A proof-of-concept study for the
Face2Face™ Diagnostic Technique's Use of Facial Micro-expressions of Emotion (FMEEs) as biomarkers of emotional status

This study will begin in just under 2 weeks on May 20, 2018. If you are interested in receiving preliminary results and updates as they become available, please sign up on our mailing list.

Dr. William d'Alelio and Dr. Brian Marx

Face2Face is a computer application that maps and identifies the emotions conveyed in facial expressions from each frame of recorded or live videos of subjects responding to evocative stimuli or clinical interview questions. The data it provides is compiled and matched to a continuously self-correcting library of facial expression patterns designed to help clinicians identify the presence and severity of psychiatric disorders and assist in treatment planning and delivery.

The Principal Investigators: Dr. Brian Marx is a Principal Investigator in the Behavioral Science Division, National Center for PTSD of the Boston Veteran's Administration Hospital. He is an author of the gold standard PTSD CAPS-5 diagnostic clinical interview. Among his many other honors, he was the recipient of the 2017 Outstanding Contributions to the Science of Trauma Psychology from the American Psychological Association. Dr. William d'Alelio is a Clinical Psychologist in Washington D.C. with 40 years of experience treating and studying PTSD. He is the Chief Clinical Officer of Future Life, Inc.

The problem being addressed:
Twenty % of veterans (4million) suffer from PTSD. As of 2016, it is estimated that nearly 90% of combat veterans with PTSD are eventually identified, but it is often only after the condition has become chronic. The most commonly used early screening and identification instruments (e.g. PCL-M) are estimated to only have a 40% accuracy rate. Once identified with PTSD approximately 2 out of 3 veterans do not get a full course of best practice evidence-based treatment. The VHA is overwhelmed by the number of patients needing care, and by their geographic dispersion. Despite heroic efforts by their caregivers, 22 PTSD Veterans commit suicide every day. Face2Face™, a telehealth application, is being developed to increase the speed, accessibility and accuracy of PTSD diagnosis and treatment by means of computer analysis of FMEEs.

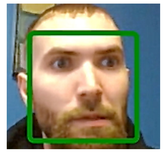
Work by such renowned researchers as Paul Ekman and David Matsumoto has proven that Facial expressions lasting 1/15th of a second or less are being continuously emitted by people in response to their environments, both external and internal. In Face2Face™ we have developed a way to capture and analyze FMEEs not only as static images, but as part of a continuous flow of non-verbal communication. Used in this way, they can reveal the following information:

7 Universal Emotions: Joy, Anger, Surprise, Fear, Contempt, Sadness, and Disgust.
Emotional Valence: Positive, Negative, or Neutral feelings about/orientation towards a focus, or life in general.
Activation: How emotionally reactive an individual is likely to be in response to a stimulus, or as a baseline disposition.
Engagement/Detachment: How likely an individual is to attend to or disregard a stimulus, or to engage or withdraw from interaction with others.
Resilience: How well a person can self-regulate, that is, self-sooth when distressed and then react positively when appropriate.

The Faces of Trauma

"On 9/11, the plane flew past my window in the Pentagon. It sounded like a freight train. The building shook, and then there was this unbelievable explosion… Friends died in the room next to mine. They never found some of them. I didn't start crying till days afterwards"

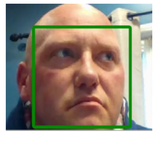
"We took our first KIA (Killed in Action) the day after Christmas. It was my best friend. I could see the smoke column from my guard post on the wall. He lost both his legs. He bled out in the helicopter."



Survivor Guilt	
Anger	1.76
Shock	1.57
Fear	1.26
Disgust	1.42
Sadness	2.98

Log10 Scores

Q. Did you think much about how things would be when you came home?
A. *I didn't think I was coming home anyways. We took casualties daily. We took 350 IEDs in 7 months, it was a good deployment.*



Complex PTSD	
Anger	1.43
Shock	1.16
Fear	0.45
Disgust	1.25
Sadness	1.81

Log10 Scores

ARMOR DOWN

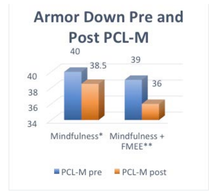
Armor Down is a service-disabled, veteran-owned, non-profit that helps combat veterans reintegrate after their tour(s) of duty. They provide training in Mindfulness, and Resiliency and Transition Techniques, often by telecommunication.

