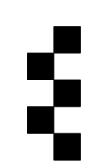
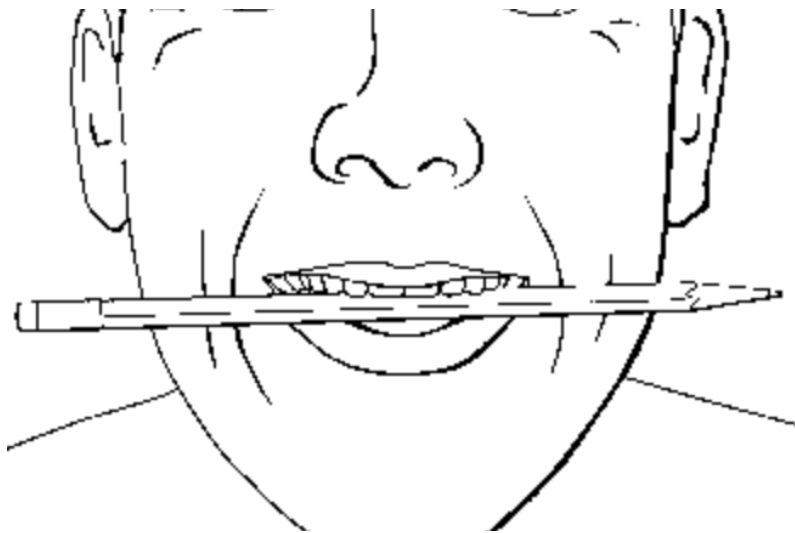


Re-Examining the Facial Feedback Hypothesis: Investigating Emotion Induction through Functional Neuromuscular Electrical Stimulation (fNMES) of Facial Muscles

Themis Efthimiou



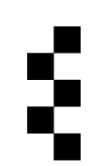
- The Facial Feedback Hypothesis (FFH) suggests that facial expressions influence the processing of affective signals through a facial feedback mechanism.



Botulinum toxin injection sites in the glabellar region



Strack et al 1988; Marsh et al 2019; Marmolejo-Ramos et al., 2020; Coles et al 2020, 2022; Hennenlotter et al., 2009; Kim et al., 2014

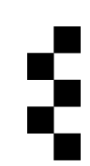


- **Weaknesses**

- Lack of precise targeting of muscles
- Difficulty in getting participants to produce the expression of interest

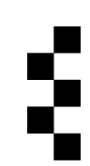
- Limited studies have explored the use of fNMES in investigating the Facial Feedback Hypothesis.





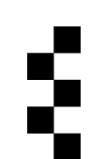
- Experiment 1 - the effects of fNMES on emotion perception using a forced-choice categorisation task.

