Here we address and rule out possible source for LFP artifacts including the electrical and mechanical perturbations in high and low frequency bands, and eye-movement related activity.

High frequency component (> 20 Hz)

Several studies reported high frequency oscillations of LFPs during the movement planning period in various brain areas including the parietal reach region (PRR) (Murthy and Fetz, 1992; Sanes and Donoghue, 1993; Pesaran et al., 2002; Scherberger et al., 2005; Spinks et al., 2008). Therefore, it is unlikely that the high frequency oscillations (above 20 Hz) during the memory period observed in this study is mechanical or electrical artifacts related to our specific experimental setup. To ensure this, however, we compared electrical signals from electrodes at three different locations: 1) in body fluid above the surface of the dura prior to entering the dura or the brain, 2) inside the brain (intraparietal sulcus) but not in PRR, and 3) in PRR. If the high frequency oscillations are artifacts, it would appear in an electrode that is not placed in the brain as well. Figure-S1A and B shows the raw electrical signals outside the brain and in PRR and their spectra for 5 individual trials. Unlike the LFPs recorded from PRR, the electrical signals recorded from outside the brain show a gradual $1/f^2$ roll off without a bump above 10 Hz and do not show a consistent difference between the delay and movement periods. More interestingly, the spectrum differs between LFP sites simultaneously recorded within the brain as well. Figure-S1C and D show the raw signal and spectrum, respectively, from a non-PRR site and PRR site. The oscillation above 20 Hz occurred selectively in PRR. This analysis eliminates the possibility that the oscillation at 20-40 Hz appearing in PRR during the delay period may reflect an electrical contamination caused by our equipment.

