

ELECTROPHYSIOLOGICAL MEASURES OF EMOTIONAL REACTIVITY AND EMOTION REGULATION IN HEALTHY INDIVIDUALS AND PATIENTS WITH INTERNALIZING DISORDERS

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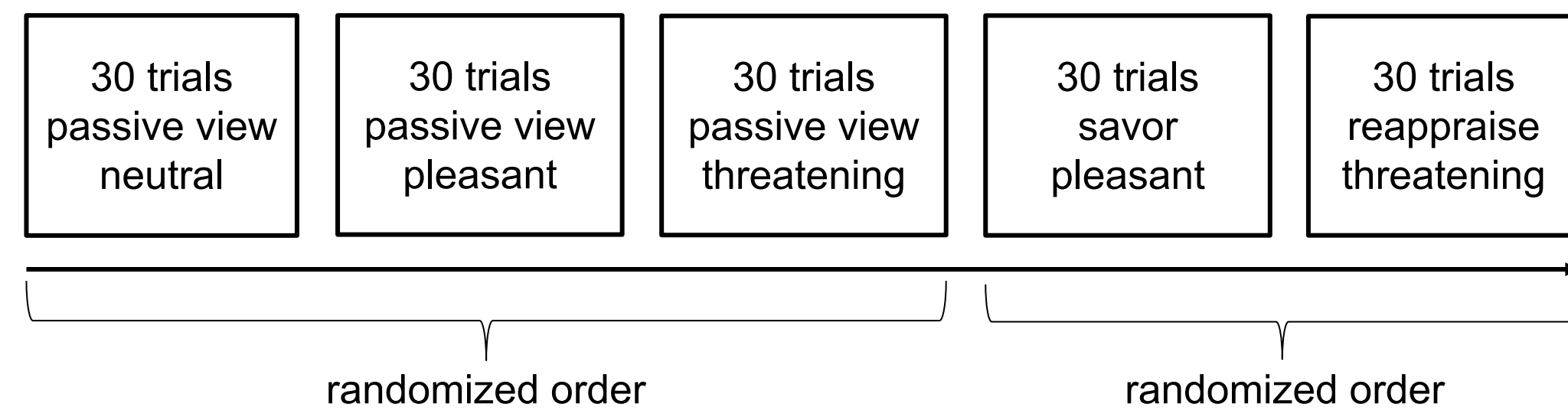


INTRODUCTION

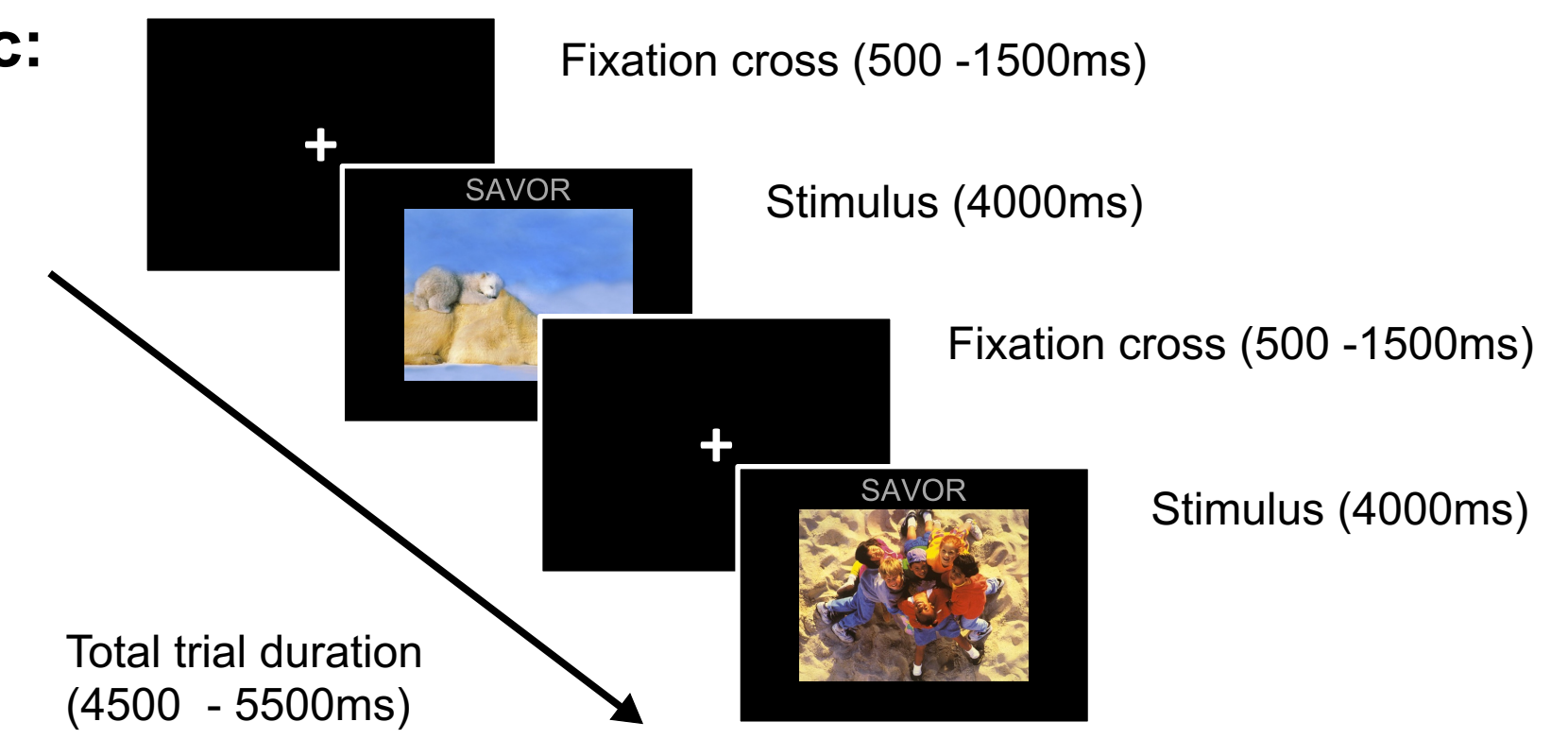
The **late positive potential (LPP)** provides electrophysiological measures for emotional reactivity and emotion regulation¹. While **reappraisal** of negative stimuli has been shown to reduce the LPP^{2,3}, **savoring** of positive stimuli for enhancing the LPP is a relatively new approach in emotion regulation research⁴. **Objective:** In this study, we investigated LPP-based measures of both emotional processes in a novel combination of up- and down-regulation. Our sample consists of a healthy control group and a group of patients with internalizing disorders enrolled in a larger research project dedicated to predicting (non-)response of cognitive behavioral psychotherapy. This study addresses the following question: **Do LPP-based measures of emotional reactivity and emotion regulation differ between healthy control participants and patients with internalizing disorders?**