- Experiment 2 - the effect of fNMES on emotional state

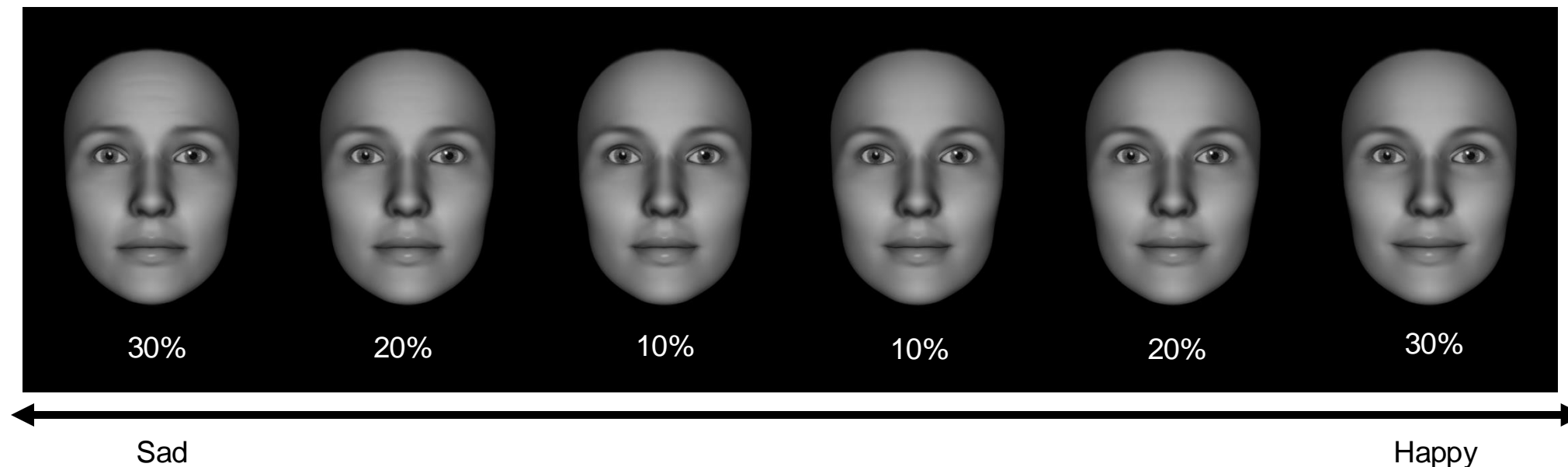


- fNMES effects on visual ERPs

- The **P1** component emerges in the extrastriate cortex within 100 ms of a visual stimulus being displayed it can potentially reflect the emotional characteristics of facial expression.
- The **N170**, localised in the superior temporal cortex, component is associated with structural encoding of faces. Sel and colleagues (2017) showed own emotional expression acts as a top-down influence on low-level neural encoding during facial perception.
- The Late Positive Potential (**LPP**) arises in the temporo-occipital region. Associated with sustained attention and elaborate processing.

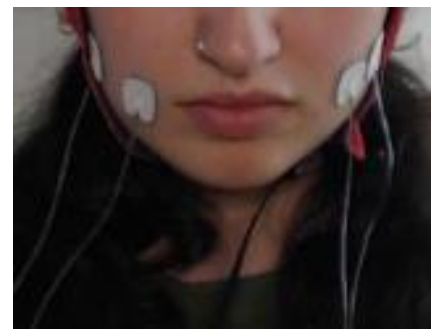
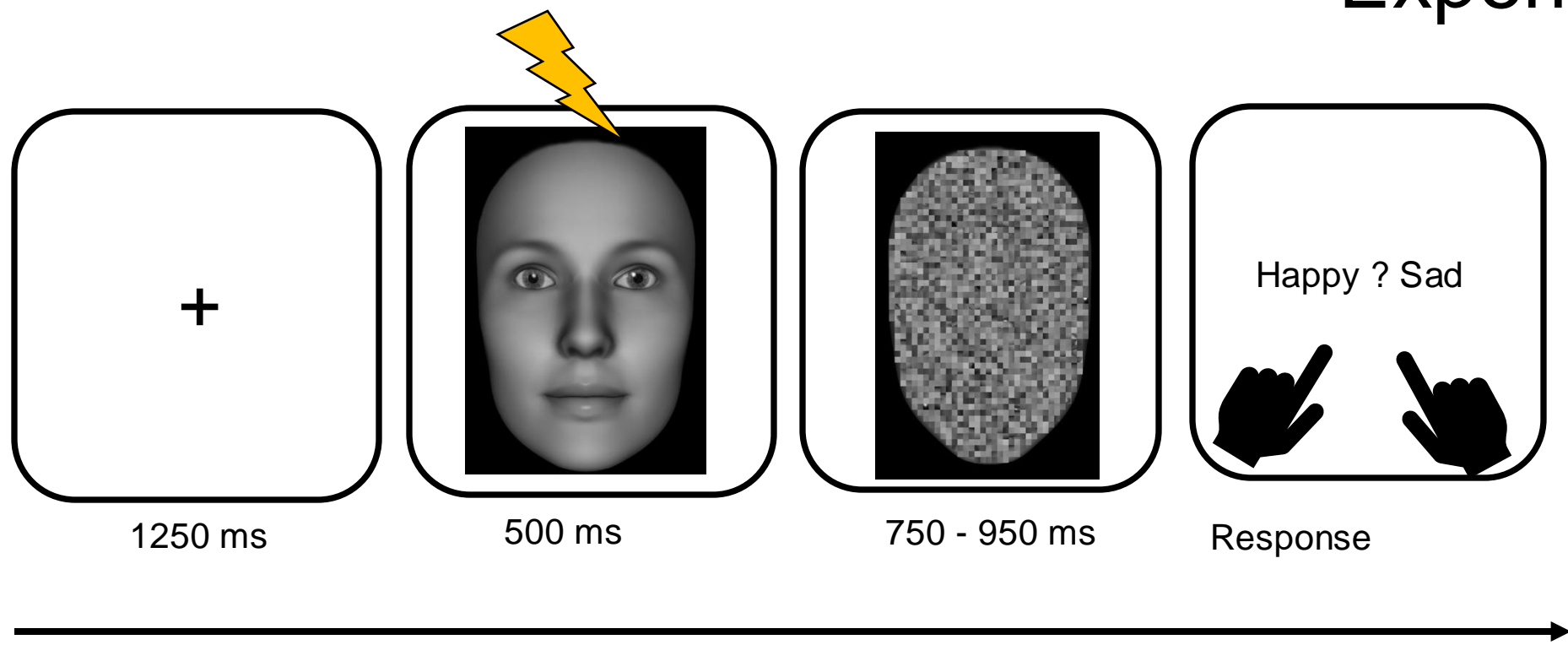


