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Introduction:

Depression and **Social Anxiety** are prevalent mental disorders that impair the quality of life. These disorders are associated with severe impairments in **social interactions**. People with these disorders report more negative, deteriorated and unsatisfying social interactions than healthy people. Despite the importance of social interactions in health, their neural basis are still not well understood.

The **Ultimatum Game (UG)** is a task from behavioral economics that recreates **fair and unfair social situations**.

Event-Related Potentials are useful to study the neural activity with high temporal resolution. The **Medial Frontal Negativity (MFN)** is a negative frontocentral component related to the negative emotional impact of the stimuli. The **Late Positive Potential (LPP)** and the **P300** are associated with the same cognitive processes and neural sources. The LPP/P300 is related with motivational processes and with the allocation of attentional resources to the stimuli.

Objective:

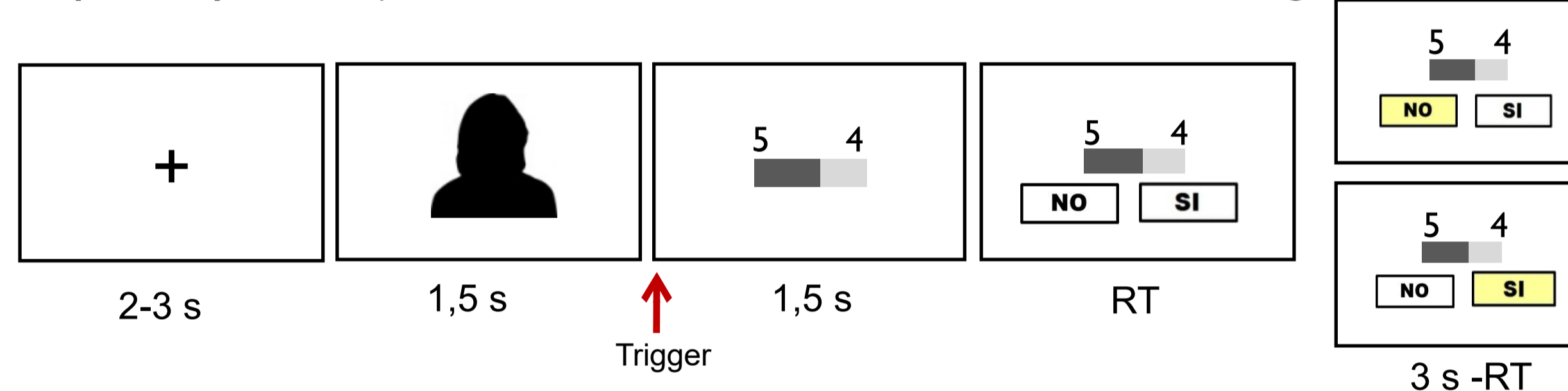
- Investigate the neural activation associated to fair and unfair social interactions in Major Depression and Social Anxiety using Event-Related Potentials.

Methods:

	Control	Depression/ Social Anxiety
n	47	49
Age	21,9 ± 3,4	23,4 ± 4,2
BDI	1,5 ± 1,9	23,4 ± 11,1
LSAS	12,6 ± 9,4	74,7 ± 23,1

1) Task: Ultimatum Game

The participant **receives offers** from other players on how to split a sum of money.
 - If the participant **accepts the offer**, the participant and the player who made the offer accumulate the money.
 - If the participant **rejects the offer**, both accumulate nothing.

