Project VOICE: Annotated Bibliography

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Introduction

Project Description: Today, non-verbal children are believed to have minimal intelligence and cognitive abilities. We are aiming to prove this to be false. The Voice Project initiative aims to reverse biases in academia and show that communication is still possible without words or signs. Our current work consists of integrating computer software with biomedical engineering and neurology to explore non-verbal and non-symbolic communication through brain monitoring applications.

Research

Foundational Emotions: Fear, Sadness, Joy/Happiness

1. Heart Rate (HR)

Fear: Heart rate tends to increase with fear due to the activation of the sympathetic nervous system (the fight-or-flight response). The increase in heart rate is part of the body's preparation to face a perceived threat.

- Range: 90-120 bpm (can possibly be higher in intense fear situations)

Sadness: Heart rate may decrease in response to sadness. The parasympathetic nervous system (which calms the body) might be more active during this emotional state, leading to slower heart rate and reduced arousal.

- Range: 60-80 bpm

Joy: Joy or happiness often leads to an increase in heart rate, though the increase might be less intense than with fear. Positive emotions tend to activate the sympathetic nervous system, but in a more moderate way than fear.

- Range: 80-100 bpm

2. Blood Pressure

Fear: Blood pressure typically rises with fear due to the body's stress response. This happens as the body prepares for action—either fight or flight—by sending more blood to muscles and vital organs.

Range: Systolic 120-140 mmHg, Diastolic 80-90 mmHg

Sadness: Blood pressure might either remain steady or slightly decrease with sadness. A prolonged emotional state of sadness can lead to lower overall arousal, including a reduction in blood pressure.

Range: Systolic 100-120 mmHg, Diastolic 60-80 mmHg

Joy: Blood pressure can increase with joy, particularly if the emotional

state is intense or accompanied by physical activity (e.g., laughing or jumping around). However, the increase is typically less pronounced than with fear.
Range: Systolic 110-130 mmHg, Diastolic 70-85 mmHg

3. Skin Conductance (Galvanic Skin Response or GSR)
Fear: Skin conductance (which measures sweating) increases during fear. Fearful emotions trigger the release of adrenaline, which activates sweat glands, leading to higher skin conductance.
Sadness: Skin conductance can decrease during sadness. When experiencing sadness, there's often less physiological arousal and lower sweating.
Joy: Joy may also increase skin conductance, but generally not as much as fear. Positive emotions can lead to mild increases in sweat production, but the response is less intense compared to fear.

4. Respiration Rate
Fear: Breathing rate typically increases with fear. Rapid, shallow breathing is a common response as the body prepares for quick action.
Range: 18-30 breaths per minute
Sadness: Sadness can be associated with slower and deeper breathing, as it is often linked to a more subdued and low-energy state.
Range: 12-18 breaths per minute
Joy: Joy is often marked by faster, shallow breaths, especially if the person is laughing or excited. However, in a calmer state of joy, breathing might be normal or even deeper than usual.
Range: 15-22 breaths per minute

5. Pupil Dilation
Fear: Fear triggers dilation of the pupils (mydriasis). This response is part of the fight-or-flight mechanism, increasing visual sensitivity to detect threats in the environment.
Sadness: Pupil dilation is generally less pronounced with sadness, although there might be some dilation due to emotional distress or fatigue.
Joy: Pupil dilation can occur with joy or excitement, though it is often less noticeable than with fear. Positive emotions can lead to increased alertness, which can cause minor dilation.

6. Facial Expressions
While not strictly physiological markers, facial expressions are closely tied

to emotion and can give additional context to the physiological signals. For example:
Fear: Widened eyes, raised eyebrows, and a mouth that might be open.
Sadness: Downturned lips, furrowed brows, and eyes that might be teary or appear "droopy."
Joy: Smiling, with the mouth forming a wide grin and the eyes potentially squinting or showing "crow's feet."

7. Body Temperature
Fear: Often, body temperature might decrease in response to fear (cold hands or feet), due to the redirection of blood flow to essential organs and muscles.
Sadness: Sadness may lead to a slight decrease in body temperature, especially if it leads to lethargy or feelings of coldness.
Joy: Positive emotions like joy can sometimes cause a slight increase in body temperature, particularly if the joy is linked to physical activity or excitement (e.g., laughing, running around).

8. Cortisol Levels
Fear: Cortisol, the stress hormone, increases during fear as part of the body's preparation for danger.
Range: Approximately 15-25 mcg/dL (can vary widely, depending on the intensity and duration of fear)
Sadness: Cortisol levels may also rise during sadness, particularly if the sadness is prolonged or linked to stress.
Range: Approximately 10-15 mcg/dL (slightly elevated from baseline in some cases)
Joy: Cortisol tends to be lower during positive emotions like joy. Joy and laughter can reduce stress and lower cortisol levels.
Range: Approximately 5-10 mcg/dL (slightly lower than baseline)

9. Muscle Tension
Fear: Increased muscle tension is common with fear, especially in the face, neck, shoulders, and hands. This is related to the fight-or-flight response.
Sadness: Muscle tension tends to decrease with sadness, as the body may feel fatigued or weakened.
Joy: Joy can lead to muscle relaxation and less tension. Laughter and other joyful expressions often involve a relaxation of facial and body muscles.