

Facial Coding as a Neuromarketing Technique: An Overview

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Abstract

The author's interest for the subject of facial coding and micro expression analysis within the neuromarketing field lies into the advantages this tool has in applied neuromarketing research for identifying and understanding customer behaviour. Facial Coding remains the only inexpensive tool that provides real-time and accurate data due to micro expressions' characteristics – which are spontaneous and, therefore, uncontrollable.

The aim of the current article is to provide an overview regarding the facial coding tool which is, along with biometrics, a less explored technique with application within the neuromarketing field. The process and some of the challenges imposed by the automatic micro-expression analysis were approached, together with an overview of facial coding applied within neuromarketing research. The findings of the current paper suggest that, particularizing on facial coding, there is an imperious requirement for researchers to develop a more reliable and standardized research frame for micro expression collection, evaluation and analysis.

Key words: neuromarketing, facial coding, facial expression, micro expression, consumer behavior
J.E.L. classification: D83, D87, D90, M30, M31, M39

1. Introduction

Neuroeconomics and neuromarketing represent novel disciplines inspired by a mixture of ancient knowledge and contemporary discoveries regarding how the human brain works. Mass-media (and not only) constantly promotes news on specific areas of the brain where particular thoughts, emotions or feelings occur, thus making the general public believe that we can straightforwardly observe the brain at work. But is it truly so?

Facial measurement procedures are used as a way of interpreting behaviours through facial expressions. Within the economic field, these expressions are primarily considered to be independent variables, and authors research their effects on other variables that are under study (Ekman and Rosenberg, 2005, p. 41). The importance of neuromarketing lies in the common feature of all neuro-disciplines – the fact that the mind itself resumes its existence to what the brain does: considering that emotions (and emotional behaviour) are created by the brain and, at the same time, these conduct individuals toward action, decoding and correctly interpreting them represents the leverage that ensures long-term success.

The focus of the current article is literature research involving measurement of the facial behaviour itself, with an emphasis on its application within the marketing field. This subject was chosen due to increased interest shown nowadays for neuromarketing research techniques, thus a gap in the literature was identified: while the majority of the research focuses on fMRI (functional magnetic resonance imaging), EEG (electro-encephalogram) and eye-tracking (according to Alsharif et al., 2021, p. 346), there is difficult to find relevant information on the less explored techniques, such as biometrics and facial coding.

2. Literature review

Through a Scopus database analysis, 479 publications that approach neuromarketing were identified from 2004 to 2020 (Alsharif et al., 2021). Based on the neuromarketing tools approached within the articles, Lewinski remains the only author that used a face reader device and thus the facial

coding system in his research. He used FaceReader to code the facial recordings belonging to the speakers who took part in the main social media campaigns (developed and distributed on YouTube) organized by two different commercial banks (Lewinski, 2015, p. 241), aiming to predict the popularity of YouTube videos on social media platforms based on facial expressions. According to his findings, non-emotional non-verbal expressions is what viewers find most compelling, while the disengaging facial emotions expressed by the speakers did not prove to be an indicator of the social media content performance on the long-run (Lewinski, 2015, p. 241).

Studies on micro expression spotting usually focus on posed videos, rather than on spontaneous ones. In terms of micro expression recognition, research studies have a low performance. Li et al. (2018) propose a method for spotting spontaneous micro expressions in long videos, based on feature difference contrast exploration.

Micro expression research studies with application within the neuromarketing field focus on a single person's reactions while watching a movie trailer or an ad. More than that, the research environment is usually a highly controlled one (video taken from frontal view only, while the entire individual's face is visible and where there is bright light. This is mainly due to the early stage development of the AI tools used – yet the general direction is to overcome challenges imposed by nowadays limitations. More sooner than later it will be possible to analyse multiple individuals interaction and reaction. Instinctive and innate interactions will generate emotional responses that are more natural and spontaneous when it comes to facial expressions and micro-expressions, yet the scenario remains problematic and complicated. It would be stimulating to examine the interpersonal co-occurrence (like imitation, transmission, contagion), not only the changes that occur at individual level; more than that, appears appealing to investigate the affective dynamics of an entire group (Zhao and Li, 2019, p. 3).