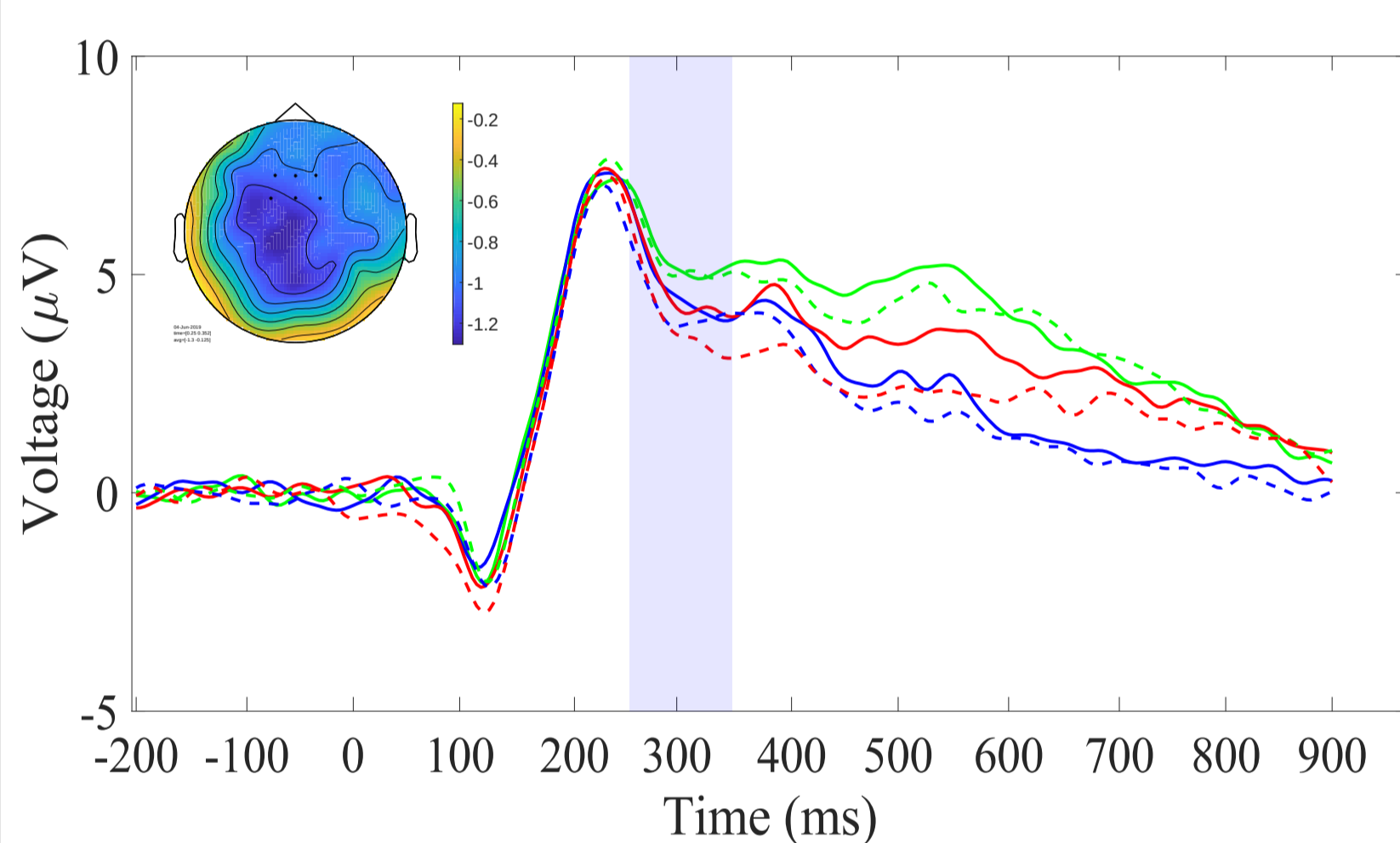


2) Task feedback

After the UG, the participant rate in likert scales how many **happiness, anger, sadness, betrayal** and **devaluation** he/she felt when facing specific offers in the UG.

Results:

1.a) Medial Frontal Negativity (MFN)

