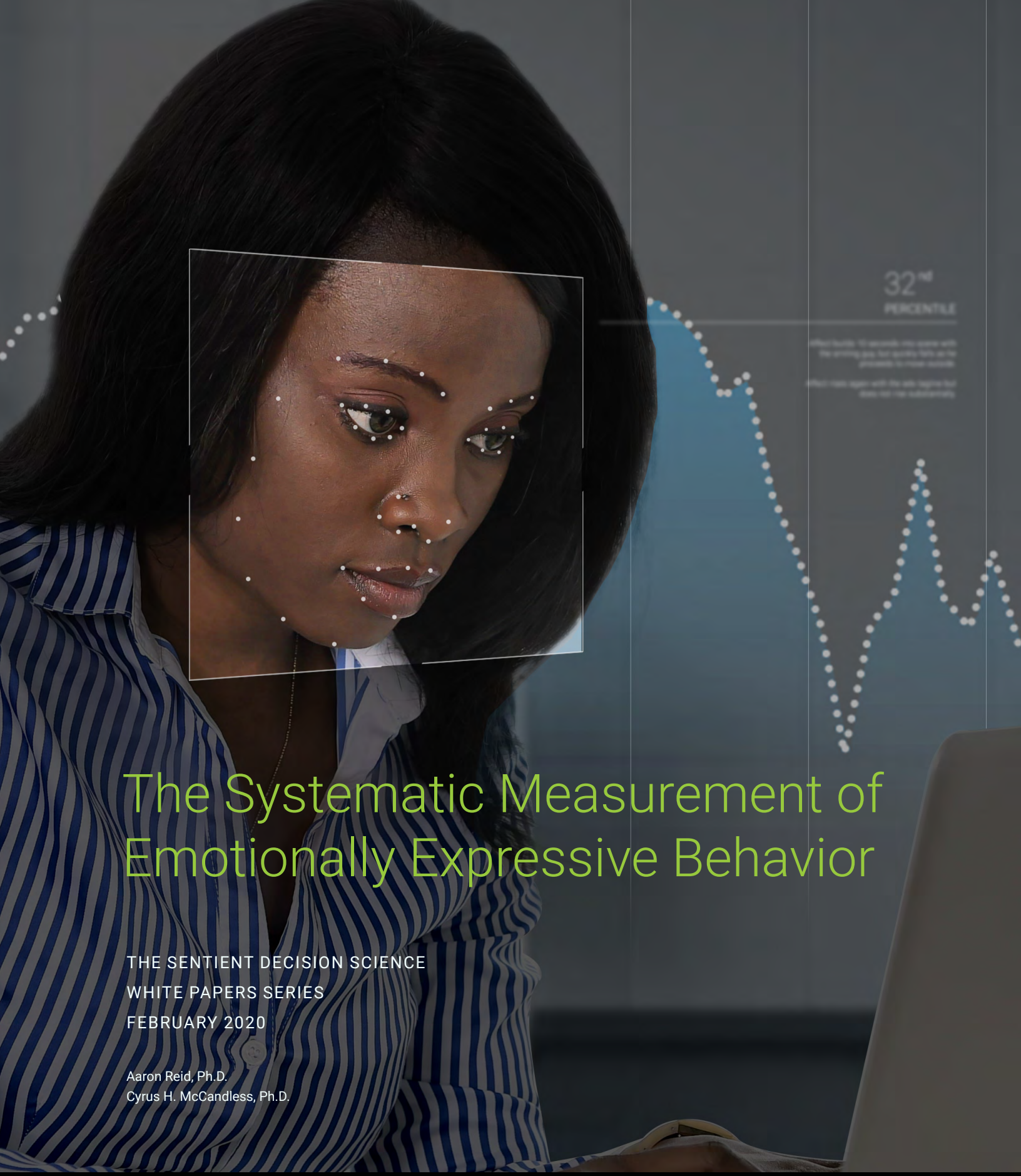

The Systematic Measurement of Emotionally Expressive Behavior

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I. Introduction

Our understanding of the human emotional experience is about to deepen. Rapidly.

The automated coding of expression of emotion has opened up datasets for analysis that were previously thought to be intractable in scale for manual coders. These technological advances have marched in sync with scientific advances on the validity of coding expressed emotion. New insight on emotion has come from important theoretical shifts, statistical modeling innovation, and data visualization techniques. And now, the most advanced research is cataloguing at least 28 human emotions that are reliably expressed through multimodal signals involving the face, body, gaze and voice.