Facial Expression Analysis was used by Mauri et al. (2021) in researching website user experience, showing how the perception and assessment of user experience (UX) may be enhanced by the use of neuromarketing, where traditional and modern techniques are used altogether (Mauri et al., 2021). Zhongshan et al. approached the subject of facial landmark detection using artificial intelligence (Zhongshan et al., 2021). Even if the focus of their article addresses facial identity detection, their findings may be perceived as a starting point in developing a facial expression analysis software.

Verma et al. (2021, pp. 17) introduce a software that transforms into a single analysed response all the data collected from rapid and brief data representing micro expressions. More than that, they focus on capturing micro-expressions through an AffectiveNet: a piece of artificial intelligence that captures all the exquisite changes and learns the subtle dynamic facial features in order to differentiate, categorize and describe classes of emotions (Verma et al., 2021, pp. 17); the novelty of their research is based on capturing both crass and minuscule disparities shown by facial emotional features.

Tejada et al. (2021) approach the subject of building and validating facial expressions from a transcultural perspective, sustaining that two of the main challenges faced by obtaining objective measurements of the emotional state of research subjects are represented by 1) the adjustment to cultural and social context and 2) the recognition and perception of those expressions, feelings and emotions that are more complex.

3. Research methodology

The research methodology used for writing the present article is a multidimensional (each of the steps involved in the research process had various dimensions) and interactive (each step utilized within the research was dependent on all the other actions taken in this regard) one. Both quantitative and qualitative studies were explored, together with journal articles, specialized websites and conference papers. The information found within the literature was explored, organized, analyzed and synthesized, with an emphasis on the inter-relationship between facial coding and other neuromarketing techniques.

On one hand, the author tried to underline and delimitate a conceptual framework for the fundamental elements related to facial coding; on the other hand, through emphasizing the theoretical framework of the paper, the author offers an overview of the facial coding as one of the techniques

used in neuromarketing field based on the already existing formal theory and case studies. Thus, the literature review methodology used for writing the current article may be perceived as an instrumental case study designed to examine the facial coding process within the neuromarketing field.

Scientific articles, national and international databases and books from different fields such as psychology, physiology, artificial intelligence and marketing were used for collecting, summarizing, and processing information on the approached subject. No primary data was collected and/or analysed for the current article, the aim of the paper being to provide a knowledge base for future research carried out in the field of facial coding used as a neuromarketing technique.

4. Facial coding: micro- and macro- expressions within the neuromarketing field

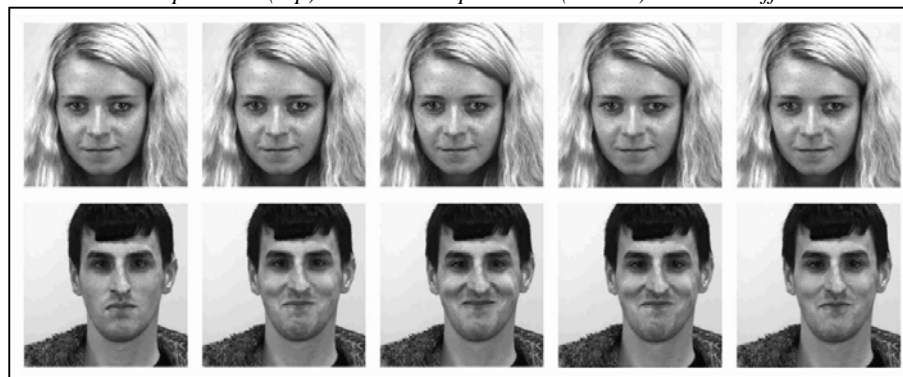
The facial coding technique represents one of the six neuromarketing research tools (facial coding, facial electromyography, implicit association test, skin conductance, eye tracking, physiological responses' measurement) that do not focus on recording brain activity. It is done usually employing a video recording of the facial expressions – which are spontaneous and provide real time data. These are based on the subjectiveness of the decisional process when assessing if an action that has occurred met the minimal coding requirements or not (Bercea, 2012). In different words, facial coding recognizes, identifies and measures macro- and micro- expressions (that represent non-conscious responses of an individual), based on the movement of the facial muscles.

