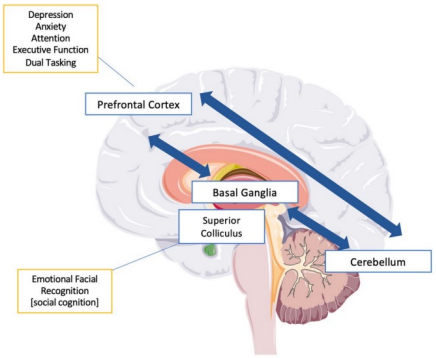
Emotion in Slow Motion

EVALUATING SOCIAL COGNITION IN CERVICAL DYSTONIA USING ELECTROENCEPHALOGRAPHY

Svit Pestotnik Stres, Prof. Richard Reilly
School of Medicine, Trinity Centre for Biomedical Engineering, School of Engineering
Trinity College Dublin, the University of Dublin

1. Cervical Dystonia & Social Cognition

Cervical dystonia (CD) is a hyperkinetic movement disorder; and the most prevalent phenotype of the adult-onset idiopathic focal dystonia (AOIFD). The motor symptoms are treated reasonably effectively with **botulinum toxin**. The non-motor symptoms, however, are complex and are the **main predictors of quality of life**. The mechanisms underlying AOIFDs remain unclear. Studies have shown that patients with CD have **abnormal social cognition**. This is suspected to be due to the involvement of the **superior colliculus**, a centre in the midbrain responsible for processing visual information and gaze shifts.



2. Introduction

It is hypothesised that social cognition, particularly **emotion processing**, plays a significant role in the manifestation of the condition. This should be evident through a **delayed facial expression change recognition**, which can be observed through EEG. To date, research papers in this area have primarily relied on static emotion pictures as stimuli presented to the patient, but dynamic emotion is much more resemblant to the natural mechanism of emotion processing.

3. Aims

The aim of this project was to develop a **novel experiment paradigm** and show the viability of a video-based experiment for Cervical Dystonia investigations in the future. In the long run, it is hoped that delayed emotion recognition can be used as a diagnostic tool.

4. Methodology

- ADFES-BIV database of videos
- Smarting EEG 24-lead electrode cap
- NBS Presentation software
- LSL- Lab Streaming Layer
- Evoked Response Potentials (ERPs) theory

4.1 NBS Presentation Software & experiment

Stimuli were presented using NBS Presentation, which allows accurate control of timing and signal processing. **4 blocks of 120 videos** were shown (6 min/ block) with 1s after each successive video. 60% of videos presented were neutral, with different emotions (anger, joy, fear, surprise) allocated 10% each- creating an **oddball task**. After every block, a 1 min break was allowed for rest.

4.2 Lab Streaming Layer

To ensure video stimuli are synchronised with the EEG cap, LSL was used, which allows for multiple streams of information to be incorporated together. In this case start and end of the emotion transition were overlayed on top of the EEG data.

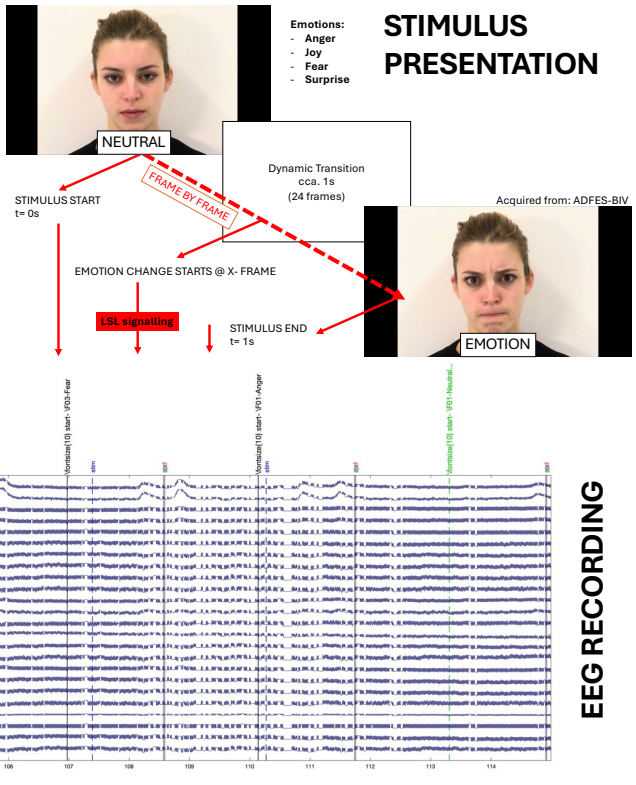
4.3 Evoked Response Potentials (ERPs)

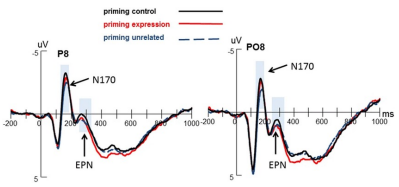
Changes in neurological activity- ERPs- were assessed through EEG waveforms to investigate emotion processing. Specifically, N170, Early Posterior Negativity and Late Positive Complex were emphasised in the literature.

N170- is a negative deflection and arises 170 ms after stimulus onset and is associated with **human face processing**.

EPN- emerges as early as 150 to 300 ms after stimulus onset as a negative deflection is considered to reflect **attention allocation to the stimuli.**

LPC- appears at around 500 ms, as a long-lasting, enhanced positivity and is suggested to reflect **elaborative processing and conscious recognition of the stimulus.**





5. Results

From the early pre-processing analysis we can establish a few things, which are seen in the graph above. There is a response, which at least for now shows that the experimental setup is working. Due to time limitations, extensive testing was not possible, but the initial aim of the research was achieved- namely developing a novel experiment paradigm. Further research and investigation are required to confirm the viability of this approach for patient testing.

Acknowledgements

Many thanks to Trinity College Dublin and Laidlaw Undergraduate Leadership and Research Programme for the support and funding of this research. Additional thanks to my supervisor Prof. Richard Reilly for feedback and support. Thanks also to AdFutura and MOL stipends from Ljubljana, Slovenia.

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