At the center of this deepening understanding, is newly created intelligent technology that can detect and quantify expressions of emotion. With this technology, we have begun rapidly processing and classifying images and videos according to emotionally expressive content and context. These emotional datasets provide a new layer of explanatory depth on the big data landscape. The predictive power of cognitive and past behavior based datasets is improved dramatically by adding emotion based data streams.

This new reality places Marketing Research and Insights professionals in a unique position.

We know how to analyze big cognitive data.

We know how to analyze big behavioral data.

And, while we still have much to learn, we are the early leaders in analyzing big emotional data.

If the indsutry decides to walk away from automated coding of expressed emotion, because it either doesn't fit with existing research firm business models, or because we're still caught up in a 50 year-old debate (see Feldman-Barrett et. al., 2019) [1], we're going to miss our next great opportunity: becoming the experts at analyzing big emotional data. And that data, is about to become abundant.

In this paper, we make the case the for the valid, reliable and practical use of facial action coding.

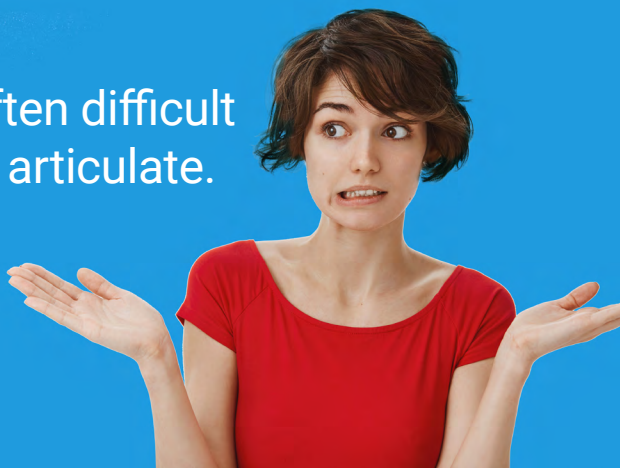
[1] Source: Feldman-Barrett et. al., 2019

II. The Issue Facing Marketing Research and Insights

Emotional experiences are complex phenomena that are:

a) Sometimes embarrassing to admit.

b) Often difficult to articulate.



Current methods of asking consumers to describe how they feel often return inadequate and inaccurate data.

Beyond simple descriptions, explaining how emotional experiences will influence our future behavior is even more challenging for a lay person trying to introspect and project into the future while taking a survey.

To advance human understanding of the experience and expression of emotion, we need to use the most advanced measurement techniques and ground our work in the most advanced academic understanding of emotion (see Cowen et al., 2019). [1]

To illustrate the power of advanced emotion measurement in Insights, we need look no further than advertising effectiveness research.

In the following study of over 200 ads, with 14,000 consumers, three distinct data types evaluating the experience and impact of each ad were obtained:

1. stated opinion of the ad

2. emotion expressed on the face

3. implicit associations with the brand

We were keen to understand if any of these measures of emotion would be related to how people engage with adver-sting. Which measures best predict the virality of an ad?

[1] Source: Cowen et al., 2019

What we wanted to know:
which measures best predict the virality of an ad?

Behavioral data on the success of each ad including number of online views, number of social shares, and total digital share of voice served as our dependent variables for analysis.

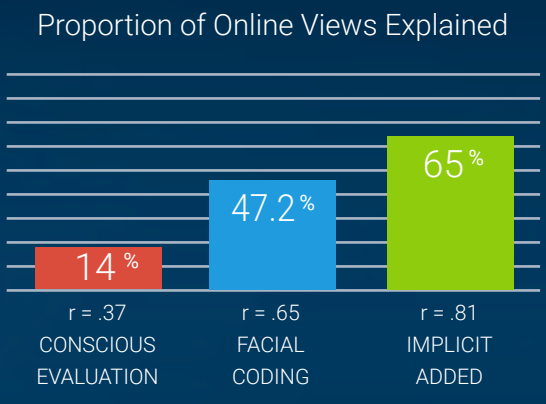
Ninety-five percent of people say advertising does not affect their behavior, and yet we turn around and ask those same people how our ads influence their behavior. Is it any wonder that expressed opinion of an ad is not predictive of the success of that ad? In fact, a standard Likert scale evaluation of an ad accounts for only 14% of the variance in online behavioral interaction with the ad.