EXPERIMENTAL DESIGN

Emotion Regulation Paradigm: Participants were instructed to maintain, reduce, or enhance emotional responses using passive viewing, reappraisal or savoring. **Stimuli:** Neutral, threatening and pleasant pictures (IAPS)⁵



Trial Schematic:

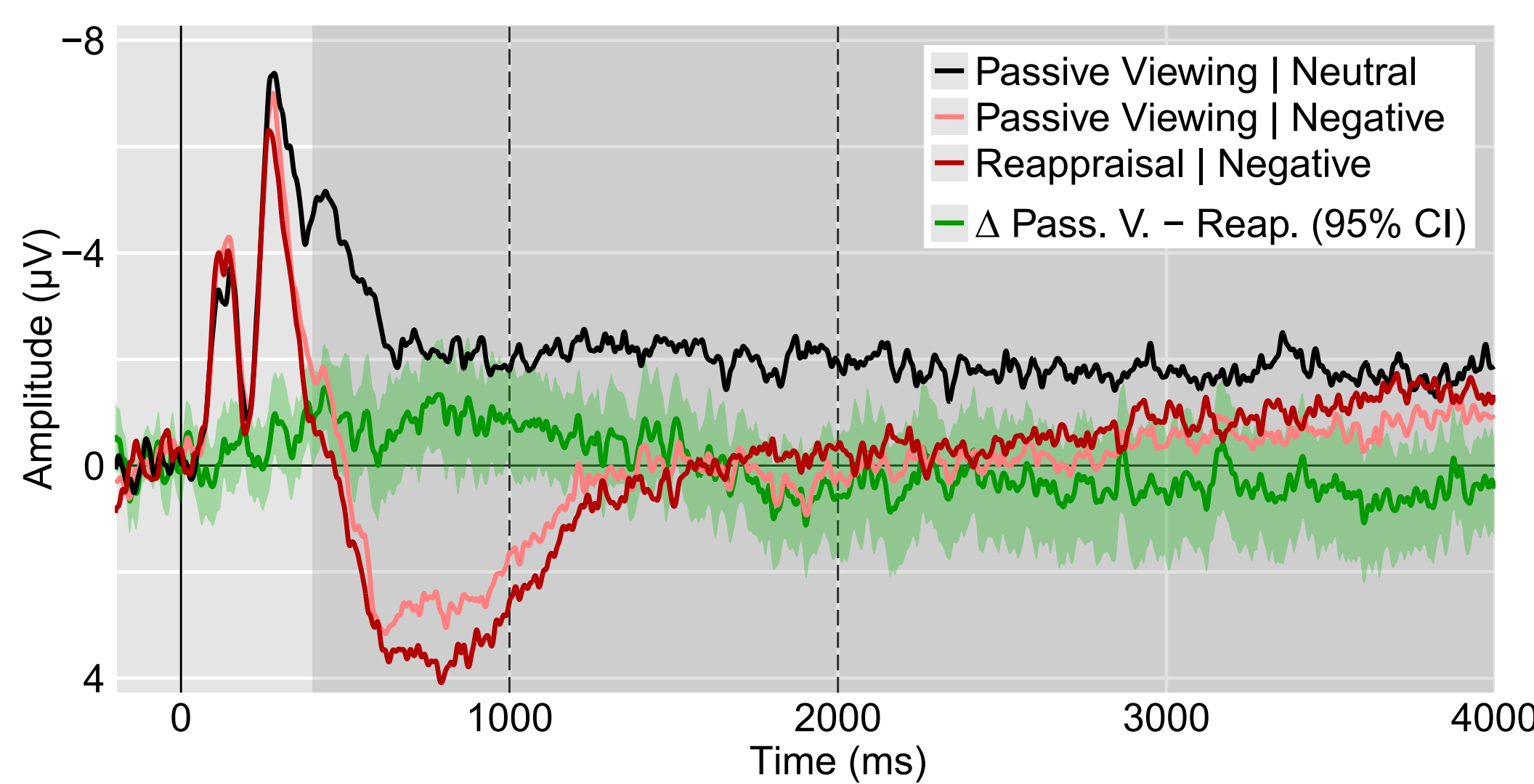


RESULTS

Sample: Healthy Control Group: $n = 48$ ($M_{age} = 32.63$, $SD_{age} = 11.98$, 17 males, 31 females), Patient Group: $n = 265$ ($M_{age} = 33.22$, $SD_{age} = 11.70$, 100 males, 151 females, 3 cases of diverse gender, 11 cases of no disclosed gender)

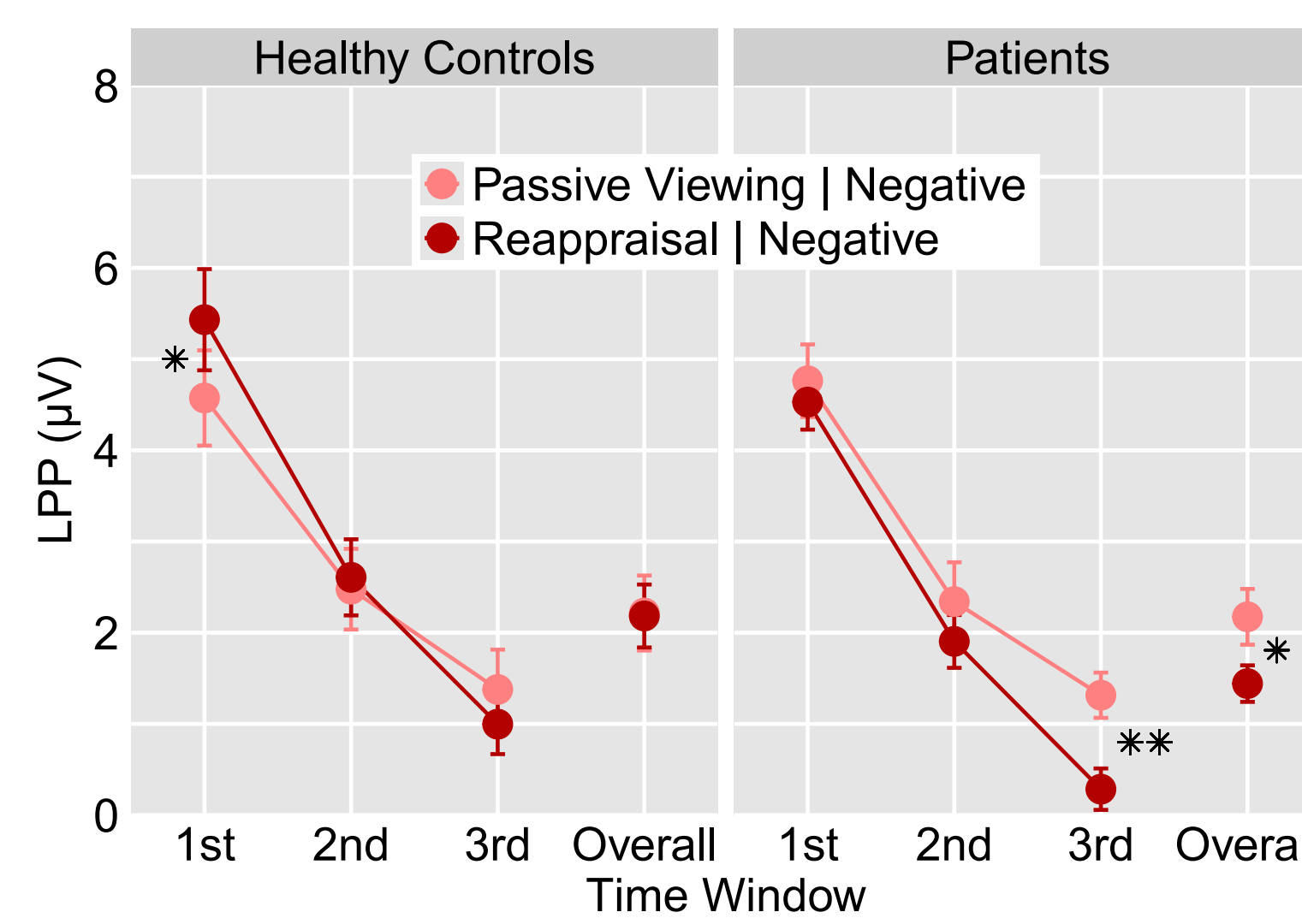
ERPs for Passive Viewing & Emotion Regulation: Based on prior research, four windows of interest were determined for which LPP scores were quantified by computing the average of the mean amplitudes at CPz, CP1 & CP2 for 1.) 400 - 1000ms, 2.) 1000 - 2000ms, 3.) 2000 - 4000ms, and the overall window 400 - 4000ms. These aggregate scores are visualized in the middle column. Significant regulation effects, detailed below, are marked (* $< .05$, ** $< .01$, *** $< .001$), for each group. There was neither frequentist nor Bayesian evidence for a difference between the groups in any regulation effect, or in overall LPP strength. The outer columns show the grand average ERPs underlying the aggregate scores.

