

# Mapping Emotive Biometrics to Social Media Data

Prepared by Olivia Jeffers  
via Compassionate Technologies

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The goal of this study is to computationally link biometric data with social media and behavior data, in order to heal the underlying causes of harmful actions before they manifest as violence.

Existing efforts at behavior prediction or sentiment analysis focus only on mining text data, which are a proxy for the underlying physical sensations that lead to undesirable actions. This experiment aims to gather data directly from the source, and map physical sensation to behavior.

Using machine learning models, scientists will be able to generate probability maps of how people are physically feeling based on social media data. Rapid changes or acceleration towards unpleasant sensation indicate that individuals are suffering, and may soon resort to violence to alleviate their physical discomfort.

The aim of this study is to generate models for how the mind, brain, emotions, and body work, in order to effectively alleviate suffering and reduce violence in the global sphere.

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## I. Current Theories of Emotion and Behavior

Do you believe that you can tell how someone is feeling by looking at their face? If you have watched the popular show ‘Lie to Me’ then you might believe that you can spot a liar by reading their face, or spot a genuine smile with crinkled eyes (Duchenne’s Marker) versus a fake one. These markers are based on the Facial Action Coding System (FACS), which theorizes that people across cultures express emotions using the same facial expressions. FACS has been used to train law enforcement professionals, and is based on years of cross-cultural studies.

Recent studies point to systematic oversights in experimental methodology which unintentionally concealed cultural bias of the researchers, indicating that FACS may be wrong in theory, but right enough in practice. New theories point to emotions as predictive constructions of the mind: the result of the brain’s effort to budget the body’s energy using billions of subtle body sensations occurring in each moment as data. Similar to waves on the surface of a deep ocean, we experience the grand summary of these sensations as **affect**, or general mood or feeling.

This means that among a cultural group that shares similar mental concepts about emotions, FACS might appear accurate — but the danger is in believing that a FACS-based analysis will hold accurate for members of different cultures, such as an American law enforcement officer on the lookout for a potential ISIS member. In this case, training for cultural sensitivity in addition to facial and body cues might be more accurate and life saving.

If the face is not an accurate indicator across cultures, how else can we measure emotion?

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## II. Proposed Methodologies

By taking away the middle-man of emotive words or facial expressions, we can directly measure the underlying physical sensations and reactions which mold our emotions, affect, perceptions, and actions.

**Emotive Biometric Data.** I propose to measure emotional muscles using electromyography (EMG) tests in conjunction with fMRI, heart rate, breath rate, blood oxygenation, and skin conductance data. **Emotional muscles** are the important or tiny muscles that are difficult to consciously control or notice. They are linked to breathing and feelings such as ‘butterflies in my stomach’ or ‘chest tight with anxiety’, i.e. the sternocleidomastoid (SCM) in the neck, masseter muscles in the face, or intercostal muscles in the chest.

**Word and Concepts Data.** The biometric data will be recorded while the subject views certain words, combinations of words, and then words in various social media contexts (Twitter online, Twitter mobile, Snapchat, Facebook mobile, Facebook NewsFeed, etc.) Does the visual venue significantly alter the biological emotive reaction? Or is the reaction based on words alone? Care should be taken to cross-analyze emotive biometric data across all individuals in total, as well as across various combinations of cultural sub-groupings.

**Connecting Biometrics to Social Media Data.** Once enough data is collected, we can begin to use machine learning algorithms to find patterns. By letting machines, and not human scientists, interpret the data, we are minimizing potential for human bias, although it will still exist even in the machine models. The goal of this study is to computationally link biometric data to social media data, to generate a real-time map of how people are physically feeling around the world.