Perhaps not surprisingly, adding expressed emotion on the face while watching an ad increases the correlation with behavior to .65 accounting for 47% of the variance. Finally, including the implicit impact of the ad on perceptions of the brand, explained 65% of the variance in number of online views of the ad.

When we look at the model that includes facial coding of emotion data and see that it accounts for over 3x the amount of variance in behavior than the conscious evaluation alone, we can't help but wonder:

If these measures of emotional expression outperform the standard explicit question approach in marketing research, why is there any question whether these measures are valid and useful for understanding the impact of emotion on behavior?

Three years, 200 ads, 14,000 consumers.
Facial coding is 3X more accurate than stated opinion in predicting whether an ad will go viral.



Source: Sentient & iSpot.tv testing 200 ads.

III. Is Facial Coding Valid? *Where the criticism comes from and why it's hindering advances in understanding the human emotional experience.*

The foundational work on emotionally expressive behavior began with Darwin, where he detailed his observations of over 40 expressed emotions, and was formalized by Paul Ekman in the late 60's. Ekman and colleagues observed cross-cultural similarities in the recognition and labeling of six basic emotional expressions on the face.

This seminal work inspired so much research that 50 years later, prominent psychologists are still trying to make the argument that this conceptualization of emotional expression is incomplete.

However, there is an important distinction to make here. If an explanation is incomplete it does not also mean it is invalid. In fact, this is the one of the easiest arguments to make in all of behavioral science: "your measure doesn't account for all of the variance we're trying to explain".

All measures of something are incomplete measures of that something. Concluding that current measures of a behavioral phenomena are incomplete accounts of that behavior, is a claim that can be made about all measures.

One problem for that literature is that the argument is no longer of interest to the scientists who are rapidly advancing our understanding of the human emotional experience.

A bigger problem, though, is that the conclusions drawn from that criticism are not well articulated by the authors and are being erroneously amplified by those with vested interest in the measurement technique not being valid (e.g. companies with business models built on other, less scalable measures, or competing cognitive assessment techniques).

Of course, research in an area as interesting as human emotion has progressed over the past 50 years. More complete accounts of emotional experience and expression have revealed a multidimensional emotion space. Behavioral (Cordaro et. al 2019) and physiological (Kreiberg, 2010; Shenhav & Mendes, 2014) measures are now being used to more accurately classify emotional experiences across taxonomies of at least 25 distinct emotions.[1]

This more advanced view of human expression has strong ecological validity, and accounts for more variance in human emotional experience than the theories advanced by the critics of discrete emotion theories (e.g. Feldman-Barrett et. al., 2019).[2]

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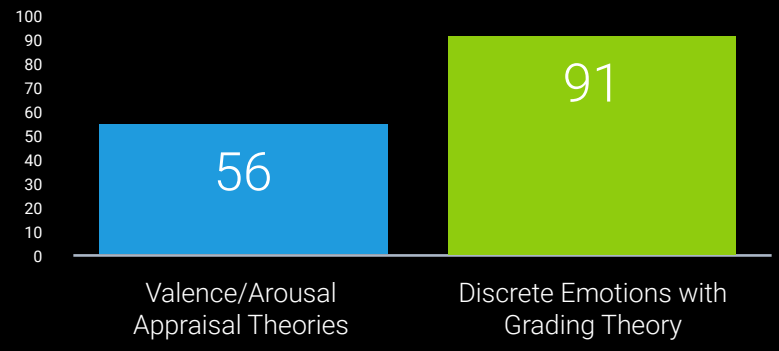
[1] Source: Cordaro et. al 2019, Kreiberg, 2010; Shenhav & Mendes, 2014
[2] Source: Feldman-Barrett et. al., 2019

Amount of Variance in Emotional Experience Explained by Competing Theoretical Models



"Emotion recognition from expression cannot be accounted for by 13 domain general appraisals…at least 24 emotions can be reliably communicated with vocal bursts and 28 through visual cues from the face and body."
- Cowen and Keltner, 2019.

Surely, we all know that emotional experiences and expression are much richer than a mere six distinct categories would suggest. So, saying that six prototypical facial expressions do not capture the whole of human emotional expression is important but not incomplete statement.

The serious scientists in marketing research aren't saying this. Worse, many otherwise excellent researchers within our space are holding up this criticism as evidence against the validity of facial action coding as a measure of emotion.

Unfortunately, it is the criticism itself that is invalid, and if we don't move beyond it, we will lose our place as the foremost experts in understanding big emotional data.