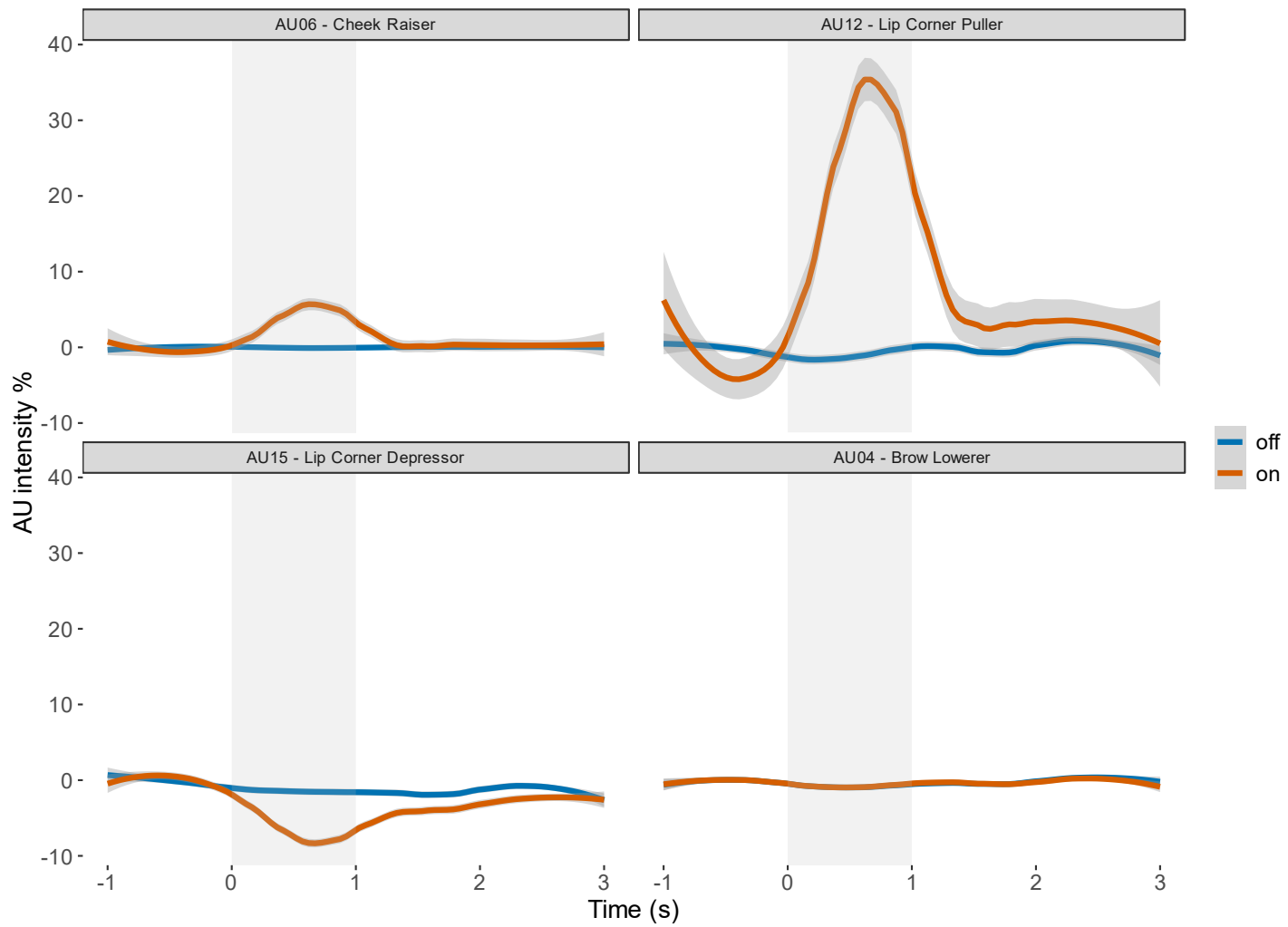
- Stimulus set: 22 avatars (11 male) generated using FACSGen software



