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Supplemental Information

Parvalbumin-Expressing GABAergic Neurons in Primary Motor Cortex Signal Reaching

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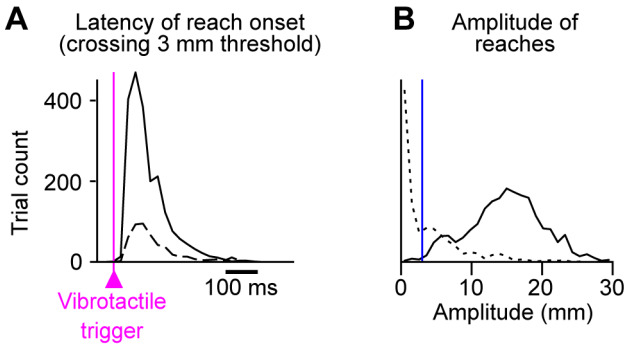

Figure S1. Distribution of the latency and forepaw movement amplitude of triggered reaches recorded across all experiments. Related to Figure 1.
(A) Latency of reach onset (time to cross the 3 mm threshold) following the vibrotactile trigger. Continuous line: reaches that ended with a touch of the reach sensor (hits). Dashed line: reaches without target sensor contact.
(B) Amplitude of the paw trajectory in the 500 ms after vibrotactile trigger onset. Continuous line: trials with target sensor contact (hit). Dashed line: trials without target sensor contact (all trials, including no-movement trials). Blue line: 3 mm threshold between no-reach and reach trials.

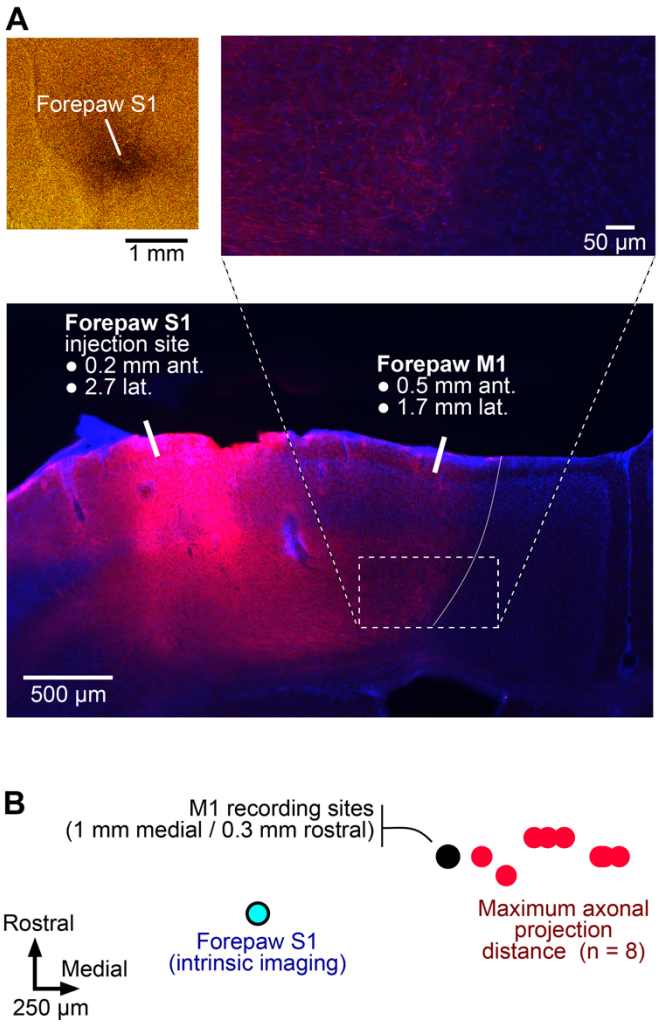

Figure S2. Functional and histological identification of forepaw M1. Related to Figure 2.

(A) Top left: example intrinsic optical image signal of forepaw S1 following tactile stimulation of the forepaw in an isoflurane anesthetized mouse. Bottom: Example coronal section of cortex showing eYFP expression at viral injection site in forepaw S1. Slices of the brain were stained with combined anti-GFP antibody and DAPI. Note the axonal bundle projecting from S1 to M1, and detail of the fibers in the insert (top right). White continuous line shows medial extent of S1 axonal projections. Coordinates are given with respect to bregma.