GUIDANCE FROM THE LEAD SCIENTIST

Getting reliable insights from data produced by any research method or technology depends on proper research design, sampling plans and statistical analyses that are appropriate for each method or technology deployed to answer the question at hand. We would never make a prediction about what a change in message or packaging will do for a brand without knowing how wide our margins of error are and how representative our sample is, or before considering the normal range of values returned by a particular method.

Recently, popular press headlines on the academic research of Dr. Lisa Feldman Barrett, at Northeastern University, along with some unfortunate misunderstandings of the implications of this research, have caused some waves in the marketing research community. This is important work that market researchers would be wise to follow by reading past the headlines to the original, peer-reviewed research papers.

The peer-reviewed statements of Dr. Feldman Barrett are based on extensive research, but they must be considered in context. We should avoid overly-broad interpretations of popular press article titles that are written by a journalist who has spent only a few hours studying a researcher's work for the purpose of summarizing it in a manner that is intended to capture attention rather than explain its complete context, scope, or implications.

Dr. Barrett's argument is not that facial action coding is meaningless or ineffective in any and all cases, but rather that the variety of facial expressions individuals might make when in a given emotional state, and the many reasons those expressions might appear on the face regardless of emotional state, means that facial action coding is not a 1:1 proposition. Given this lack of 1:1 correspondence, Dr. Barrett is arguing against the use of facial action coding for the evaluation of individual emotional states, particularly where facial coding is being used to assess guilt, innocence, or suspicion (as has been practiced to varying degrees by the TSA, intelligence agencies, police investigators, and in the courtroom). However, the author's conclusion that "it is premature to use this technology to reach conclusions about what people feel on the basis of their facial movements", should not be interpreted by marketing researchers as a conclusion that the research method doesn't provide reliable insight on the overall population being sampled.

Just as the shopping behavior of a single individual on a single occasion cannot give us representative, projectable insight into the behaviors of all shoppers on all shopping occasions, the brain activity, skin conductance response, or facial expressions of any single individual on any single occasion cannot be used to infer that person's mental state with 100% accuracy. This shouldn't be alarming news for the marketing research and Insights industry. We know very well, that, by collecting data from hundreds of individuals, talented researchers can make very reliable predictions about the cognitive and behavioral responses of larger populations to things like product or packaging design changes, messaging or advertising.

As with all the methods we use, what we need is a tool that allows us to get meaningful data from a representative number of respondents, and we need to understand how much 'noise' we should expect, relative to the signal we're attempting to detect. The sample sizes recommended by reputable facial coding vendors (typically 200-300 respondents) are both manageable and based on a rigorous statistical analysis of what is required to produce reliable, projectable data on the emotional responses.

- Dr. Cyrus McCandless, Vice President of Scientific Discovery and Innovation

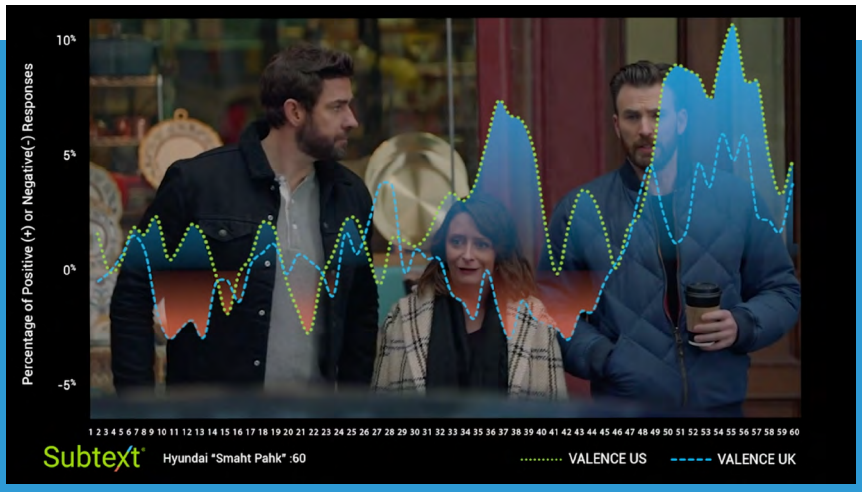
IV. The Valid Application of Facial Action Coding in Marketing Research

Having established evidence of the predictive validity advantage of facial action coding over conscious affective evaluation, we'll now turn to the face validity of the measurement technique. To illustrate its useful application in marketing research, let's visit some case study examples.