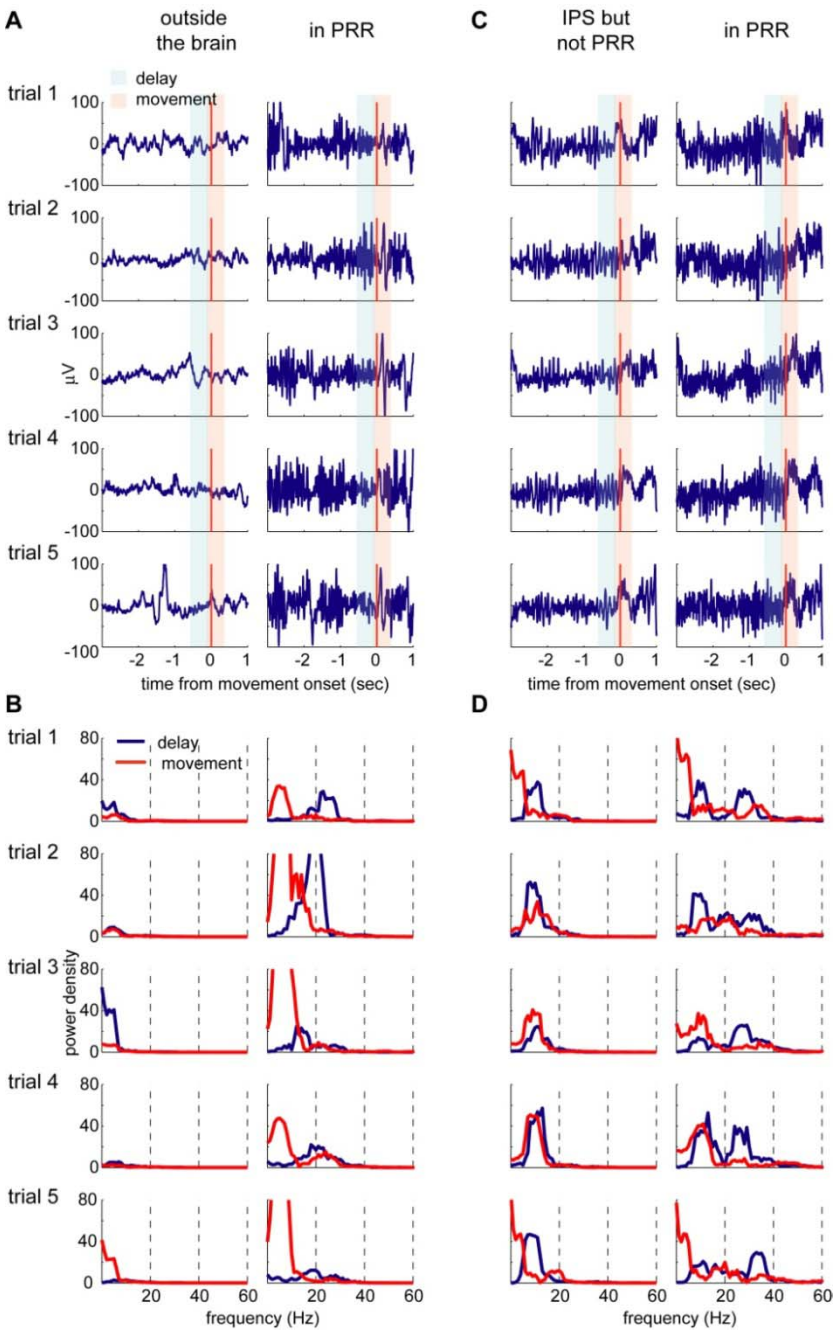

Figure-S1. **A.** The electrical signal recorded outside the brain and from PRR. The signals in the two columns are simultaneously recorded. Each row represents an individual trial. **B.** The power spectrum of the signals in **A**. **C.** The electrical signal simultaneously recorded from a non-PRR site in the intraparietal sulcus (IPS) versus PRR. **D.** The power spectrum of the signals in **C**.

Low frequency component (< 10 Hz)

The low frequency component is especially prone to contamination by mechanical artifacts. To rule out that the rise of low frequency power in LFPs associated with the reach movement onset is due to mechanical artifacts, we took multiple approaches: 1) we computed the event related potentials (ERPs) of the electrode positioned outside the brain as described above, 2) we examined the spatial tuning of after-movement potentials, and 3) we reanalyzed data after filtering out very low frequency components (<5Hz) which are most vulnerable to mechanical artifacts.

First, Figure-S2 shows the ERPs from an electrode outside the brain and in PRR, respectively. These two sites are identical to those shown in Figure-S1. As indicated, the PRR site shows a typical ERP associated with the movement onset, while the site outside the brain shows no distinctive ERP around the movement onset. Similar to the argument used for the high frequency component above, if the low frequency component of LFPs was due to mechanical perturbations, it would have appeared in the electrode outside the brain as well. Since the distinctive ERPs occurred selectively in the electrode inside the brain, it supports the idea that the ERPs observed in PRR indeed reflect the brain activity rather than artifacts.

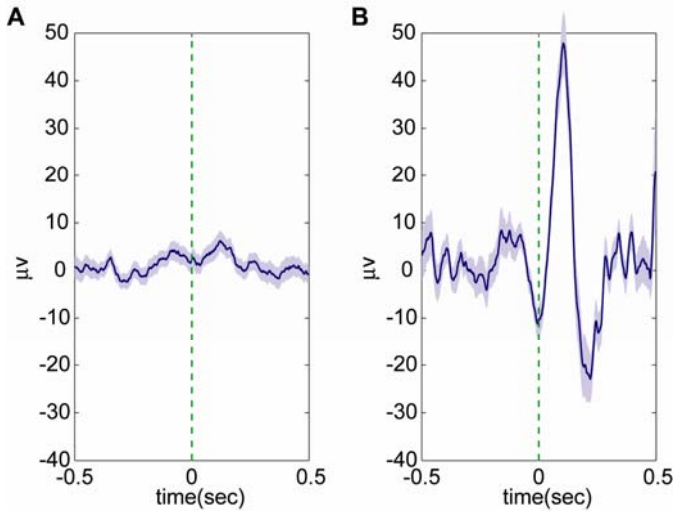

Figure-S2. Event related potentials (ERPs). **A.** No ERP is associated with the reach onset from an electrode outside the brain. The light band reflects the standard error. **B.** ERP from an electrode in PRR. Traces in **A** and **B** correspond to left and right column of Figure-S1, respectively.

