate recording of the facial features that might be used to uniquely identify an individual. FACS is only concerned with specific changes in the appearance of faces from moment to moment, and relies on facial features that we all share. Importantly, modern AFER systems that adhere strictly to FACS utilize neural network models and other algorithms that are extremely poorly suited to the task of identifying individual faces. Facial recognition algorithms are in fact far less computationally intensive, with the consequence that attempting to use neural network based AFER systems to uniquely identify faces would be so enormously inefficient as to render this approach useless for any practical application.

Leveraging FACS in MRX

How can brands use facial expressions of emotion to better understand their audiences?

While the reliability of facial movements as indicators of emotional experience has always had its challengers, correct implementation of FACS has proven its worth empirically over thousands of real-world tests.

Using Sentient Expression, we can determine whether (and how) audiences are engaged by dynamic media in real-time, in their natural consumption context—the missing link in our understanding of real-world consumer response to advertising.

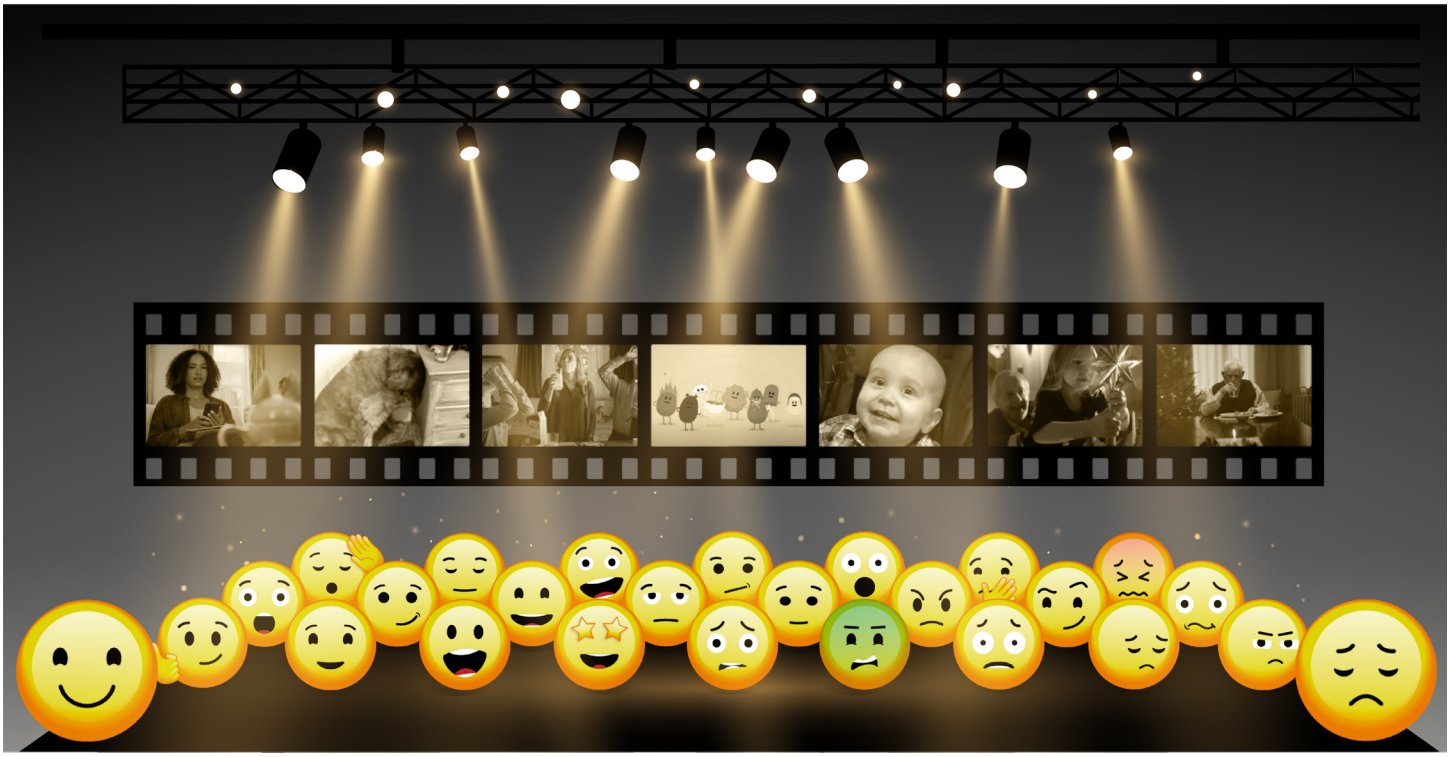
With the large percentage of advertising spend brands waste, creative teams are looking to advanced behavioral science research to uncover the real drivers of human behavior, gain evidence-based explanatory insight, and advance the predictive accuracy of pre-market testing. When collected and used properly, FACS data allows brands to identify opportunities to improve creative assets by opening a window on viewers' real-time experience of dynamic media. Creatives can now understand whether viewers are really drawn in to their story and pinpoint the moments that connect audiences with narratives, drive Engagement, and change attitudes.