In the first video on the left, you can see the emotional response of the audience, as expressed on the faces of viewers as they watch the Mint Mobile "Chunky Style Milk" ad. As you can see, the emotional expressions related to disgust and amusement are apparent at all the key moments of the ad. Additional evidence for the face validity of the measurement technique can be found in the chart to the right. By combining measurement techniques, we can see that people who consciously expressed that they didn't like the ad, physically expressed no happiness while watching as compared to people who found the ad amusing.

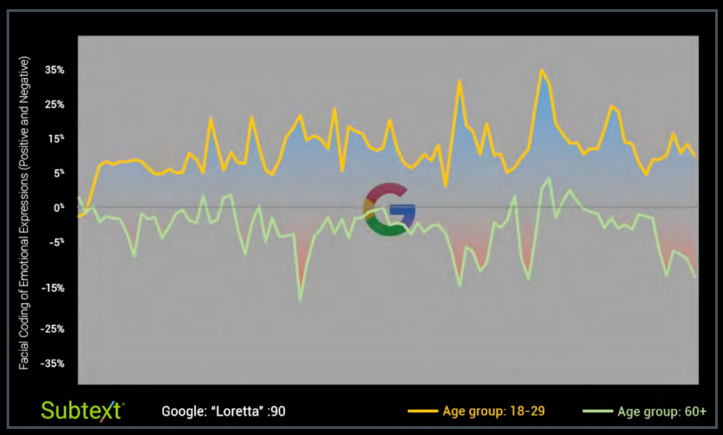
IV. The Valid Application of Facial Action Coding in Marketing Research

For cross cultural research, examples of differing emotional reactions to content tell a compelling story on the sensitivity of the measures to capture the different emotional experiences of different groups of people. In a recent England vs. New England study, we found the following emotional reactions to Hyundai Sonata's "SmahtPark" ad.



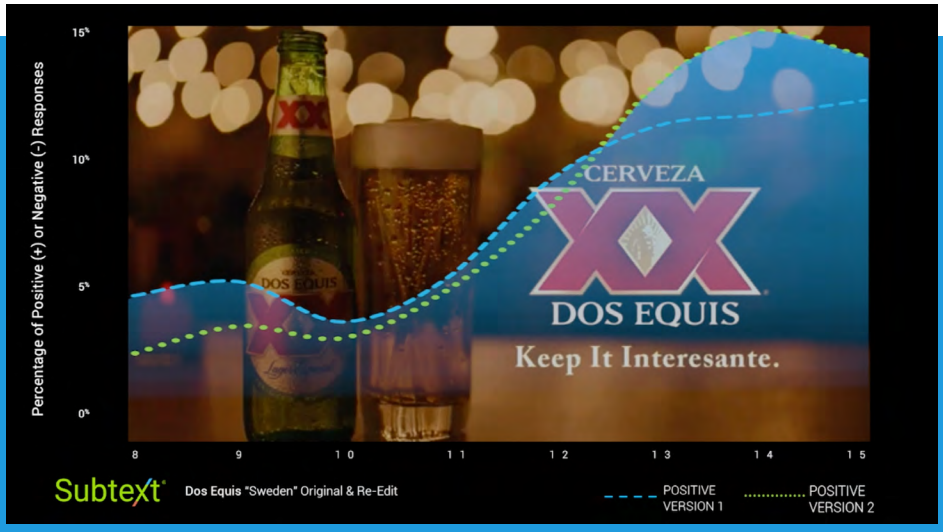
In this ad, there are some universal joke lines, and well known celebrities that provoke similar emotional reactions across countries. However, when the ad delves into the local detail of where he has "pahked his cah" (Squamscott, the Harbor etc.) the US locals express a lot of amusement while the UK viewers have an opposite negative emotional reaction. Clearly, cultural differences in the emotional resonance of marketing communications, are sensitively separated by the behavioral measures of facial action coding.

Beyond broad cultural differences, the measures are discriminating enough to capture differences in emotional reactions by demographic characteristics of viewers. In Google's Loretta ad, we observed a mirror image of emotional expression between 18-29 year old viewers anticipating the creation of life long memories versus the 60+ age group reflecting on having created those same memories. The younger cohort watched expressing happiness, while the older age group expressed more negative emotions on their faces.



IV. The Valid Application of Facial Action Coding in Marketing Research

As a final example, consider the reliability of the measures across independent samples of consumers. In the case study below within the US beer category, we tested emotional expressions during the viewing of the same ad among two distinct groups of people, and a scene shown within a 15 second spot.