**Connecting Biometrics to Undesirable Action.** If you think about the last time you ever hit someone, broke something out of anger, raised your voice, or fantasized about ruining someone’s reputation — what were you feeling in your body? In your chest, in your hands? Did your heart rate increase and your chest become tight? The aforementioned behaviors are all forms of violence, in thought or in action. Violence is often preceded by a cascade of subtle physical sensations that rapidly amplify into overwhelming, unpleasant physical sensations. The goal of this study is to computationally link biometric data to action.

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### III. Connecting Biometrics to Action

*Biometrics > Sensation > Perception > Mental Concepts > Awareness > Action*

**Biometrics.** Our bodies have six sense organs: eyes, tongue, nose, ears, body, and brain. The first five sense organs are linked to the brain via axons of the nervous system. The brain is the sixth sense organ, because the brain is linked to itself in the same way that it is linked to other sense organs, i.e. parts of the brain generate neural activity which other parts of the brain process. At any moment in time, the neural pathways connected to these sense organs are either firing or not firing. Each moment the brain is receiving a tremendous amount of neural data.

**Sensation.** How does your brain process the billions of neural signals occurring at each moment? These neural data are experienced as sensations of either pain, pleasure, or indifference, depending on various factors such as neural circuitry, genetics, and environment of the organism. Most sensations in your body are subtle and beyond everyday awareness, referred to as **interoception**. Can you feel the biochemical reactions in the skin of your hand? The movement of your colon? The beating of the left ventricle of your heart? The tightness or looseness of the intercostal muscles in your chest?

**Perception.** How the brain interprets these physical sensations depends on its mental concepts. When sensation becomes a perception, it enters the mental space as a concept. The mind can use mental concepts even though we are not consciously aware of or directing the use. Newer theories of constructed emotion hypothesize that parts of the mind use these interoceptive perceptions to budget the body's energy processes, and that the outcome from these budgeting calculations are **emotion**<sup>1</sup>.

**Reaction.** Our minds react to these perceptions of pain or pleasure with aversion or craving. If we experience pain, our default reaction is to push the pain away (aversion). If we experience pleasure, our default reaction is to pull the pleasure closer (craving). Over time, we develop conditioned reactions, such as Pavlov's dog developing a craving for food, manifested as salivation, on the sound of a bell. These reactions give us goals.

**Awareness.** It is frequently cited that humans can only hold  $7 \pm 2$  items in working memory<sup>2</sup>, and that we can only be aware of one item at a time<sup>3</sup>. Our awareness tends to follow the loudest sensation. Our subtle, interoceptive sensations often go unnoticed. When a conditioned reaction enters our cognitive awareness, the mind devotes resources to manifesting our goals: it either tries to get rid of unpleasant sensations, or get more pleasant ones.

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<sup>1</sup> "How Emotions are Made" by Lisa Feldman Barrett, 2017

<sup>2</sup> The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information (Miller, 1956, *The Psychological Review*)

<sup>3</sup> "Think You're Multitasking? Think Again" (Hamilton, 2008, NPR)

**Physical Action.** In organisms without higher level thought, actions are predictable according to conditioning. For example, two rats electrocuted in a cage will attack each other and other nearby animals<sup>4</sup>. Unable to understand where their pain is coming from, they try to get rid of the sensation in the only way their less complex minds have concepts for: they attack the other. It is important to note that not all mammals had this reaction. While paired rats and hamsters attacked each other, paired guinea pigs did not.

**Mental Action.** In organisms with higher level thought, the first reaction is often the mental action of trying to figure out why a sensation is occurring. By default, we search for external causes for our strongest sensations. In humans, this manifests as assuming that someone or something else is making us relaxed, unhappy, feel connected, or anxious. As we form mental concepts, we come to associate certain people or objects with our internal reactions of craving or aversion, rooted to our internal sensations of pleasure or pain. For example, we may label certain types of people as ‘enemies’, ‘untouchables’, or ‘terrorists’ and make them objects of our aversion — the same way that we may label others ‘lovers’, ‘superiors’, or ‘saints’ and make them objects of our craving.