Micro-expressions were defined as very refined facial movements that are extremely brief (1/25 to half of a second) and barely perceptible by the human eye. Because these are difficult to notice, artificial intelligence -and especially machine learning strategies used for micro-expression analysis- becomes more than useful, as Zhao and Li sustain (2019, p. 1). Micro-expressions represent a rich source of data that uncovers genuine feelings of an individual. Their origin is based on high-stake circumstances, meanwhile somebody intends to inhibit their honest sentiments or sentiments inside the context of their manifested expressions (also known as macro-expressions). Considering this, the importance of micro expressions' identification and correct analysis within the neuromarketing field lies in the fact that an individual's facial expressions never lie – so human faces become the main source of details, data and information needed to be integrated into marketing strategies.

Even if micro expressions are defined by a peculiar temporal evolution, their manifestation can be summarized into five steps, according to Bruni and Vitulano (2021, p. 2): 1) neutral phase, when ME is still absent; 2) onset phase, when ME starts; 3) apex phase, when ME reaches its maximum expression, 4) offset phase - when ME begins to dissipate and 5) neutral phase, when ME disappears.

Macro expressions are dynamic and differentiate themselves from micro-expression through being active for 4-5 seconds on an individual's face, thus being perceived easier (Figure no. 1).

Figure no. 1. Micro expressions(top) and macro expressions (bottom) – visible differences



Source: Zhang, L.; Arandjelovic, O., 2021, p. 414;

Face coding as a neuromarketing tool is generally used for testing advertisements and movie trailers, measuring non-conscious reactions through analysing the activity of 43 facial muscles; it allows the researcher to note and recognize in real-time 6 core emotions (happiness, sadness, surprise,

dislike, fear and anger) and it is mostly used for improving ad content, being a relatively inexpensive neuromarketing tool – see Table no. 1.

Table no. 1 Facial coding: an overview

Facial coding: an overview	
How it works	Identifies facial expressions and micro-expressions
Why is it used	<ul style="list-style-type: none"> • To test advertisements • To test movie trailers
What does it measure	<ul style="list-style-type: none"> • 6 (six) core emotions: happiness, sadness, surprise, dislike, fear and anger • 43 facial muscles • 23 action units • Non-conscious reactions
Scope	<ul style="list-style-type: none"> • To reveal the general emotional response regarding an ad or a movie trailer in order to improve their content • To gain insight into one’s preferences, which can help inform creative advertising and content development • To learn which features elicit the most excitement and engagement in users • To identify how specific content is observed, recognized and analyzed in regards to competitors • To determine what should suffer alterations in order to improve the content and increase its effectiveness
Strengths	<ul style="list-style-type: none"> • Provide real-time data • Facial (micro)expressions are spontaneous and, therefore, sincere • Is relatively inexpensive
Weaknesses	<ul style="list-style-type: none"> • Subjectivity in deciding when a (micro)expression meets the minimal requirement for being coded • Because of the subjective nature of emotions, emotional AI is especially prone to bias
Software	For spontaneous facial reactions were created adaptative software; for cases when the software doesn’t adapt its behavior, usability evaluation needs to be reassessed;
Analysis flow through specific software	<ul style="list-style-type: none"> • Face acquisition (whole face and facial features) • Facial feature extraction (deformation extraction and motion extraction) • Facial expression classification (recognition and interpretation)

Source: elaborated by the author based on Fasel and Luettn (2003), Bercea, M. (2012) and Harell, E. (2019)

5. Findings on measuring facial behavior: process, software, limitations

Within the multitude of articles that approach micro expression research, three study directions have evolved: researchers aim to either clearly differentiate between micro- and macro- expressions within the identification phase of their research, or 2) aim to identify specific micro expressions over a specific period of observed facial movement within the detection phase of their study, or 3) analyse the inference of emotions somehow expressed through micro expressions. The later refers to the recognition phase and proves to be a very challenging process, mainly due to due micro expressions’ short duration and low intensity

Since micro expressions are fleeting, being hardly perceptible while analysed in the context of a video recording, it is very challenging to identify, perceive and decipher them accurately; their nature makes them profoundly challenging to be distinguished and categorized automatically. As Feng et al. (2007, p. 254) mention in their paper, the traditional methods used for facial recognition are inadequate for approaching faint facial movements – which are specific and more often than not present when micro expressions occur.

