BACKGROUND

Given its high temporal resolution, brain potentials related to events (ERP) potentially allow the evaluation of the time-course of facial expression processing states (von Cramon & Blass, 2000) but still, the neural signatures for facial expressions remain under debate. Several components of the ERPs might be sensitive to the emotional content of the faces:

- The P1 (10-120 ms post-stimulus onset at occipital sites), and its negative counterpart N1, reflect early selective attention and low-level stimulus properties (e.g., color, texture) (Spence et al., 2003). Evidence about emotional modulation of the P1 during face viewing is mixed, with some studies reporting enhanced P1 for fearful compared to neutral and happy faces (e.g., Kelly & Tipples, 2003 and others do not (Rothwell & Perrett, 2007).
- The N170 (~130-200 ms post-stimulus onset at occipito-temporal sites) and its positive counterpart VPP, are the earliest indicators of face processing (von Cramon & Blass, 2000; Rothwell & Perrett, 2007), though its sensitivity to emotion in faces is still under debate (Rugg, Martin & Nätänen, 1996). Thus, enhanced N170 for fearful compared to neutral and happy expressions have been found in some studies (e.g., Alia et al., 2007) sometimes related to a right-hemisphere advantage in the processing of negative faces (von Cramon & Blass, 2000) but not in others (e.g., Krampe et al., 2003).
- The LPP (beginning ~300 ms post-stimulus onset at central-parietal sites) is associated with sustained attention to emotionally salient stimuli –whether pictures, words or faces (Cuthbert et al., 2000; Kopp, Reibel, Maltin & Forst, 2013).

AIM

To investigate with dense-array ERP recordings the time-course of emotional facial expression processing using three electrophysiological indices: P1, N170 and LPP.

METHOD

Design
Participants: 127 undergraduates (95 females)

Stimuli: Faces of NimStim (Tottenham et al., 2009)

288 TRIALS: 10 Actors (9 Real) 4 Expressions 4 Blocks

Data acquisition and analyses

- Analog filters: 0.1 - 100 Hz bandpass; digitized at 250 Hz with a 24-bit A/D converter
- Epochs: 500 to 1000 ms
- Baseline correction: -500 to 0 ms
- Dependent variables (DVs):
  - P1: 90 - 110 ms peak amplitude at PO7 clusters (left and right)
  - N170: 130 - 150 ms peak amplitude at T6b (left and right)
  - LPP: 600 - 1000 ms mean amplitude at Cz (left and right)

Statistical analyses

- A 4 (Emotion: Fear, Happy, Neutral, Scrambled) x 2 (Laterality: Left, Right) repeated measures ANOVA on each DV

CONCLUSIONS

The three ERP components studied are sensitive to different aspects of perceptual processing of emotional faces:

- The P1 amplitude is greater for the faces than the scrambled stimuli and this effect is greater over the right hemisphere, confirming that P1 is a sensitive component, specifically, to the low-level structural properties of the stimulus (Calder et al., 1999).
- The N170 face-specific ERP amplitude is greater for faces compared to scrambled stimuli and, importantly, larger for fear compared to the other facial expressions, being these effects greater over the right hemisphere. These results suggest that threat detection seems to be prioritised quickly in neural systems supporting emotion recognition (Cabeza et al., 2000).
- Also indicating a right-hemisphere advantage in perception and interpretation of emotional expressions (Wolpaw et al., 1995).
- The LPP amplitude continues to show priority processing for fear over the other emotional expressions, suggesting that the facilitated motivated attention for fearful faces is maintained over time.

REFERENCES