Importantly, real-time emotional responses can demonstrate whether a narrative is received as intended by creatives, e.g. whether the audience empathizes with a character's misfortunes, shares in a hero's triumph, or just 'gets the joke.' While it's popular to imagine that advertisers should work to identify a specific emotion (e.g., happiness or sadness) that is most effective in driving consumer preference, the reality is that ads succeed when they engage viewers in an emotional journey. Whether that journey is joyful, sad, pleasant, funny, bizarre, or even disgusting, the key is that the narrative connects with the viewer's imagination and leaves a memorable brand impression.

> "Half the money I spend on advertising is wasted. The trouble is I don't know which half.
>
> - A maxim of obscure origins, put in famous mouths.[6]

Compelling Narratives Come in All Shapes and Sizes

A sampling of the diverse cast of noteable narratives in advertising...



Looking across famous examples of highly effective, viral messaging, nearly all evoke a range of emotions over the course of their narrative arc, frequently combining emotional elements from opposite ends of the spectrum of emotions from positive to negative, and from low to high arousal.

Advertising Examples

- IKEA - "Silence the Critics"
- Google - "Teach an Old Dog New Tricks"
- Mint Mobile - "Chunky Style Milk? That's Not Right"
- Metro Trains Melbourne - "Dumb Ways to Die"
- St. Jude Children's Research Hospital
- DocMorris - "Take Care of Yourself"
- EDEKA - "Come Home"

Conclusion

Whether you're seeking to draw attention to important social issues, or looking to boost preference for your brand, effective narratives must engage viewers and leave a memorable impression that includes your brand, product, or message. Over thousands of real-world tests of pre-market and in-market media, gathering real-time responses from hundreds of thousands of diverse respondents around the globe in their natural, everyday viewing contexts, Sentient Decision Science has amassed a definitive database demonstrating the practical utility of properly-executed Automated Facial Expression Recognition for the optimization and robust prediction of the behavioral and attitudinal impacts of creative content.

Sentient's Subtext test methodology provides robust prediction of impacts on behaviors and attitudes, as well as explanatory, diagnostic value from real-time emotional responses to narratives in viewers' natural media consumption environment.

It's important to remember that there's no silver bullet, key emotional target, or 'one weird trick' for creating engaging and persuasive content. The universe of possible narratives is infinite, but what successful narratives have in common is the ability to engage viewers and 'bring them along for the ride.' Looking across the pantheon of the most impactful creative outputs, nearly all evoke a range of emotions over the course of their narrative arc, frequently combining emotional elements from opposite ends of the spectrum of emotional valence.

There is no single formula for creating effective messages—as culture, human needs, and the world around us evolve and change over time, effective engagement with audiences will always require the insight and expertise of innovative, talented storytellers who can connect with their intended audience and offer something novel, meaningful, and compelling.

While we can't prescribe one particular structure for messages that break through and resonate, advanced methods and proven technologies from the Behavioral Sciences can provide a game-changing advantage. **We're now able to leverage objective, scientific measurement of real-time audience responses at scale to identify the real reasons your creative content connects (or fails to connect), optimize your content across platforms and formats, and accurately predict which creative executions will be most successful—helping you avoid costly mistakes and maximizing the impact of your messages.**

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For more information on how Sentient uses Automated Facial Expression Recognition for marketing research, contact us at info@sentientdecisionscience.com.

About the Author

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Since 1995, Dr. McCandless has specialized in Neuroethology—the study of brain function during natural behavior and stimulation—with a focus on motivation, goal-directed behavior, navigation and spatial orientation, gaining extensive experience in the direct investigation and analysis of the neurophysiological systems underlying the structure and causes of behavior, as well as non-invasive brain imaging methods such as fMRI and advanced computational modeling and statistical analysis of dynamic systems. Dr. McCandless created the Machine Learning and Deep Learning models at the heart of Sentient Expression® which powers the industry-leading ad testing product, Sentient Subtext®.

Dr. McCandless is the recipient of four competitive federal awards to support his research into the neurophysiology of behavior and cognition. He has published in major peer-reviewed journals, and presented his work at national and international conferences.

Dr. McCandless earned his A.B. in Psychology at the University of Chicago, M.S. in Neuroscience from the University of Pittsburgh, and Ph.D. in Neurobiology from the University of Pittsburgh School of Medicine. He also holds a Certification in Cognitive Neuroscience from the Center for the Neural Basis of Cognition, a National Science Foundation Center of Excellence.

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