Second, studies have shown that the ERPs associated with movement onset can be directionally tuned, and may reflect the difference in the proprioceptive feedback and/or the execution signals for different directions of movement (Mehring et al., 2003; Waldert et al., 2008). Thus, we examined the directional tuning of the ERPs in PRR. Figure-S3 shows the ERPs separately for the direction and type of movement that occurred during an experiment: rest-to-screen, center-out, and screen-to-rest. Note that ERPs are different between the leftward and rightward movement trials in the center-out and screen-to-rest movements but not in the rest-to-screen movement type. This result is likely because the center-out and screen-to-rest movements involved different directions of movement for left and right targets. On the other hand, the rest-to-screen movements were from an initial rest position to the center of the screen; i.e. they were on average similar movements. Also, the LFP power below 10 Hz showed a significant level of spatial tuning ($p<0.01$) at 27% of LFP sites during the movement period (0.5 s after the center-out reach onset). This is a much larger proportion compared to the baseline (0.5 s before the cue onset, 2%) or the memory period (0.5 before the reach onset, 9%). The spatial tuning of ERPs, thus, seems to be consistent with the idea that the after-movement potential reflects proprioceptive feedback.

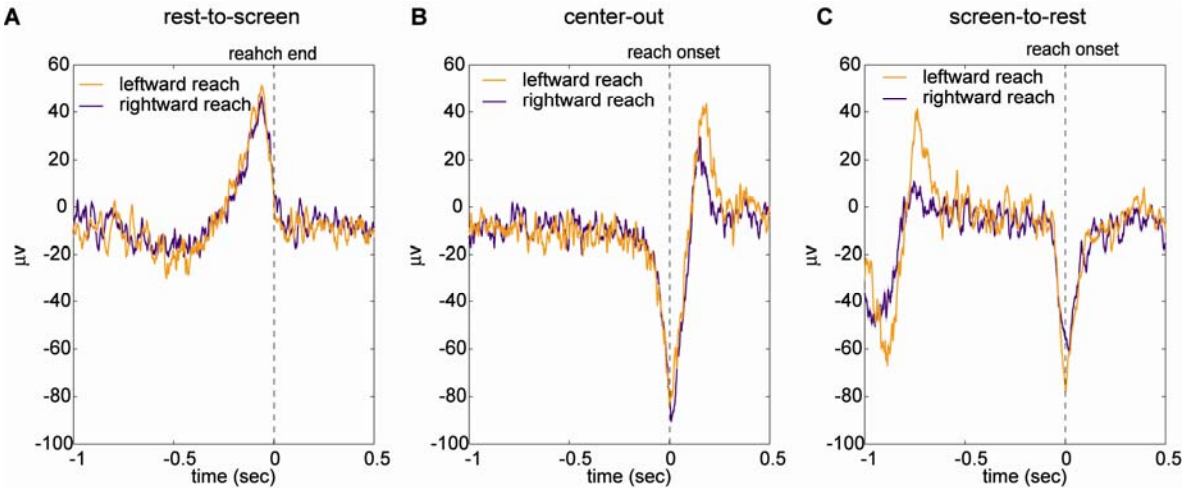

Figure-S3. Spatial tuning of event related potentials. **A.** Rest-to-screen movement with the ERPs aligned to the event time when a reach from resting position to the center of screen is completed. During this event, a touch to the screen is acquired. The orange trace is from trials when the leftward center-out reach follows while the purple trace is from trials when the rightward center-out reach follows. **B.** Center-out reaches in which the ERPs are aligned to the event time when a reach from the center of the screen to the periphery of the screen is initiated. During this event, the touch to the screen is released. **C.** Aligned to the event time when the target is released. Notice the ERPs are different for the leftward versus rightward reaches for the center-out and screen-to-rest reaches. The traces in **A-C** were computed from the same LFPs presented in Figure 3 of the main text.

