

FACE2FACE Deception Detection Study #1: Fear

There has been a popular belief that Facial Micro-expressions of Emotion (FMEEs) were the key to deception detection since the mid-1980's. They seemed a likely candidate: they were involuntary and so fast (only a 30th to a 15th of a second) that they couldn't be seen unaided, and the person showing them didn't know they were. There were no peer reviewed studies confirming FMEEs could be evoked or could be quantified in situations involving deceit, but 3 popular press books and a TV show sold the public on the idea: *Unmasking the Face: A Guide to Recognizing Emotions From Facial Expressions* (1975); *Telling Lies: Clues to Deceit in the Marketplace, Politics, and Marriage* (1985); *Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life* (2003); and *Lie to Me* which aired on Fox from 2009 till 2011. Paul Ekman (the originator of the Facial Action Coding System FACS used to classify FMEEs) wrote those books (along with 13 others) and was the scientific consultant for the series. He is a brilliant man, but the use of FMEEs as the new Lie Detector had a long way to go before it could become a reality.

The first rigorous studies of FMEEs use in deception detection, only started around a decade ago in 2008. The results were discouraging. When measured outside the context of Macro-Expressions of Emotion (normally occurring facial expressions of ½ to 4 seconds duration), and subtle facial expressions ("blended" FMEEs and or Macro-Expressions) they simply didn't work. The failures ranged from frustrating: Less than 1 in 3 subjects showing FMEEs, and for them, FMEEs made up only 2% of their facial expressions; to horrifying: Analysis of television footage of heartfelt pleas for the return of missing relatives by family members... Half of the subjects were truly asking for help, the other half had murdered the missing person... There were no detectable differences between the FMEEs produced by the two groups.

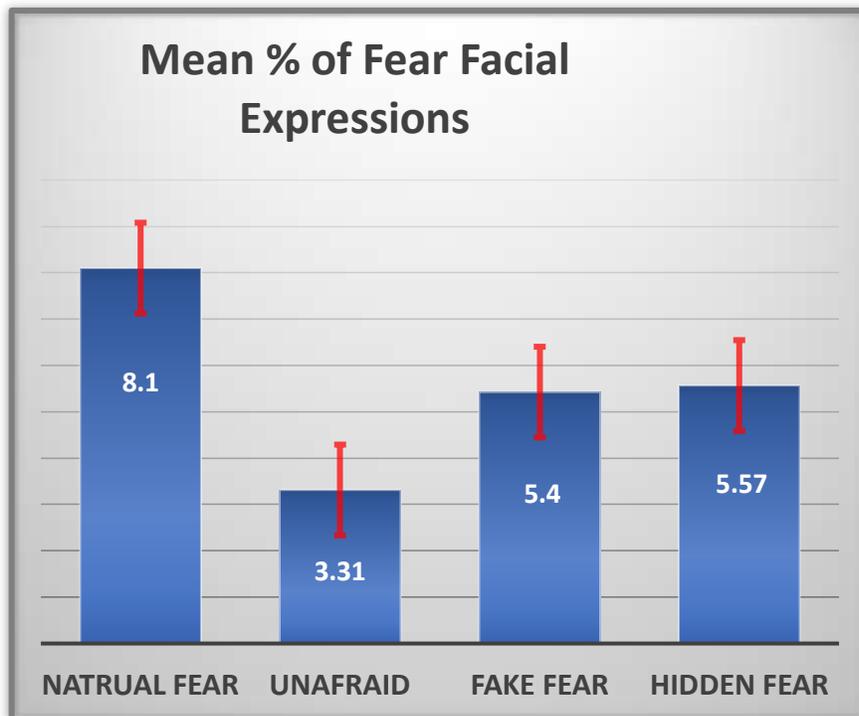
The problems in these early studies were primarily from two sources:

- 1) To use FMEEs to detect truthfulness, they have to be part of an interactive context, that means sequences of FMEEs, Macro, and Subtle Expressions would need to be processed. Expressions of emotion much longer than 1/15th of a second needed to be processed: Emotions aren't static, lying takes place in an interpersonal or societal framework, and that means there will be complex, interactive Facial Expressions of Emotion streaming as a Flow. Recent work published on this topic by Dr. David Matsumoto, Dr. Ekman's protégé and now most dominant researcher on FMEEs, indicates that the "sweet spot" for detecting deception through facial expressions is between 1/5th of a second a 1 second.
- 2) The studies were analyzing FMEE data from expression coders trained in the FACS coding system, but there is unavoidable bias and error when an individual reviews 18,000 frames of video to code 10 minutes of interaction. The capabilities of an Artificial Intelligence program are much more suited to this kind of work.

