

Supplemental Material

Research Articles | Systems/Circuits

The extralemniscal system modulates early somatosensory cortical processing

<https://doi.org/10.1523/JNEUROSCI.1815-24.2025>

Received: 9 September 2024

Revised: 22 July 2025

Accepted: 1 August 2025

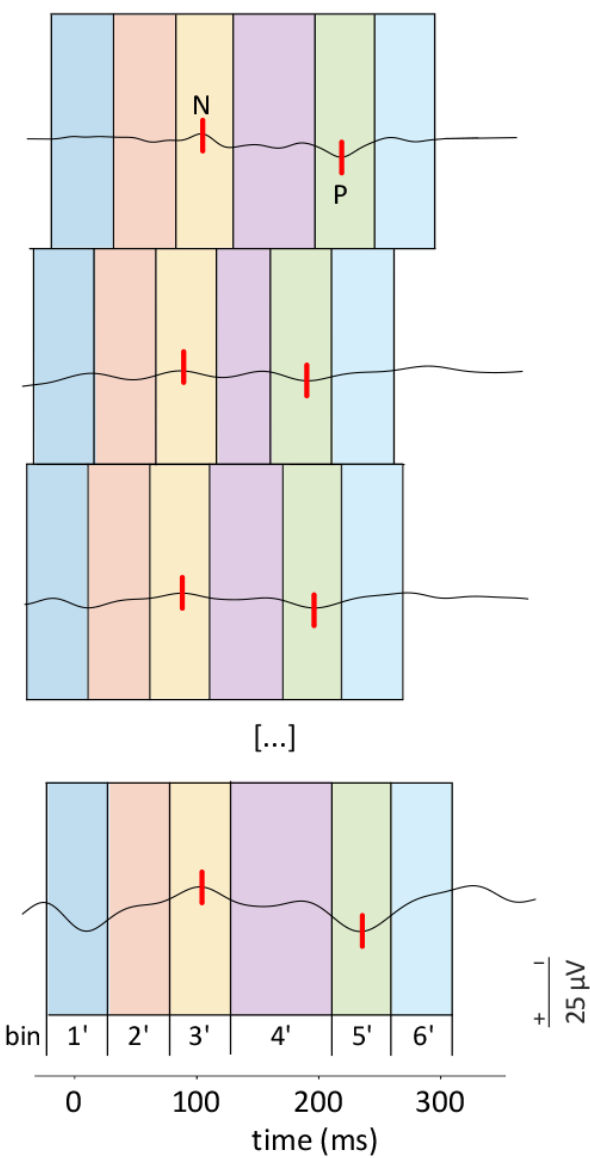
Copyright © 2025 the authors

Figure S1. The observed modulation of S1 lemniscal processing is not determined by ongoing fluctuations of cortical excitability. In the ‘*Single-trial real VP phase binning*’ (right column) we binned each individual SEP as a function of the latency of the N and P waves of each single-trial VP at Cz. We then calculated, for each participant, the average SEP elicited by somatosensory stimuli occurring in each bin. However, this single-trial latency estimation analysis selects the most negative and positive time points in the two time windows containing the N and P peaks in the across-trial average VP. Thus, this approach always highlights one local minimum and one local maximum, even in the absence of a VP. To ascertain whether the observed SEP modulation was not dependent on the selection of local minima and maxima in the ongoing EEG, we repeated the analysis performed on SEPs collected during auditory stimulation using the ‘*Control SEPs*’ measured in periods devoid of auditory stimulation (left column), and grouped single-trial control-SEPs in 6 time bins defined using a procedure identical to that performed for the ‘*Single-trial real VP phase binning*’ (see Methods). In the presence of the concomitant VP, there was a cluster of strong across-bin modulation, located on the contralateral somatosensory cortex at the latency of the P45 component (44 ms post-stimulus: $F_{5,17}=5.45$, $p<0.0002$, electrodes P2, P4, P6, CP4, PO4). The same ANOVA on *Control SEPs* revealed no evidence of SEP modulation (44 ms post-stimulus: $F_{5,17}=0.65$, $p=0.7$, electrodes P2, P4, P6, CP4, PO4; no statistically significant clusters were identified).

Figure S2. Robustness of the P45 modulation to window width. Each column shows single subjects SEPs (bottom panels), grand average SEP (middle panels) and modulation time course of P45 component when extracted from 4 different time-windows (top panel). Time-window and modulation timecourse from 42-45 ms (3 ms wide), as the one used for the analysis throughout the manuscript is shown in blue; 44-48 ms (4 ms wide) in orange; 42-48 ms (6 ms wide) in green; and 40-50 ms (10 ms wide) in yellow. Note that the changes in the time window used to extract the amplitude of the P45 component do not drastically affect the observed modulation exerted by the VP.

Figure S3. The VP phase selectively affects the P45 SEP component. The three panels show changes in SEP amplitude with respect to the concomitant VP in three different time windows: 42-45 ms (blue), corresponding to the P45 component (i.e., the same data shown in the main text); -15 - -10 ms (green), corresponding to the SEP baseline; and 50-54 ms (brown), corresponding to the end of the epoch. Mean SEP amplitudes are extracted from the somatosensory cluster. Note that only the SEP amplitude in the P45 time window depends on the factor time bin ($F_{4.17, 91.83}=4.46$, $p=0.0021$; one-way ANOVA), while this is not the case in the baseline ($F_{4.33, 95.28}=1.86$, $p=0.1185$; one-way ANOVA) and in the window at the end of the epoch ($F_{3.76, 82.82}=1.59$, $p=0.1869$; one-way ANOVA).

Figure S4. Lack of evidence of P45 amplitude modulation during spontaneous EEG deflections. Given that the algorithm for estimating the phase of individual VP waveforms applied to spontaneous EEG necessarily detected one local minimum and one local maximum (see Methods), we performed a control analysis on EEG periods devoid of auditory stimulation to test whether the observed P45 modulation was contributed by ongoing fluctuations of cortical excitability. The top panel shows the change in P45 amplitude in each time-bin (blue), together with the spontaneous EEG activity (red). There was no evidence of changes in P45 amplitude across the six bins (somatosensory cluster; $F_{3.97, 87.54}=0.93$, $p=0.4464$, one-way ANOVA). The bottom panel shows group level P45 waveforms together with their corresponding scalp maps in the 42-45 ms time window.

Single-trial *dummy* VP phase binningSingle-trial *real* VP phase binning