**Volitional Action.** These mental actions often translate into conscious, volitional physical actions. Humans will try to get more of the feelings they like, such as by writing and sending a letter to someone they love — or they will try to ‘get rid of the bad feelings’ the best way that they know how. Often this can manifest as a child having a temper tantrum, simply releasing their physical tension by screaming and kicking — or bullying another child, which gives the bullying child, who may be struggling with insecurities at home, a sensation of safety and comfort in knowing that they can physically dominate another child.

**Organizational Action.** These chains of sensations and conditioned reactions can extend beyond the individual and into large organizations, manifested as culture or tradition. In response to the pain of national humiliation after World War I, the Nazi government labeled Jews as the cause of their economic suffering<sup>5</sup>. In the same way that children bully each other, the Nazi government elevated themselves above others with the concept of a master Aryan race, and systematically degraded the Jews. What had started as a simple bullying campaign evolved into a systematic genocide campaign between the years of 1933 and 1945, in what is now called the Holocaust. The Holocaust is a testament to the human inability to notice subtle changes over time.

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<sup>4</sup> Reflexive Fighting in Response to Aversive Stimulation (Ulrich & Azrin, 1962, *Journal of the Experimental Analysis of Behavior*)

<sup>5</sup> “Black Rednecks, White Liberals” by Thomas Sowell

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#### IV. Moral Implications

Humans have much less agency than we believe we have, but we still have agency. In all actions that humans choose to take, there is an underlying motivation, which is often conditioned by mental concepts and sensations that are occurring underneath our limited, conscious awareness.

By studying exactly what we have agency over, and what we do not have agency over, we can shape education programs and international policy efforts that result in more peaceful and compassionate actions that increase joy and health in the human experience.

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#### V. Use of Methodologies

**Prediction.** These methodologies can be used to geographically map spread of affect, which may be used to predict rising physical tensions that may lead to violence. Events such as the alt-right protest in Charlottesville and Occupy Wall Street were likely easily predictable by any human active in those social circles. Because of the filtered view of the Internet, it is difficult for an alt-right member to be aware of what is going on with the Occupy Wall Street crowd, and vice versa. These techniques allows a minimally-biased machine learning algorithm to monitor physical, emotional, and social tensions worldwide.

**Antidote & Resolution.** If certain words or concepts make certain populations feel unpleasant sensation, then an antidote of healing words and emotions can help those populations deescalate negative affect. Combined with cultural awareness and education, the conceptual source of unpleasant affect can be decoupled from the sensations, allowing for deeper and non-judgmental peace efforts without resorting to violent actions, or manipulative and/or secretive propaganda.

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#### VI. Warnings for Use of Methodologies

Extreme care should be taken to remove bias, as in all scientific experiments, and the predictions should be used to gain insight into potential conflict and create cost-effective and life-saving verbal and non-violent methods for resolution. These predictions should never be used for predictive punishment or punitive action.

## VII. Practicalities, Legalities, Funding

### Who has the resources to do these experiments already?

*Currently asking around.*

Emotion Recognition in the Wild via Convolutional Neural Networks and Mapped Binary Patterns

Affective Neuroscience Lab, Northeastern, Feldman-Barrett

Affectiva

Apple's Secret Exercise Lab

### Funding

#### What grants are there available?

NSF, DOD, Templeton

List from Northeastern Affective Neuroscience Lab

#### Venture Capital

Collaborative Fund, others

### Team (volunteer basis)

*(tentative commitments)*

2 Machine Learning Professionals

1 Social Media Data Analyst

1 Science and Grant Writer

*(needed)*

Data Scientists

Emotive Biometric Measurers (collaboration needed with medical lab)

### Plan of Action

Begin to establish Compassionate Technologies as research nonprofit (1-year)

Draft research methodology, research proposal

Begin contacting labs, soft circling commitment to assist if funding comes through

Apply for funding, NIH Grant Funding, Templeton, etc.