It's obvious that the average emotional reaction to the same ad, and the same moments in the ad, is highly reliable across independent samples. And that provides a great segue into one of the most useful applications facial action coding in marketing research.

V. The New World of Emotional Expression Research

With the advent of valid, sensitive and reliable automated emotional expression coding technology, marketing research and insights finds itself in the unique position to advance human understanding of emotion more rapidly than academic institutions. By combining our best conscious and non-conscious measures, with moment-by-moment emotional experience measures, we can begin to understand the cognitive antecedents of emotion.

V. The New World of Emotional Expression Research

We're now in a unique position to understand the *why* behind emotional expression. And when we understand the why behind behavior, we gain greater empathy for the human condition.

Beyond our ability to automatically classify stimuli according to expressed emotion, the integration of implicit association techniques via Sentient Prime® has opened up a new window into the cognitive antecedents of emotional experiences. Emotional Memory Analysis (EMA) uses measures of pre/post change in implicit attitudes as a cross-cutting variable on moment-by-moment measures of emotional expression. The changes in these attitudes are related to specific moments of emotional expression, giving us greater insight into the inciting moments of emotional experience.

Beyond overall emotional change for a brand, using combinations of measures delivers deep insights that no set of explicit questions can reveal.

Beyond overall change in positive or negative sentiment toward a brand, combining facing coding with changes in discrete emotional associations with your brand, can reveal if your marketing communications are having the specific emotional impact you're striving to achieve. In this example from UK insurance company Allianz, exposure

VI. Conclusion

We conclude with a statement that is more than just a simple defense of the validity of facial action coding. It's really an imperative for our industry.

Our view is that automated coding of emotional responses, with the daily upload of billions of emotional expressions, is the largest untapped renewable resource of insight on human behavior in the world. It's not only valid, *it's the next major source of insight into the human condition*.

We cannot turn our backs on automated coding of emotional expressions. If we do, we'll miss our next great calling: becoming the experts at analyzing big emotional data combined with big behavioral data.

How do we feel about automated coding of emotional expressions?

It's written all over our faces.

ABOUT THE AUTHORS

Aaron A. Reid, Ph.D.
Founder & CEO
Sentient Decision Science, Inc.

As an entrepreneurial consumer psychologist, Dr. Reid founded Sentient Decision Science, Inc. to bring the visionary advances from the behavioral sciences to business in a practical and accessible format. Sentient is a leading behavioral science based research and consulting firm providing best-in-class implicit research technology, applied behavioral economics and marketing science based brand consulting to optimize product, pricing and promotion development and emotionally differentiate brands through strategic positioning and communications.

Dr. Reid is an expert in how emotion influences choice and the subconscious drivers of behavior. His publications include mathematical models of consumer irrationalities in top peer-reviewed psychology journals, such as the Journal of Experimental Psychology and the Journal of Behavioral Decision Making as well as industry leading recognition from ESOMAR. His landmark publication of "Emotion as a Tradeable Quantity" was the first to quantify how emotion influences choice as a behavioral weighting mechanism.

Under Dr. Reid's direction, Sentient Decision Science has developed patent, cloud based, globally scaled implicit research technology that quantifies consumer emotions and neural network associations with brands, products, packaging and advertising. This technology was recognized with the EXPLOR award in 2011 & in 2018 as the most impactful application of technology in market research. By quantifying these gut-feelings, and integrating with rational trade-offs in a single unifying choice algorithm, consumer behavior predictions are significantly more accurate.

Since 2007, the Sentient Consumer Subconscious Research Lab, has been a pioneering R&D force in the development of advanced implicit research methods, most recently demonstrating the unique neural signature of implicit self-identification with brands. The lab houses state-of-the art eye-tracking, EEG biometric and implicit affective priming technology.

ABOUT THE AUTHORS

Cyrus H. McCandless, Ph.D.
Vice President of Scientific Discovery & Innovation
Sentient Decision Science, Inc.

Dr. McCandless is the recipient of four competitive federal awards to support his research into the neurophysiology of behavior and cognition. Winner of the EXPLOR Award and the IBM LEAD Award for Shopper Engagement. He has published in major peer-reviewed journals, presented his work at international conferences, and designed the algorithms behind the facial coding platform Sentient Expression®.

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.

Dr. McCandless earned his M.S. in Neuroscience and his Ph.D. in Neurobiology from the University of Pittsburgh. He also holds a Certification in Cognitive Neuroscience from the National Science Foundation's Center for the Neural Basis of Cognition.

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