Third, we examined the low frequency component after removing power in the very low frequency band (below 5 Hz) at which LFPs are more likely to be perturbed by movements (Delorme et al., 2007). Figure-S4A shows the mean ERPs associated with the movement onset across all LFP sites after the power below 5 Hz was filtered out (14^{th} order, zero phase lag Butterworth high-pass filter with cutoff frequency at 5 Hz). For example, power at 2 Hz was reduced to 0.3% of the original value by this filter. Even after power below 5 Hz was removed, a distinctive ERP remained. Furthermore, the time course of high and low frequency components of LFPs show the same trend, albeit less strongly: that the low frequency component increases while the high frequency component decreases as time approaches the movement onset (Figure-S4B and C).

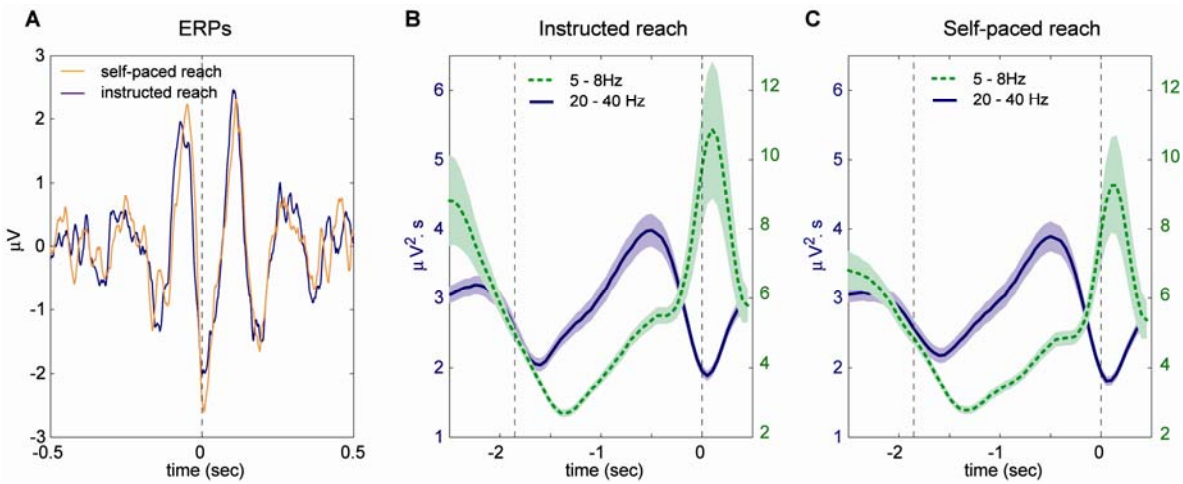

Figure-S4. State dependent LFPs after filtering out the very low frequency power below 5 Hz. **A.** The event related potentials associated with the reach onset, averaged across all PRR sites. The orange line is from the self-paced reach trials and the purple line is from the instructed reach trials. **B.** The time course of low (5-8 Hz) and high (20-40 Hz) frequency components during instructed reaches, averaged across all PRR sites. The first vertical line represents the mean time of cue onset and the second vertical line represents the reach onset. **C.** Same as B but during self-paced reaches. Notice the state dependent LFP spectrum changes remain even after removing the very low frequency power.

Contamination by eye-movement related activity

As field potentials can often be contaminated by voltage signals related to eye movements and recorded in electro-oculograms (EOGs), one might wonder how this component may affect our results. However, this component cannot play a significant role for driving the observed LFP spectrum change synchronized to the reach onset for the following reasons: First, the monkeys had to fixate their eyes at the central fixation target throughout the trials, which ended 300 ms after target acquisition. Therefore, there are no significant eye movements during the periods of our data analysis. Second, we saw the change of spectrum specifically for reach movement onsets, but not for eye movement onsets, during rest periods in which the monkeys were allowed to move their eyes freely, probably generating large EOG signals (Figure 3). Thus, it is unlikely that the reach onset related spectrum change in LFPs is significantly contaminated by eye movements.

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