Healthy Control Group

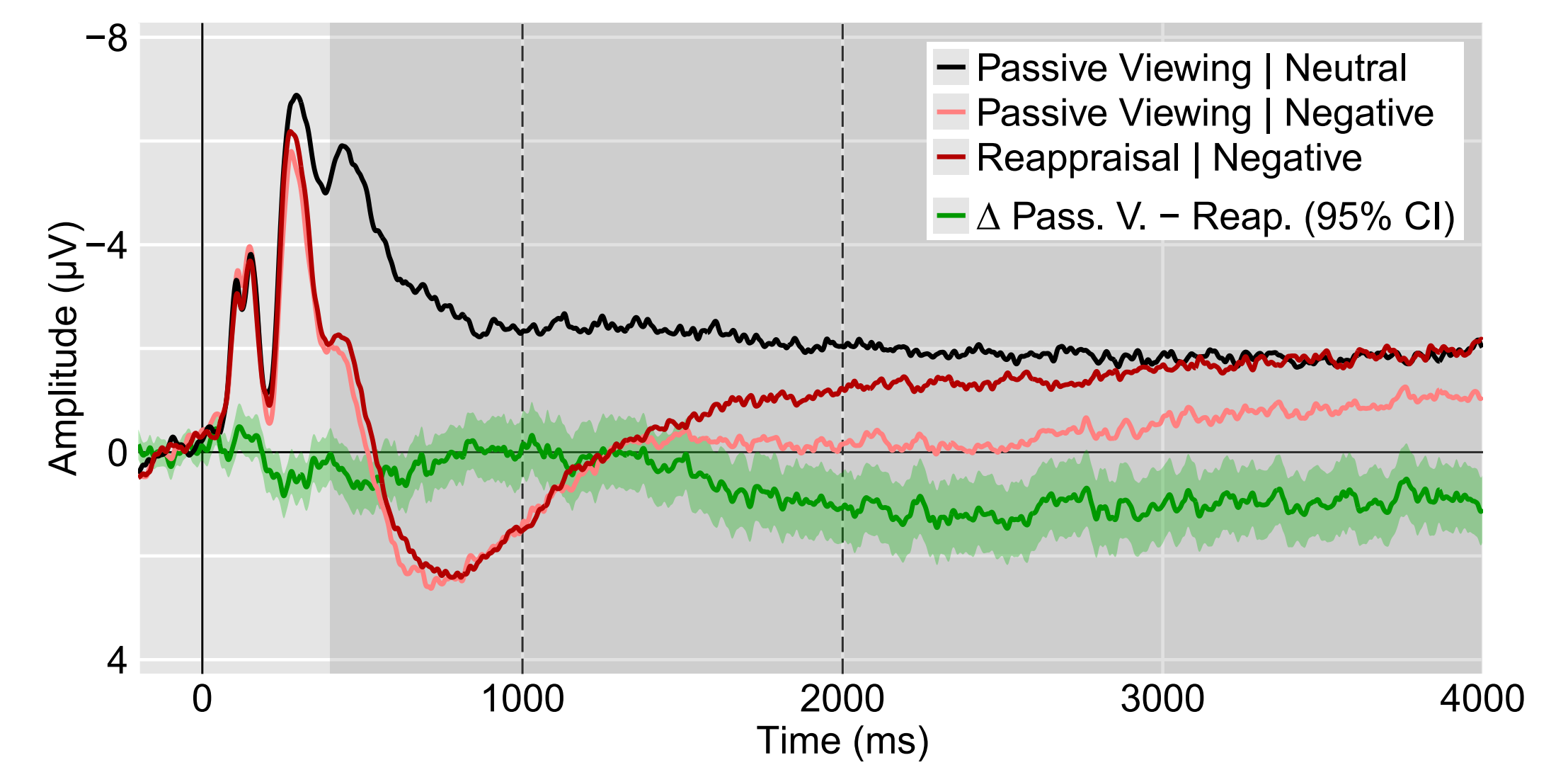


Significantly higher LPP amplitudes under reappraisal instructions between 400 - 1000ms, $t(47) = -2.13$, $p = .038$, two-tailed, Cohen's $d = -0.23$, 95% CI [-0.45, -0.1]