Dr. Nate Herr of the American University (AU) Interpersonal Emotions Lab and his Doctoral student Vincent Barberi were interested in collaborating with FutureLife because FACE2FACE could address both of these problems. Dr. d'Alelio, CCO of FutureLife, helped them design and implement a deception study in which undergraduate students either lied or told the truth about being phobic of spiders and snakes. The study used a classic two by two design in which equal numbers of subject were assigned to one of four conditions:

Phobic / Showing Natural Fear	Phobic / Trying to Hide Fear
Not Phobic / Showing Natural Lack of Fear	Not Phobic / Pretending to Be Afraid

There were ten students in each group. They were shown the same 2-minute video of spiders and snakes. To enhance the level of fear in the phobic subjects, all subjects were told they would go into an adjacent room after the video and hold a tarantula (a deception). As the subjects viewed the stimulus video, their facial expressions were captured by a high definition video camera, and the recordings were analyzed with FACE2FACE later by Dr. d'Alelio. The statistical analysis used to determine if there were significant differences observed between groups' Fear FMEEs was a multiple linear regression analysis of variance. Data from facial expressions from 1/30th of a second up to 1 second long were included in the analysis. The results are shown in graphic form below:



The findings reflected significant differences in the amount of Fear shown in facial expressions of members of the different groups at the $p < .001$ level. The differences that account for the strong statistical significance are reflected by the red error bars in the figure above. When the brackets of any two groups overlap, the amount of fear they represent is essentially equivalent. When they don't overlap, the groups have shown significantly different amounts of fear.

Using that standard, we can see that the Natural Fear group showed significantly more fear than all 3 other groups. The differences found all reached

the $p < .001$ level of significance or stronger. In other words, these results would have been produced by chance only 1 time per thousand or less.

The subjects in the Unafraid group showed significantly less fear than the 3 other groups. Their observable fear was significantly less than the Natural Fear group, the Fake Fear, and The Hidden Fear groups. All differences were at the $p < .001$ level or stronger.

The Fake Fear, and The Hidden Fear groups, both of which were engaging in deception produced very interesting results. They showed, as has already been indicated, significantly less fear than the Natural Fear group, and significantly more than the Unafraid group, but they were not significantly different from one another. They were being deceptive in diametrically opposed directions, one group pretending to be afraid, while the other group was pretending not to be, but they ended up equivalent in observable facial expressions of fear. The only thing they had in common was that they were lying.

The similarity of these two groups to one another, and their differences from the other two groups produced a main effect for dishonesty. The distinction between the subjects engaged in deception and the honest subjects was also a level found by chance less than 1 time in 1,000, $p < .001$. This finding is even more striking because the main effect for fear, the differences in observable fear between subjects who were Spider / Snake phobic and those who weren't didn't reach significance, even though the phobic subjects had been told they'd have to hold a tarantula at the end of the study.

This is a small sample size study, but it is suggestive that subjects engaged in deception experience enough inner conflict that they show higher levels of fear than their honest counterparts, *because* they are lying. That explanation is consistent with the links between deception and physiological stress that inspired the polygraph. It is also consistent with the findings in David Matsumoto's study mentioned earlier: Subjects engaged in deception in that study were properly identified close to 78% of the time by the frequency of their negative facial expressions (Micro, Macro, and Subtle) as compared to honest subjects.

As to why the Phobic subjects as a group didn't show more fear than the subjects who were honestly not afraid of spiders and snakes, the explanation is ironic. Deception is easiest to detect through FMEEs in high stakes interpersonal conditions. Telling the subjects they were going to have to hold a tarantula was intended to create just such a high stakes condition. During debriefings a number of the subjects stated they had picked up on the deception.

The bottom line for this study is that FMEEs as detected through FACE2FACE proved very reliable as a means of deception detection. Further research is needed to develop this capacity.