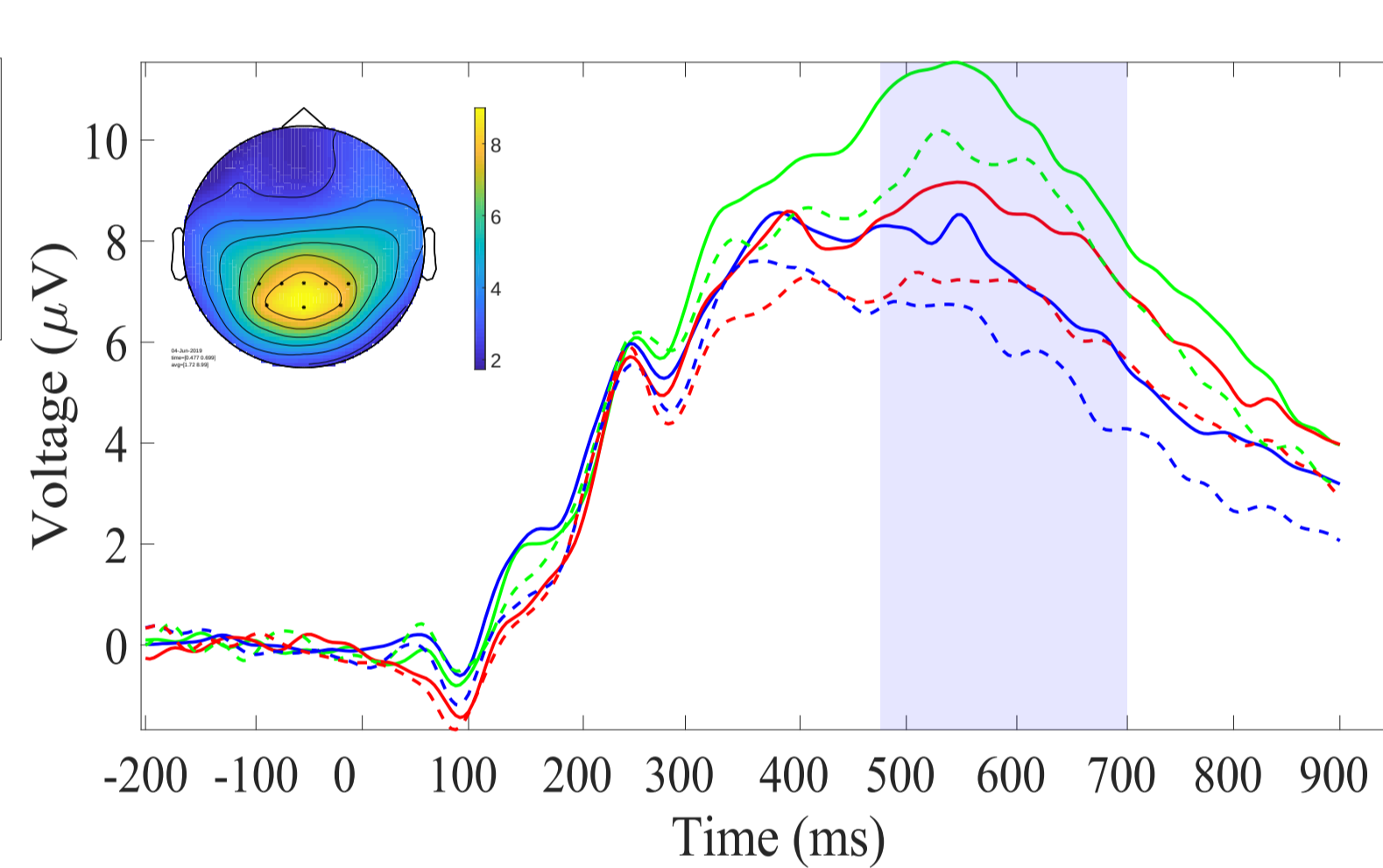


- The **MFN** was more negative in unfair and medium offers in comparison to fair offers ($p \leq 0,003$).

- There was a trend indicating that the **MFN** was more negative in the clinical than in the control group ($p = 0,056$).

The MFN was computed as the average of frontocentral electrodes (F1, Fz, F2, FC1, FCz, FC2) in the 250-350 time window.

1.b) Late Positive Potential (LPP/P300)