Group Comparisons Negative Picture Valence

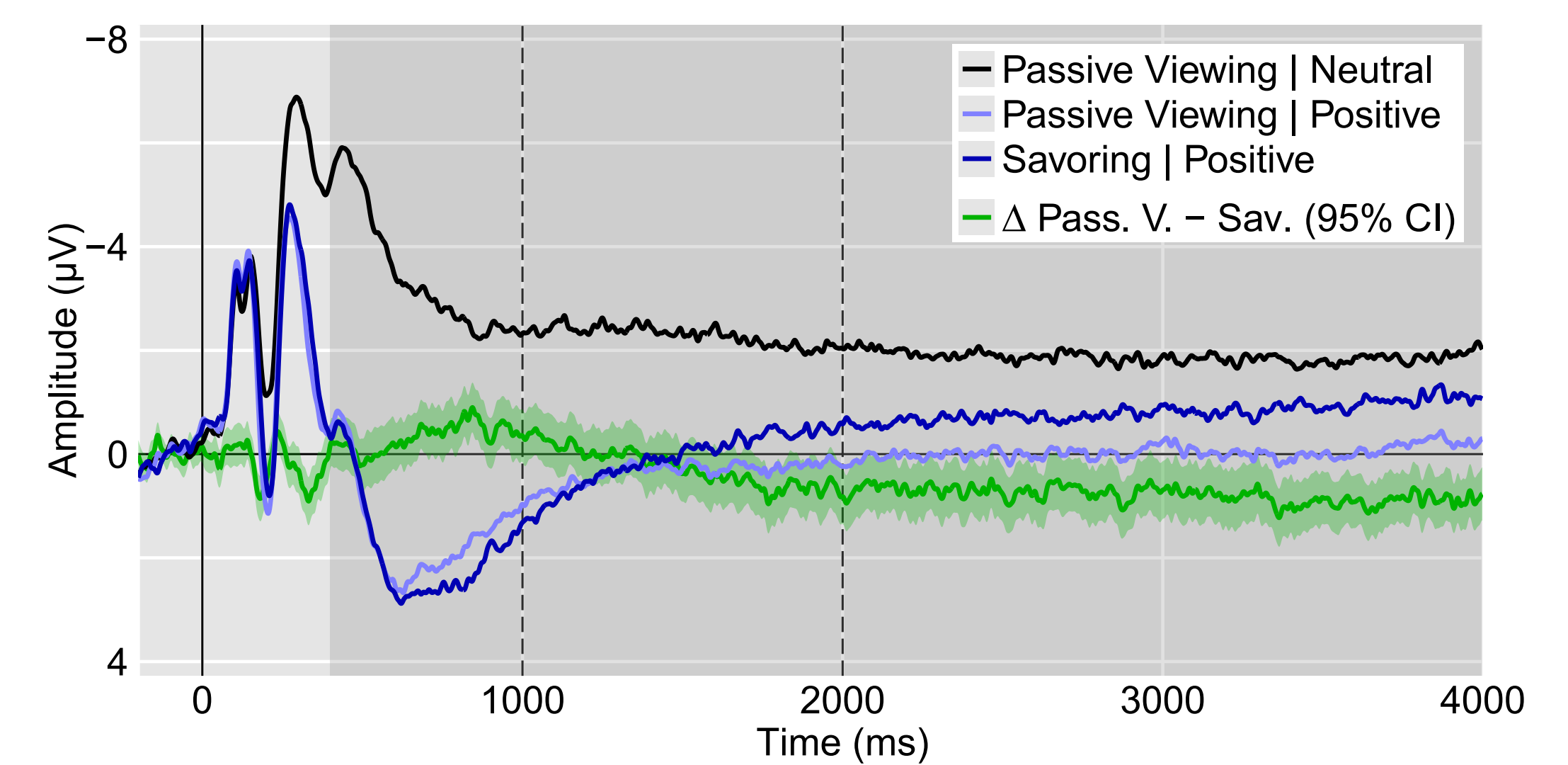
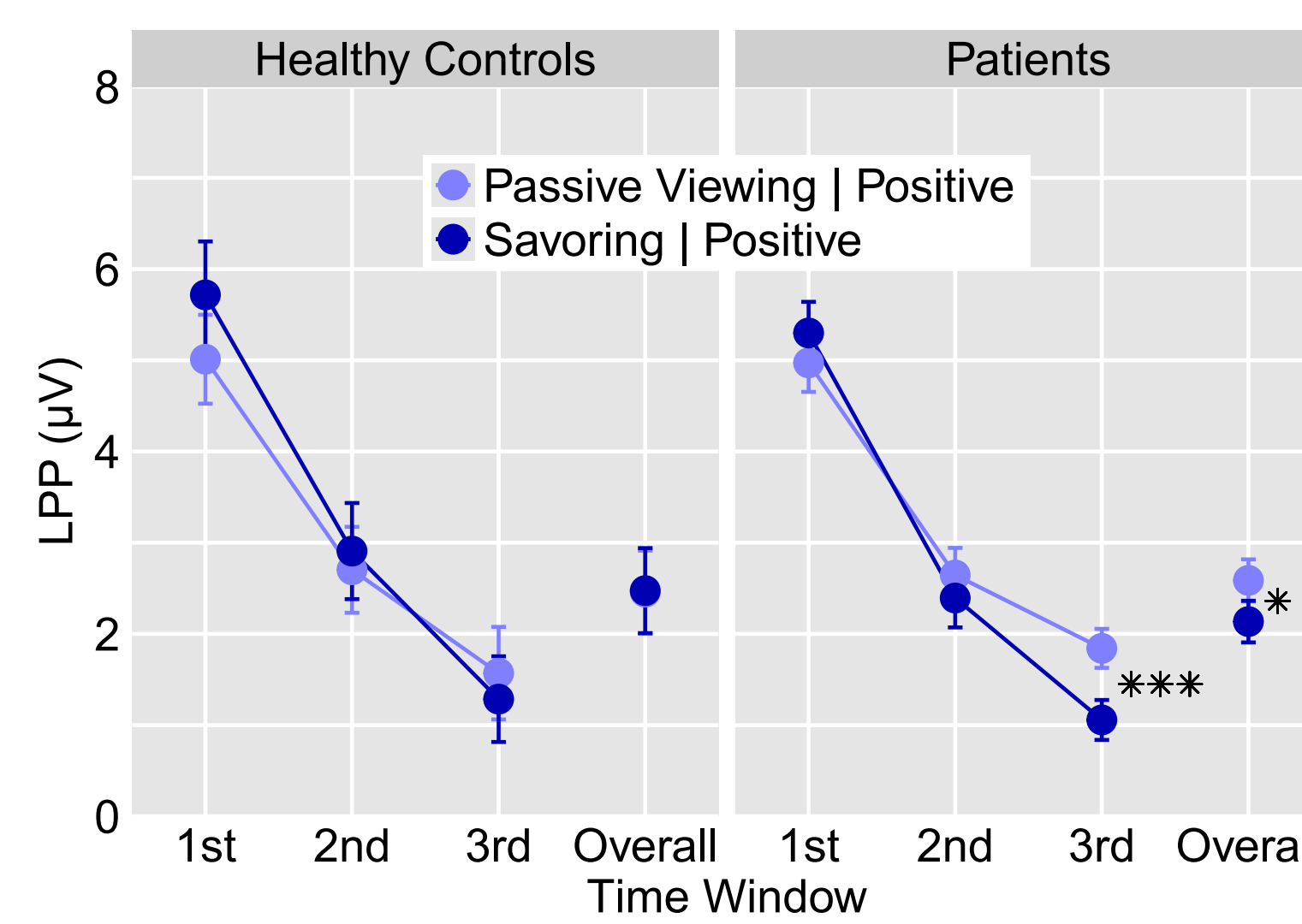