[1] Inner brow raiser
[4] Brow Lowerer
[7] Lids Tightener
[11] Nasolabial Deepener
[15] Lip Corner Depressor

[6] Cheek Raiser
[7] Lids Tightener
[12] Lip Corner Puller



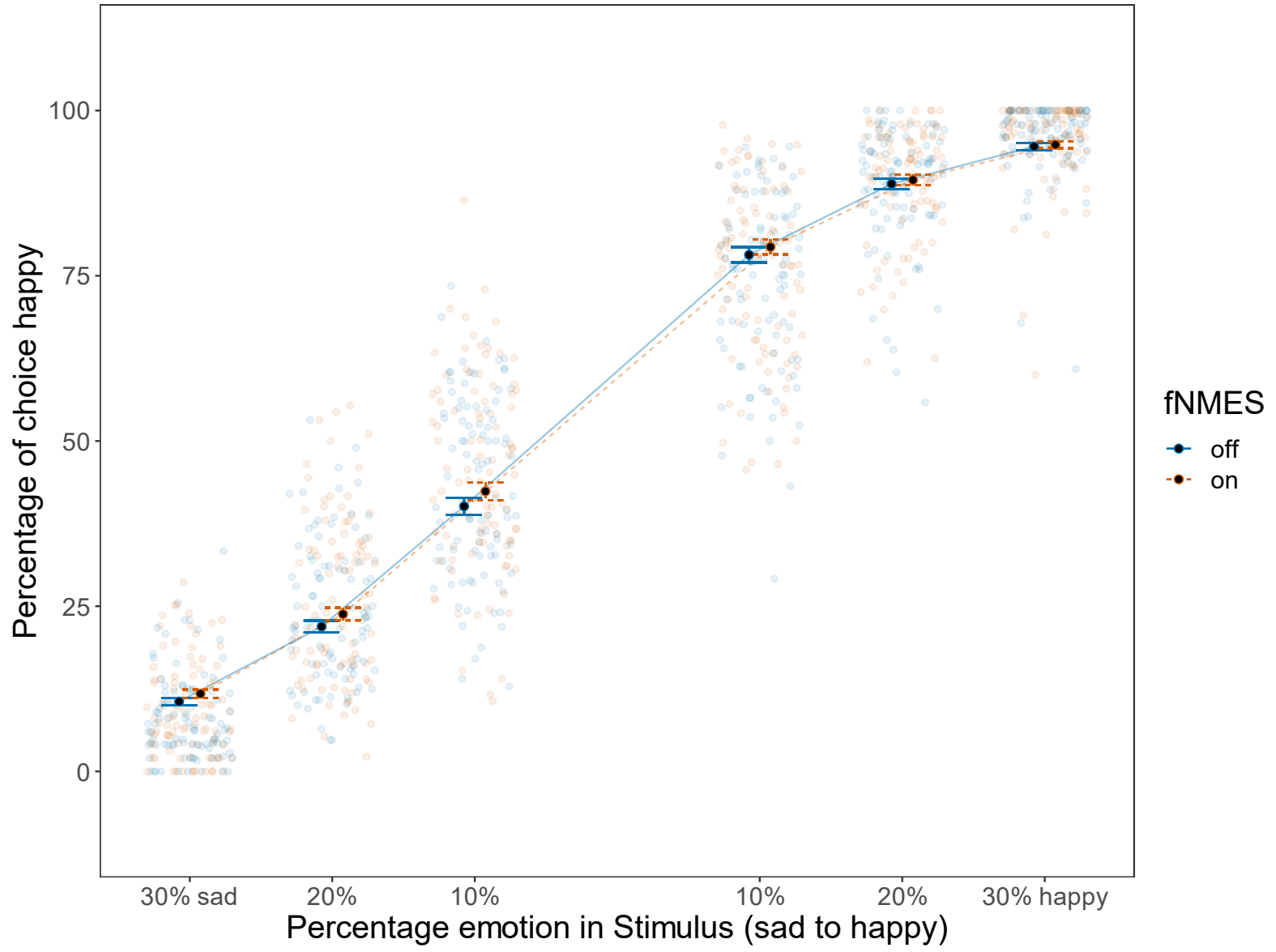


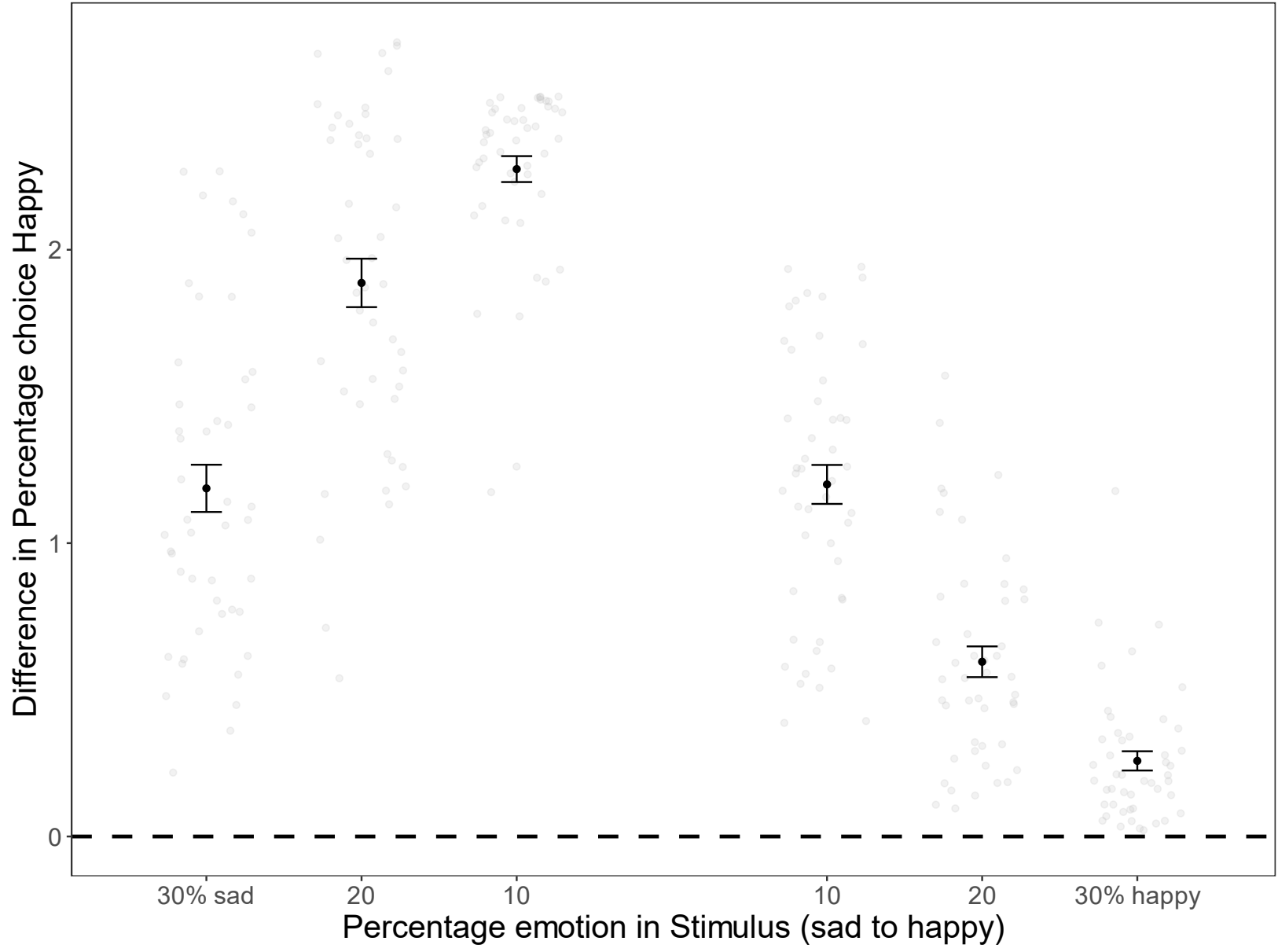
- OpenFace (Baltrusaitis, et al. 2016, 2018)