This study investigated whether a guided review of their FMEE clips would help PTSD veterans recognize internal cues of emotional flooding before being overwhelmed. The Experimental group (n=4) viewed a set of 25 Open Affective Standardized Image Set (OASIS) images at the beginning of Mindfulness and RTT training, reviewed their FMEEs at stress points in the videos, and worked to recall unrecognized internal cues associated with their negative emotions. The control group did training as usual.

The same outcome measures were used for this study as at the Eisenhower Center

Armor Down2 (85)	PCL-M pre	PCL-M post
Mindfulness*	40	38.5
Mindfulness + FMEE**	39	36

*p<.05 **p<.01



Mindfulness and RTT alone improved patients' PCL-M scores. FMEE informed Mindfulness and RTT was demonstrably better.

Armor Down	Mindfulness	Mindfulness + FMEE
% Completed Tx ***	75	100
% sesions kept**	79	96
% Assigments done*	71	92

*p<.05 **p<.01 ***p<.001

Mindfulness and RTT patients had good treatment compliance, but patients whose training included FMEE had significantly higher compliance levels.

METHODOLOGY:

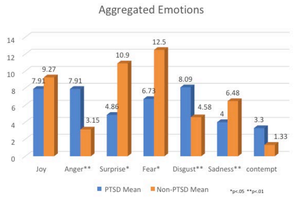
Twenty-five patients diagnosed with PTSD in the VA Boston Healthcare System will have their quantified PTSD Clinician-Administered PTSD Scale for DSM-5(CAPS-5) scores compared to their emotional valance and arousal scores derived from video-taped responses to 60 pictures from the Open Affective Standardized Image Set (OASIS). Their sequences of emotion, patterns of reactivity, resilience and emotional regulation will be coded and analyzed using mixed model repeated measures multivariate regression statistics. The derived FMEE algorithms will then be tested as diagnostically significant biometric markers of PTSD in a second group of 25 patients with varying degrees of the disorder. Co-existing medical and psychiatric conditions from the patients' medical records and psycho-diagnostic testing will be considered in interpreting the data. All subjects will receive informed consent before viewing the stimulus pictures apprizing apprising them of the fact that some of the images they view may be disturbing. All subjects will be debriefed at the end of their participation in the study to assure they are not suffering from any emotional ill effects as a result of their participation. They will be referred for appropriate support if they are.

In -house Pilot Study (2015) :

Twenty-two volunteer combat veterans, half of whom had PTSD and half who did not, were video-taped in teleconferenced semi-structured clinical interviews. The interviews were analyzed for FMEE content using the FACET coding system. Robust, statistically significant findings differences between PTSD and non-PTSD subjects found:

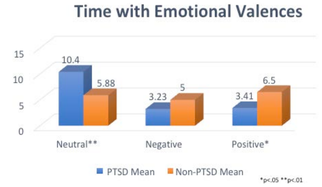
Emotion scores as a logarithmic indication of strength of evidence for an emotion

Emotion	PTSD Mean	s.d.	Non-PTSD Mean	s.d.	t	p	Sig level
Joy	7.91	3.1	9.27	4.8	0.78	.44	ns
Anger**	7.91	2.98	3.15	1.77	3.15	.01	<.01
Surprise*	4.86	3.11	10.9	8.34	2.36	.05	<.05
Fear*	6.73	3.06	12.5	7.1	2.36	.05	<.05
Disgust**	8.09	3.24	4.58	1.51	-3.38	.002	<.01
Sadness*	4	3.12	6.48	2.09	-2.08	.01	<.01
contempt	3.3	3.12	1.33	1.92	1.84	.08	ns