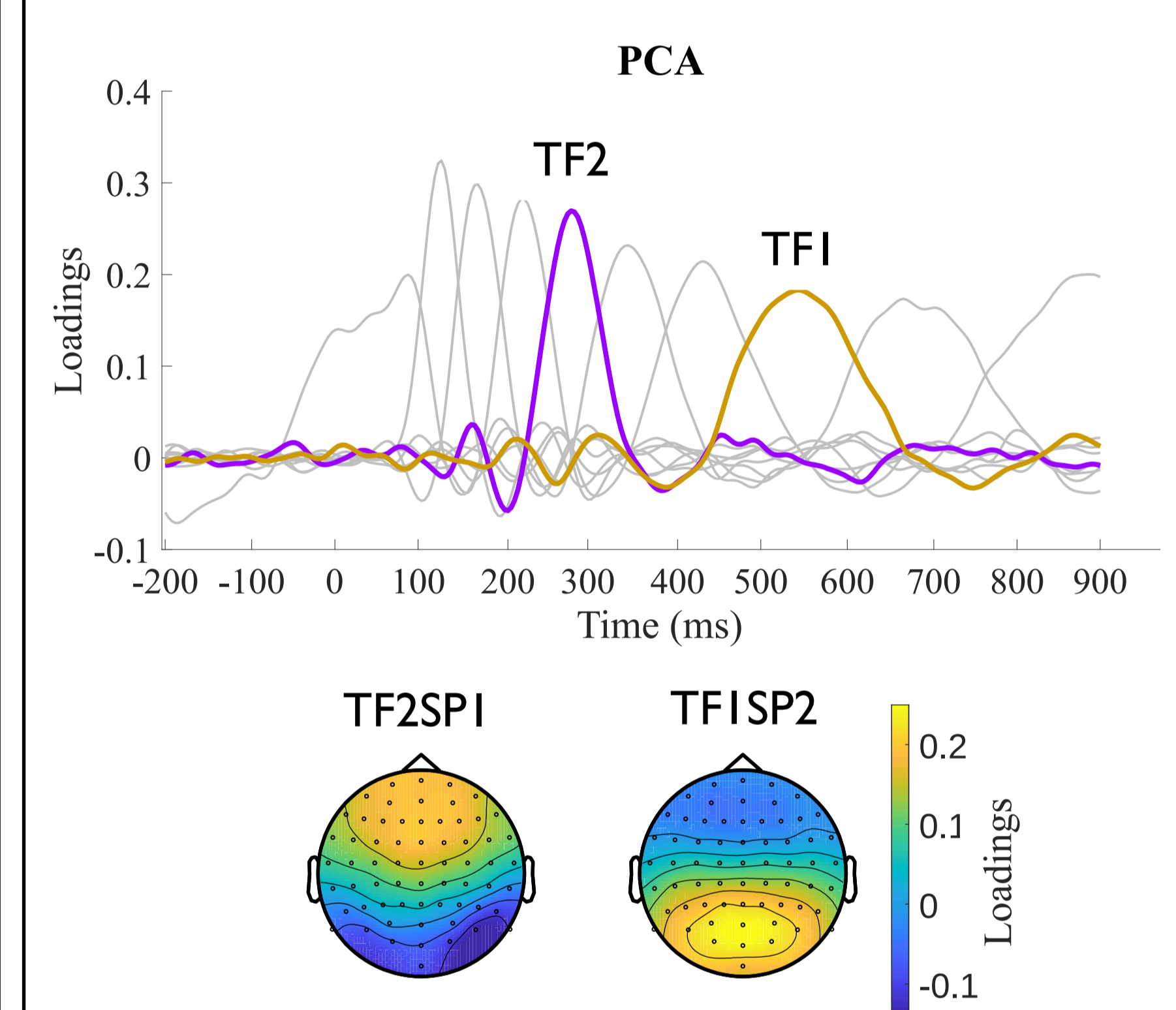


- The **LPP/P300** was more positive in fair than unfair offers, and more positive in unfair than medium offers ($p < 0,0001$).

- The **LPP/P300** was more negative for the clinical than the control group ($p = 0,038$).

The LPP/P300 was computed as the average of parietal electrodes (P1, Pz, P2, PO3, POz, PO4, P3, P4) in the 475-700 time window.

2) ERPs decomposition using PCA



The ERPs results were replicated using a data driven method based in PCA.

3) Rejection of offers:

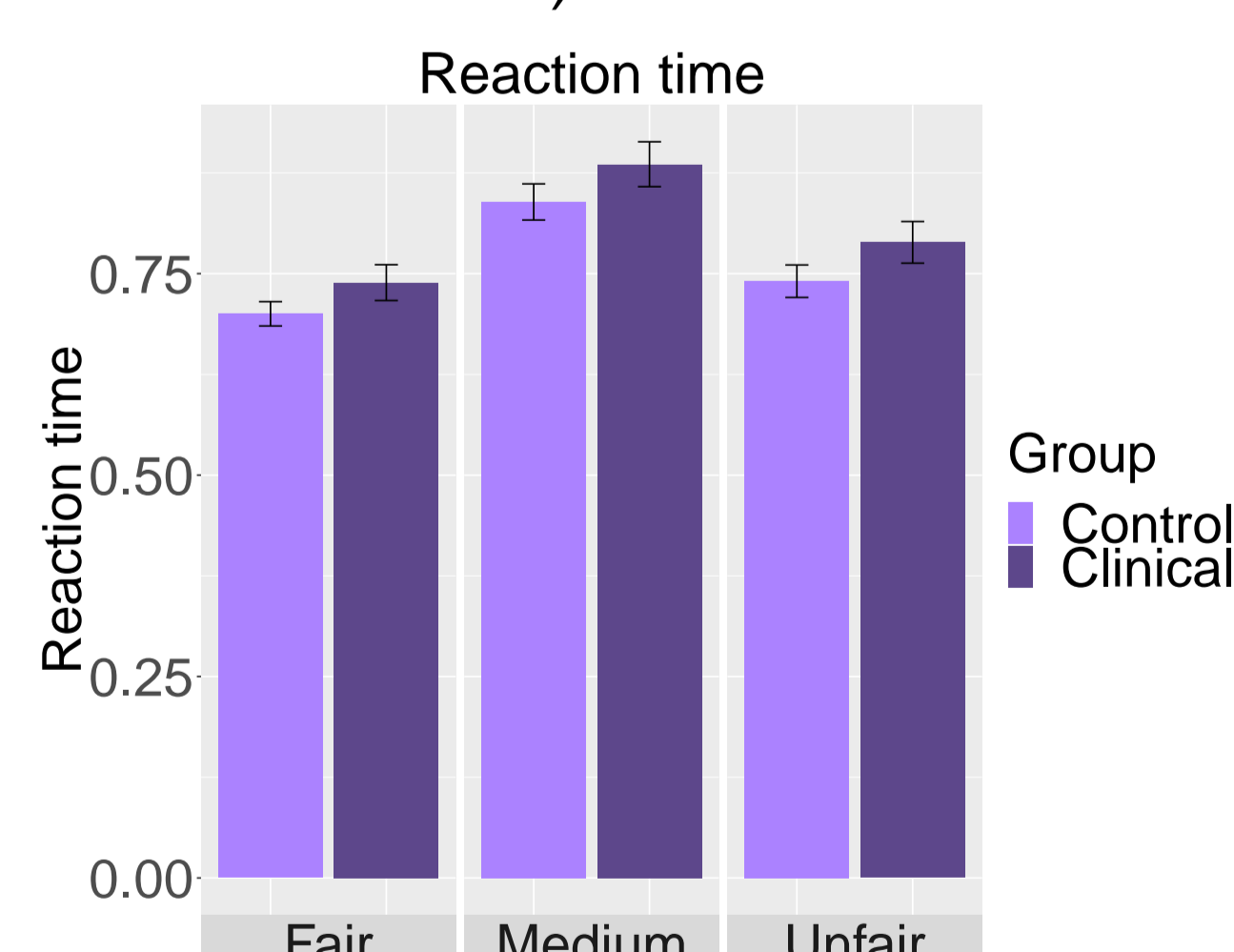
Offers were more rejected as the unfairness increased ($p < 0,0001$).



Error bars denote one standard error.