The first researchers who aimed at developing a spontaneous micro expression recognition system through AI were Pfister et al., in 2011. With the aim of collecting new data through the use of performant cameras, they planned and created an induced emotion suppression experiment. Nowadays, automatic facial micro expression analysis through Artificial Intelligence remains a focus point for research due to its multiple advantages and promising potential applications, receiving

increased attention from specialists that belong to different fields: psychology, computer science, marketing and not only. Research on recognizing and correctly interpreting micro expression are diverse and progress continuously. Here are three of the tools used in facial coding and micro expression analysis within the neuromarketing field:

- FACS (Facial Action Coding System) – represents an artificial intelligence system that was built to measure facial movements based on human anatomy (Ekman and Friesen, 1978), which is used to illustrate, based on multiple and different action units, visually distinctive facial movements (Zhao and Li, 2019, p. 2); it is also being described as an infallible technique to evaluate reactions and responses from the emotional point of view, as human grin, facial movement and expressions never lie (Baldocchi, 2021). Dr. Paul Ekman’s findings on facial expressions inspired the development of FACS, the first and only comprehensive tool for objectively measuring facial movement (first developed in 1978 and reviewed in 2003).
- FACEit System - a facial expression analysis tool developed to support the research on the study of facial expressions, created in C-programming language. Its main limitation is to evaluate facial movements when part of the face is hidden or when the entire face is not visible (when the individual covers his mouth, for example (Branco, 2006, p. 97).
- Facial Dynamics Map – represents a novel method proposed by Feng et al. (2007) in order decipher a micro expression’s development based on different granularities. They developed a new way of classification and identification of micro expressions; the findings of their study proving increased efficiency and efficacy in recognizing and interpreting facial behaviour.
- MESR - an advanced matrix for micro expression’ recognition and an automatic analysis system (known as Micro expression System Recognition) for spotting and recognizing micro expressions from spontaneous video data was developed by Li et al. in 2018.

In 2018, Rhue demonstrated that facial recognition software interprets emotions differently based on the person’s race by using a comparative analysis of a data set of professional basketball players’ pictures. The software she used (Face and Microsoft Face API) interpret black players as having more negative emotions than white players.

In 2019, a study revealed that emotional analysis technology assigns more negative emotions to people of certain ethnicities than to others. According to Purdy et al. (2019), artificial intelligence is not evolved enough to discern between social and cultural differences in perceiving and decipher emotions, thus making it difficult to conclude accurately when it comes to facial coding within cultural context.

In the last decade, research on micro expression recognition has increased considerably, yet it is still in its initial phases. Thus, not alarmingly, there still are many hesitations and provocations, as Zhang and Arandjelovic (2021) mention in their paper:

- availability, condition, predictability, standardization and uniformity of data used by researchers, considering the spontaneity involved in generating micro expression;
- the encoding of raw research data – process that is very laborious and extremely time consuming;
- the major computational challenge that AI need to overcome in recognizing micro expressions in real-time due to their characteristics;
- non-standardized performance metrics that are used to evaluate the research methods available and/or developed recently.

6. Conclusion

Even if the investigation of genuine feelings and emotions from video recordings has a wide range of applications (medical diagnosis and/or diagnostic analysis, police cross examination and law enforcement, interactive media analysis etc.), neuromarketing remains the most controversial one, being always in the spotlight: on one hand, the generic public has reservations towards this discipline, associating it with intentional misleading and manipulation; on the other hand, marketing specialists and researchers consider that neuromarketing offers the framework we need to deeply understand the decision making process, emphasizing that humans are not totally rational (as we

prefer to think) and proving that emotions and feelings positively influence our choices while heuristics and cognitive inclinations determine us to take less rational decisions (Bitbrain, 2019).

The main goal of neuromarketing remains to better understand the neural correlates of emotion, attention, memory, and decision-making (Alsharif et al., 2021) within the marketing context. Each of the techniques used in neuromarketing research have specific strengths and weaknesses, which make them more or less appropriate for different research situations. Certain combinations between techniques seem more appropriate to develop more accurate and thus effective neuromarketing studies (Bercea, 2012). Even so, particularizing on facial coding, there is an imperious requirement for researchers to develop a more reliable and standardized research frame for microexpression collection, evaluation and analysis. This will only be possible through interdisciplinary and collaborative efforts, considering the complexity of skill set needed for this process: psychology, physiology, artificial intelligence.

7. References

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