Valence	PTSD Mean	s.d.	Non-PTSD Mean	s.d.
Neutral**	10.4	2.21	5.88	3.18
Negative	3.23	1.8	5	1.15
Positive*	3.41	4.7	6.5	2.98

*p<.05 **p<.01



Non-PTSD subjects expressed most emotions with more intensity than PTSD subjects. PTSD subjects had more intense expressions of anger, disgust and contempt. Non-PTSD subjects had more range of emotional valence. PTSD subjects' total time with neutral/flat affect exceeded positive and negative valence times combined. Taken together these FMEE and Valence scores reflect the over- or under-regulated emotions characteristic of PTSD.

EISENHOWER CENTER CBT + FMEE AND ARMOR DOWN MINDFULNESS TRAINING PILOT STUDIES (2016):

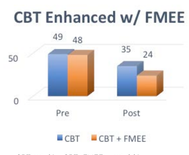
Eisenhower Center (A residential program in Ann Arbor, MI for patients with PTSD/TBI, in need of rehabilitative therapy)

Two experienced therapists trained and supervised by Dr. d'Alelio, interpreted FMEE findings as part of their CBT sessions with 4 combat related PTSD/TBI patients, and did CBT sessions as usual with 4 comparable patients from their caseloads. They used FMEE clips to let their patients actually see how their traumatic memories were triggered and as visible evidence of their progress in therapy. We compared patients' pre- and post- PCL-M scores, and markers of patients' compliance with treatment as outcome measures.

PCL-M:

Eisenhower PCL-M	Pre	Post
CBT*	49	35
CBT + FMEE**	48	24

*p< .01 ** p< .001



CBT alone was demonstrated to improve patients' scores on the PCL-M. CBT informed with FMEE was demonstrably better.

Compliance:

Eisenhower Tx Compliance	%Completed Tx*	% sessions kept*	% Assignments done*
CBT	100%	93%	89%
CBT + FMEE	88%	83%	77%

*p<.05

Patients receiving CBT showed good investment in their therapy, but patients receiving CBT informed by FMEE were significantly more compliant with the requirements on their treatment.

CARRIER CLINIC

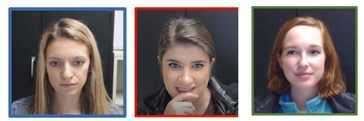
The first the first of two studies with the Carrier Clinic in Belle Mead, NJ. will start in June. It is developing a way to use FMEE technology in triage to improve differentiation between opioid addicted patients, primarily psychiatric dual diagnosis patients, and dual diagnosis patients with secondary psychiatric diagnoses. Patients' FMEE reactions to OASIS photographs will be videotaped, matched to their demographic data, medical histories, Psychiatric Research Interview for Substance and Mental Disorders (PRISM 6.0) scores, treatment compliance, and therapy outcome. Discriminant Function statistics will let us derive a Face2Face algorithm to help clinicians classify patients and their treatment needs quickly and accurately on intake.

The second is a longitudinal study, analyzing 6 month's of FMEEs from 200 opioid addicted outpatients will identify patterns of predictive emotional dysregulation in patients who relapse. That data will be used to create an algorithm that helps clinicians use Face2Face to identify high risk patients before they do.

AMERICAN UNIVERSITY INTERPERSONAL EMOTIONS LAB

We are currently working with the Interpersonal Emotions Lab at American University in Washington D.C. on a spider phobia study to test the hypothesis that FMEEs can detect the differences between subjects who aren't fearful; subjects who are afraid; subjects who are trying to hide their fear; and subjects pretending to be afraid. This work has clinical implications for disorders like PTSD where many patients feel try to conceal their problem, or alternatively, where people may pretend to have a problem for financial gain. The study has just begun and results for truly fearful subjects are not available at the time. The "Faces of Fear" images and corresponding graph, are a sample of our findings so far.

The Faces of Fear



Subject 5 Subject 6 Subject 8