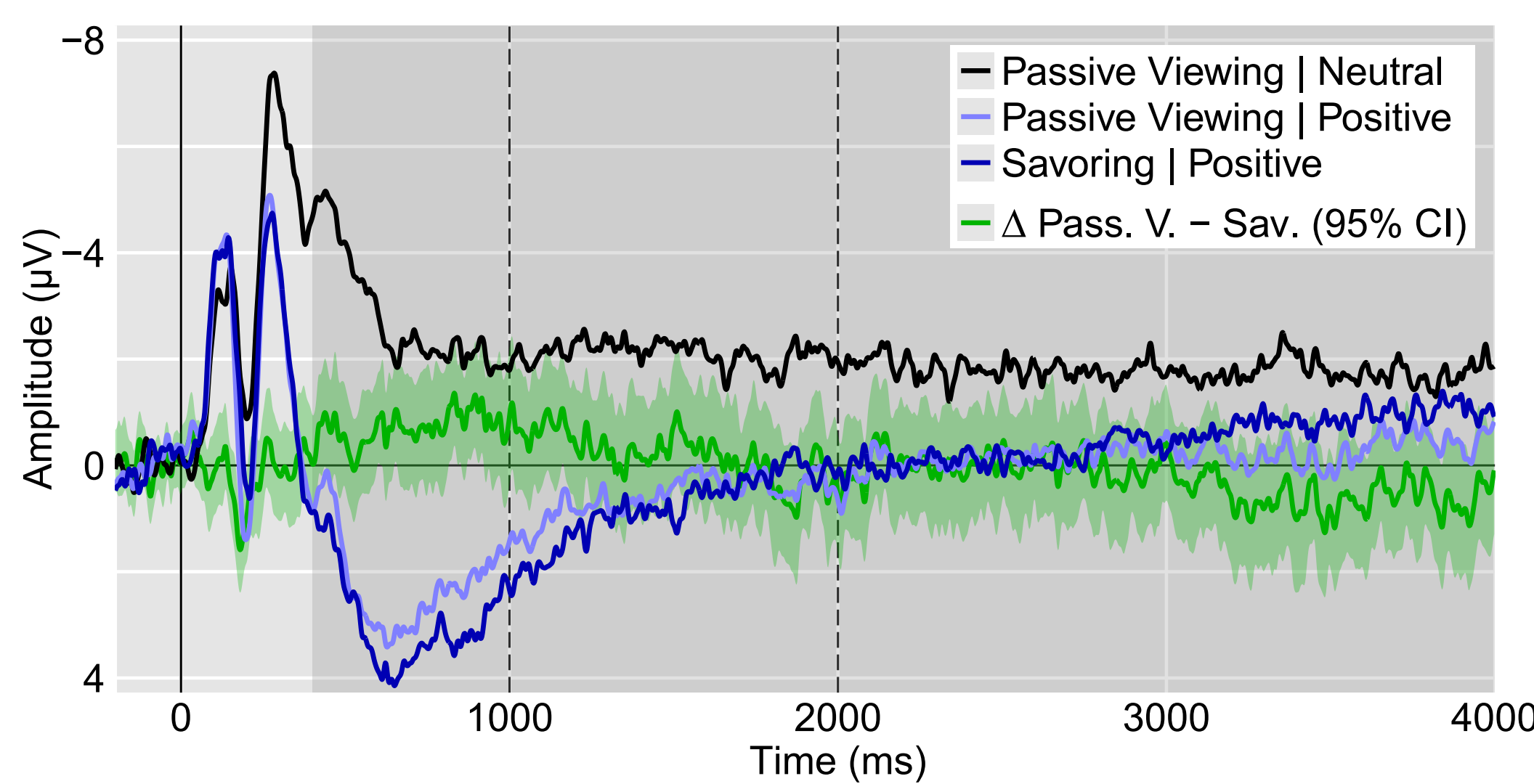