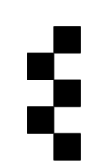
Formula: choice ~ emotion * fNMES + (emotion | participant)

Experiment 1

Emotion: $\beta = .93, p < .001$
fNMES: $\beta = .09, p = .011$

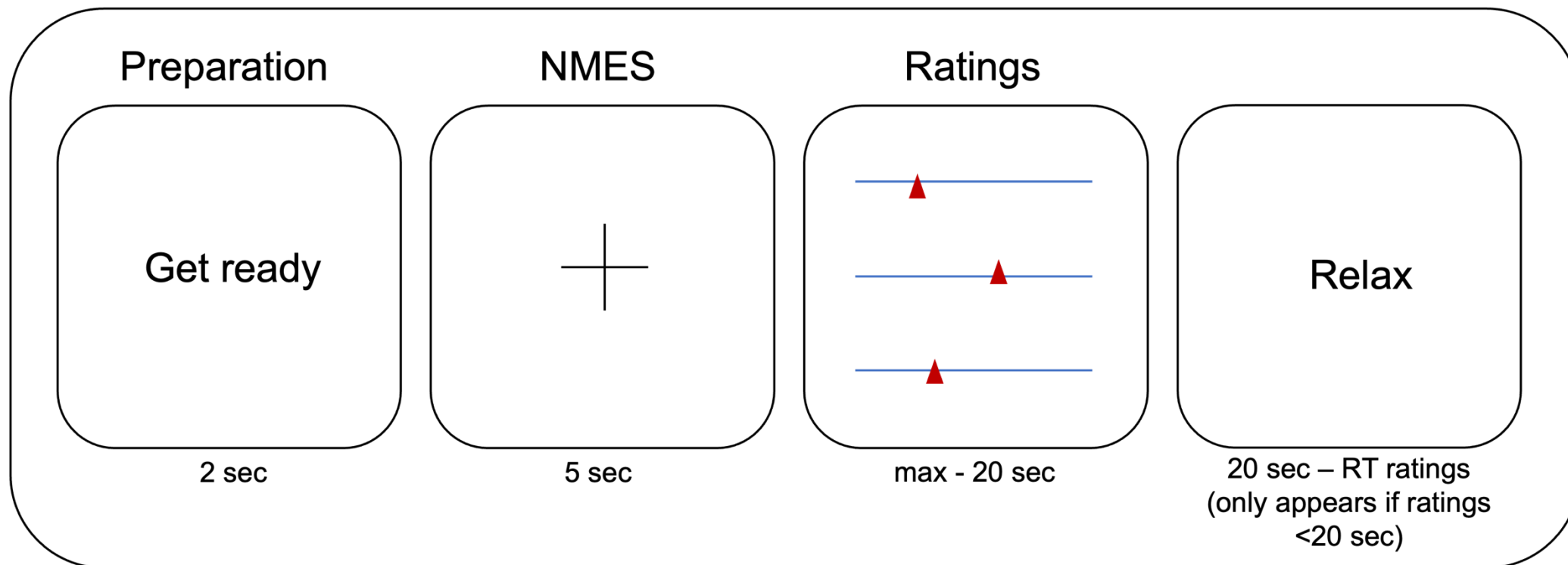
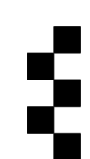






- A weak smile enhances likelihood of seeing happiness in ambiguous faces
 - This was a main effect, but the pattern indicated it to be stronger for ambiguous and sad faces
- All components were modulated by fNMES
- N170 and LPP showed modulation by both fNMES and emotion
- Main effects of fNMES on ERPs are hard to interpret in isolation, as there is a general shift towards + but this can be removed

- fNMES can be used to investigate facial feedback effects on emotional processing
- more work needed to figure out how to investigate fNMES effects on EEG



Thank you for your attention!

Thanks to my lab!

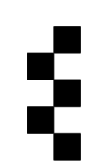


Thanks to our funder!



Find me:





- fNMES delivery through constant-current electrical stimulators (Digitimer DS5)
 - Stimulus parameters: biphasic square pulses, width of 100 microseconds, pulse delay of 14 milliseconds, 70 Hz frequency