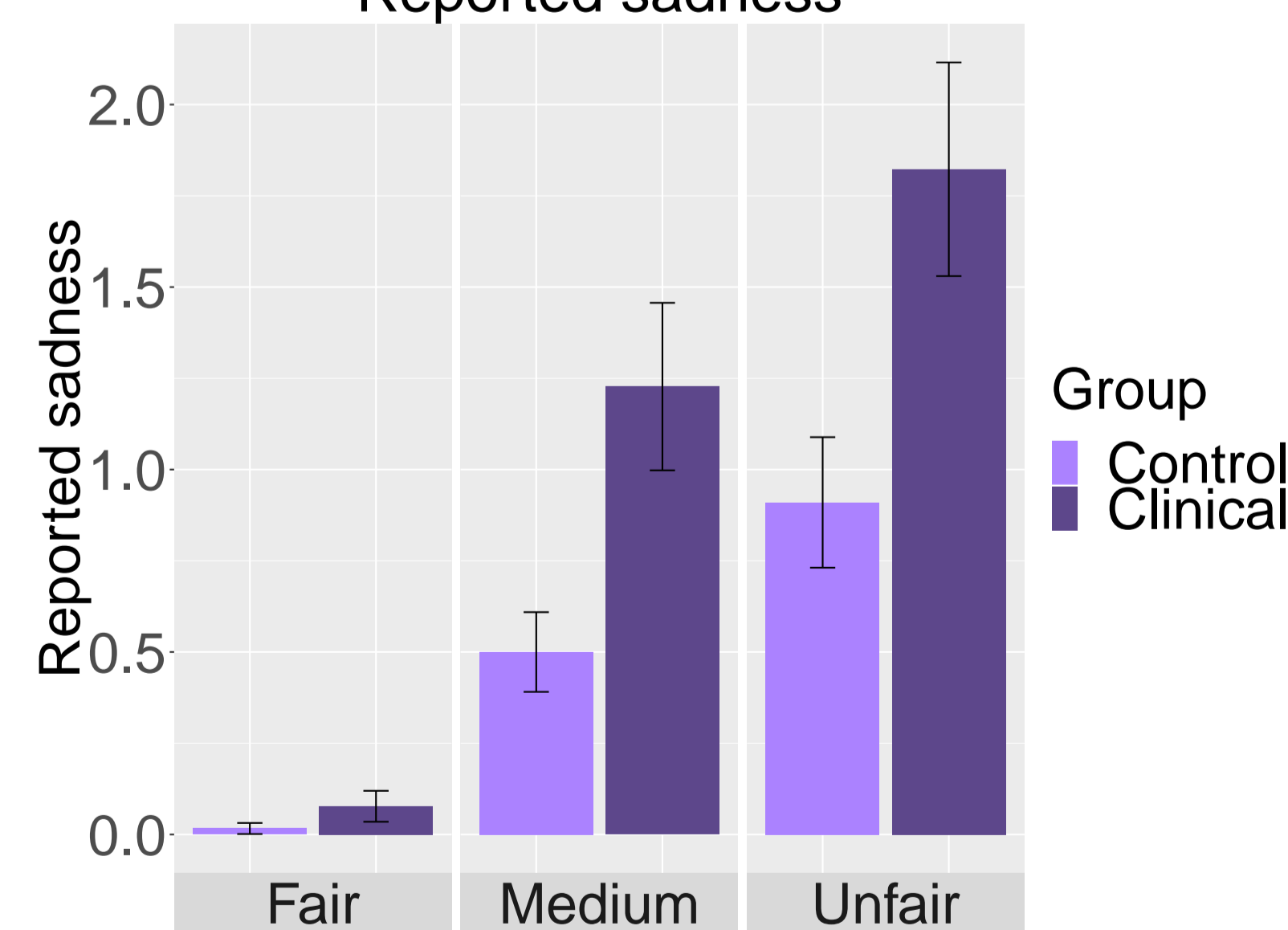
4) Reaction time:

The more conflicting offers required more time to decide ($p \leq 0,0005$) (medium > unfair > fair).



5) Emotional Feedback:

Reported sadness



Error bars denote one standard error.

Participants reported more sadness as the unfairness increased ($p \leq 0,0006$).

Volunteers with symptoms of **Depression and Social Anxiety** reported more **sadness** during the task than healthy volunteers ($p = 0,007$), especially during **medium and unfair** offers ($p \leq 0,0055$).

Discussion:

The more negative MFN during unfair and medium offers in comparison to fair offers would be associated with the negative emotional impact caused by unfairness (Osinsky et al., 2013; Polezzi, et al., 2008; Riepl et al., 2016). The more accentuated MFN in the clinical group could be related to the more intense negative emotions experienced by the clinical group during social interactions.

The fairness effect in the LPP/P300 indicate that fair offers would be associated with higher levels of attentional resources that underlie the LPP/P300 compared to unfair offers, and in turn the unfair offers would be associated with more of those resources than the medium offers (Hu et al., 2014).

The LPP/P300 was less positive in the clinical group than the control group. Lower mood in the clinical group, such as sadness would be associated with energetically costly mental processes, such as rumination, and this would compete for attentional resources available to allocate to the task.

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