

A Study on Facial Coding Differentiating Among Surprise, Anger, and Fear Facial Affects

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1. Introduction

The foundation for the study of facial expressions and their relationship to universal emotions was built by Darwin (1872), Duchenne (1862), Tomkins (1962; 1963), Wallace Friesen and Paul Ekman (1967). Ekman founded his 6 basic emotions: Anger, Fear, Disgust, Surprise, Joy, and Sadness by studying primary affects and observing how they are distinguished by people from different cultures.

The Facial Affect Scoring Technique (FAST) was created by Ekman et. al. (1971) in order to measure facial behavior that would be pertinent when distinguishing emotions from facial expressions recognized by observers. FAST measures are done in 2 steps. Facial expressions are isolated and separated in 3 groups: brows-forehead, eye-eyelids, and lower face. Then the isolated groups are classified for scoring. Ekman and Friesen abandoned this approach and created a new approach.

In 1978, Ekman and Friesen created the Facial Acting Coding System (FACS) by determining how facial muscles contract and how that can change the appearance of the face. The FACS dissects an observed expression by breaking movements of facial muscles down into specific action units (AUs that produce that movement. A combination of specific AU's) can lead to the determination of emotions in facial expressions.

Some emotions are easier to distinguish from facial expressions than others. We found that while happiness and sadness are emotions that are easily distinguished from facial expressions, anger and surprise may be misidentified with fear.

The purpose of this experiment was to find, analyze, and propose a method which would differentiate emotions, specifically anger and surprise from fear, which may be mistaken for another.

2. Method

In an online questionnaire featuring 30 random images of facial expressions, we discovered that 9 images were identified

with the emotions; anger, happiness, sadness, and surprise by those who participated in the questionnaire. Happiness and sadness are emotions that were easily identified in the questionnaire. However, anger and surprise were had lower percentages of agreement (between questionnaire participants). When we verified the participants' identification of the emotions in the facial expressions, we found that anger and surprise had characteristics of another emotion, fear.

2.1. Differentiating between emotions

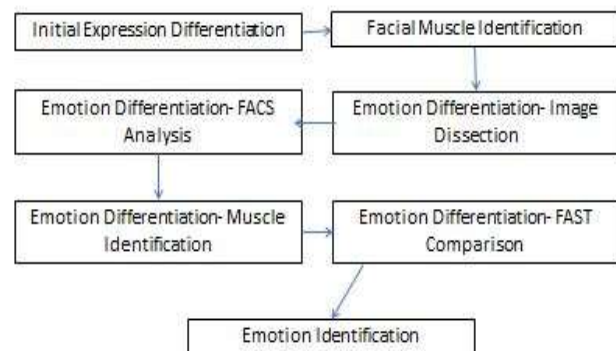


Image 1- Emotion Differentiating Model

While there are several methods that can be used to differentiate between emotions, our proposed method comprises of several segments (image 1). An initial expression differentiation is necessary when distinguishing emotions from facial expressions. While it may seem unnecessary, identifying various emotions that may be identified from a facial expression reveal potential interpretations of the expression.



Image 2- Facial Expression Image Dissection

Once potential emotions are identified, we must identify facial muscle movement that occurs in the facial expression. The muscle movements are then labeled and analyzed with

FACS in order to discover probable emotions that coincide with the facial expression. When there are multiple probable emotions that can identify with a facial expression, or when some facial movements do not completely agree with the FACS coding for certain emotions, the next step to differentiate emotions is to dissect the image into 3 sectors: brows-forehead, eye-eyelids, and lower face. After facial expression images are dissected, we must identify facial movements' specific to the three sectors and compare with FAST to see what emotions, the dissected images best identify with, regarding facial expression. By determining which emotion traits best coincide with the facial expression of emotion, we are able to determine and verify which emotion the expression is displaying.

3. Results

Our proposed method proved to distinguish between anger and fear and between surprise and fear. Most of the specific distinguishing characteristics for identifying the correct emotion from facial expressions showed in the forehead and eyebrows. We noticed that in fear expressions, eyebrows are usually flattened and there are visible forehead wrinkles. In Anger facial expressions, we can see eyebrows that are pulled down, inward, and curved, while in surprise facial expressions, eyebrows are raised and curved.

Differentiating probable emotions and dissecting the image into 3 sectors, we were able to concentrate on specific facial movements. By dissecting facial expressions of emotions and comparing each sector with FAST, allowed for aspects of facial expression distinctions to be understood while discrediting incorrect probable emotions. Doing this allowed for more of an understanding of the differences and some of the aspects of facial expressions that may cause some confusion between surprise and fear, and between anger and fear facial expressions.

4. Conclusion

While FAST is Ekman's and Friesen's first attempt facial measurement, it considers the perspective of a witness to the facial expression. Although it is an abandoned approach, when FAST is used alongside FACS, it can distinguish anger from fear, as well as surprise from fear. There appears to be a limit in how many emotions our proposed method can distinguish: FAST is comprised of facial component details for 6 emotions,

meaning that this method may only distinguish between the 6 basic emotions.

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