Patient Group



Significantly lower LPP under reappraisal instructions between 2000 - 4000ms, $t(264) = 3.29$, $p = .001$, two-tailed, Cohen's $d = 0.27$, 95% CI [0.10, 0.43], and between 400 - 4000ms, $t(264) = 2.55$, $p = .01$, two-tailed, Cohen's $d = 0.17$, 95% CI [0.04, .30]

Positive Picture Valence



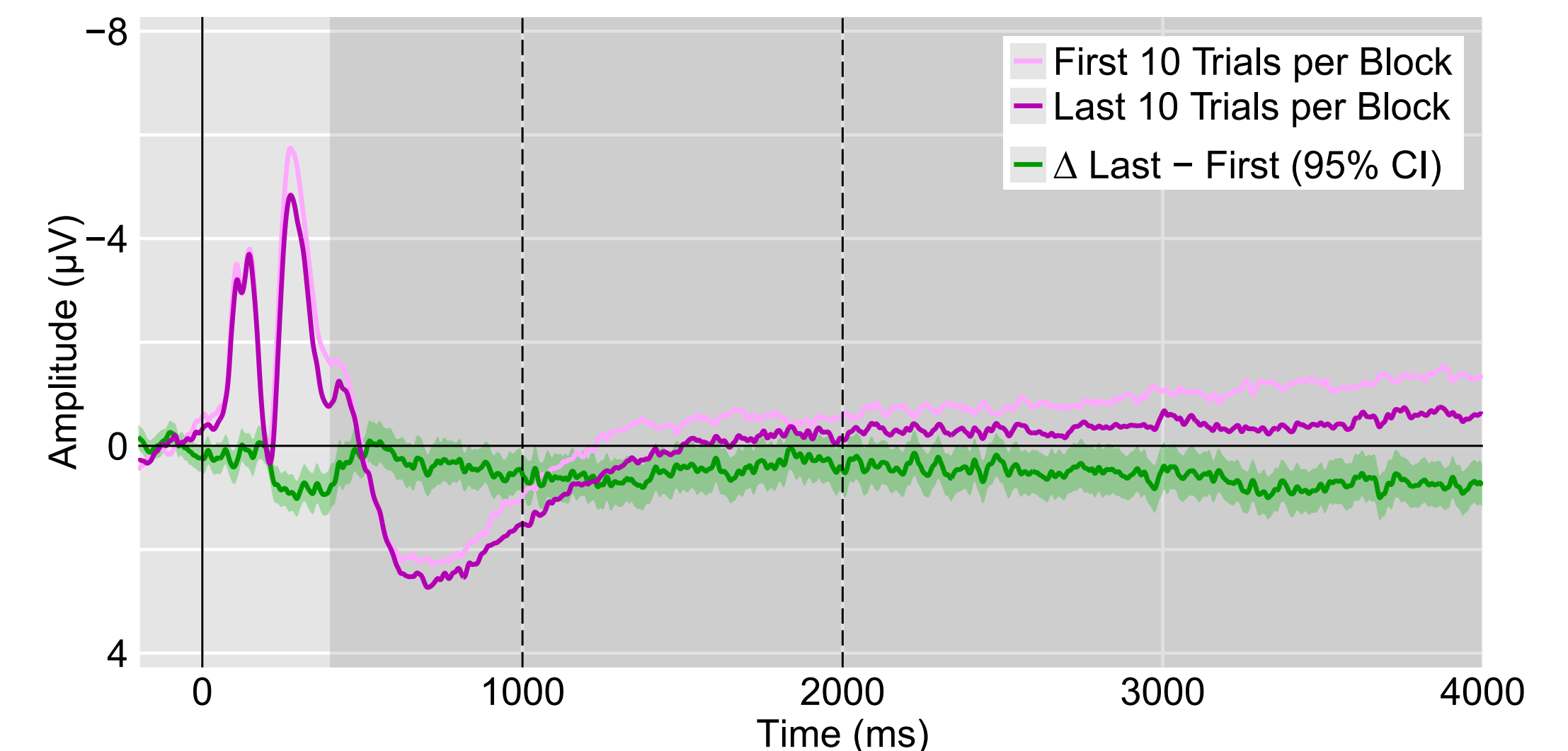
Significantly lower LPP under savoring instructions between 2000 - 4000ms, $t(264) = 3.60$, $p < .001$, two-tailed, Cohen's $d = 0.22$, 95% CI [0.10, 0.35], and between 400 - 4000ms, $t(264) = 2.27$, $p = .024$, two-tailed, Cohen's $d = 0.12$, 95% CI [0.02, 0.23]

DISCUSSION

As expected, the late LPP was significantly reduced under reappraisal instructions, in patients. Contrary to one previous finding, the late LPP was also significantly reduced – and not enhanced – under savoring instructions, in patients. This unexpected finding – as well as the seemingly regular reappraisal effect – may be due to the fact that the regulation conditions always succeeded the passive viewing conditions, in our design. Because of this fixed sequence, lower LPP amplitudes in both regulation conditions may be the result of a kind of exposure-based habituation effect. However, as the right-hand figure shows, **within blocks**, there was no LPP decrease (across all conditions involving affective pictures) from the first to the last third of trials, in the patient sample. On the contrary, there was a significant increase in the late LPP over time, within blocks. This apparent sensitization within blocks makes a desensitization between blocks seem rather unlikely.

In the absence of an alternative explanation in terms of habituation, one would have to conclude that the LPP decreases in both the reappraisal and the savoring condition are the result of regulation efforts by the patients. The unexpected direction of the savoring effect can be reconciled with this notion, if one assumes that 1.) in our sample the LPP reflected mostly arousal – rather than valence –, and 2.) savoring induces relaxation and thereby a decrease in arousal.

In our view, the healthy control sample is still too small to draw reliable conclusions. We are collecting more data aiming at $n = 80$ control participants to improve reliability.



Significantly higher LPP in the last 10 trials per block between 2000 - 4000ms, $t(264) = 3.56$, $p < .001$, two-tailed, Cohen's $d = 0.17$, 95% CI [0.27, 0.08]

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