(B) Identification of the recording site position with respect to the forepaw S1 intrinsic optical imaging signal (cyan filled circle) across 8 animals in a schematic view of the dorsal cortical surface. Red filled circles: maximum distance of the S1 axonal projections to M1. Black filled circle: position of forepaw M1 selected for recordings and viral infection with ChR2 in PV-Cre mice, located 1 mm medial / 0.3 mm rostral of forepaw S1 as identified by intrinsic imaging.

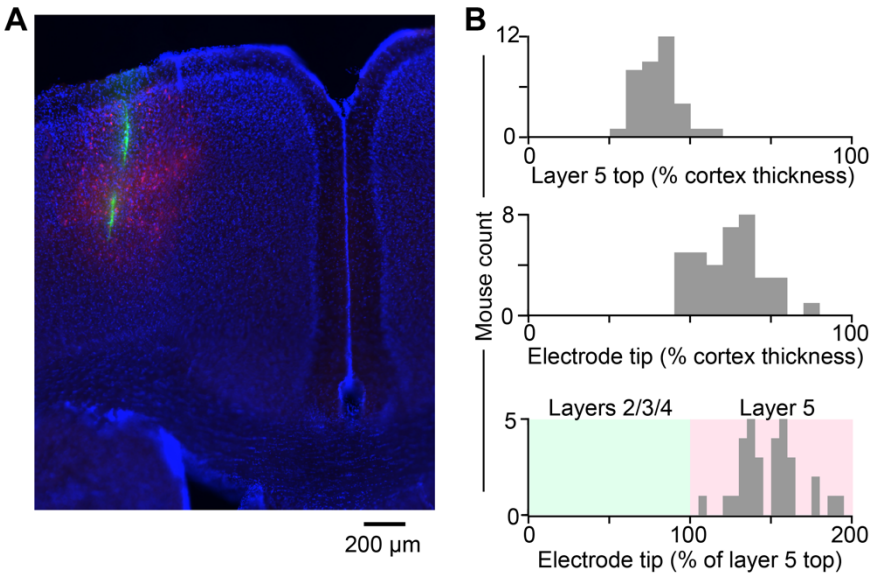

Figure S3. Positioning of recording site in layer 5 of M1. Related to Figure 3.
(A) Example coronal section from a PV–Cre mouse showing the viral vector mediated expression of ChR2-mCherry in forepaw M1. Blue: DAPI staining; red: mCherry expression in PV+ neurons. Green: DiO stain deposited by the silicon probe during an example electrophysiological recording.
(B) Top: cortical depth of the top of layer 5 relative to total cortex thickness. Middle: cortical depth of the tip of the DiO stain left by silicon probe during M1 recording. Bottom: Position of DiO stain tip relative to top of layer 5.

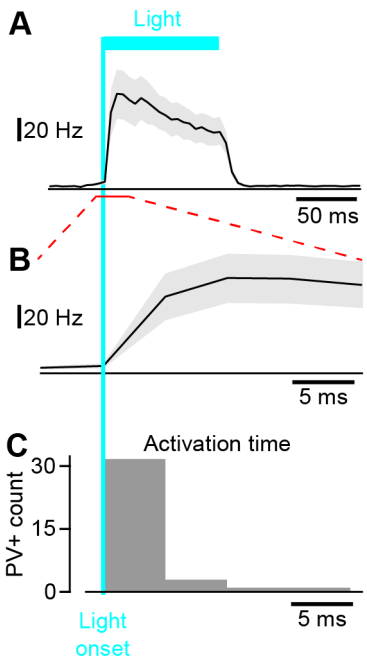

Figure S4. Optogenetic activation of PV+ neurons. Related to Figure 3.
(A) Average photoactivation-aligned PSTH of all identified PV+ neurons with shaded background showing SEM.
(B) Population average firing rate at the onset of photoactivation.
(C) Distribution of the activation time of PV+ neurons. Activation time is defined as the time bin when the neurons firing rate increased more than 2 times beyond baseline firing rate (measured in the 2 seconds before light activation).

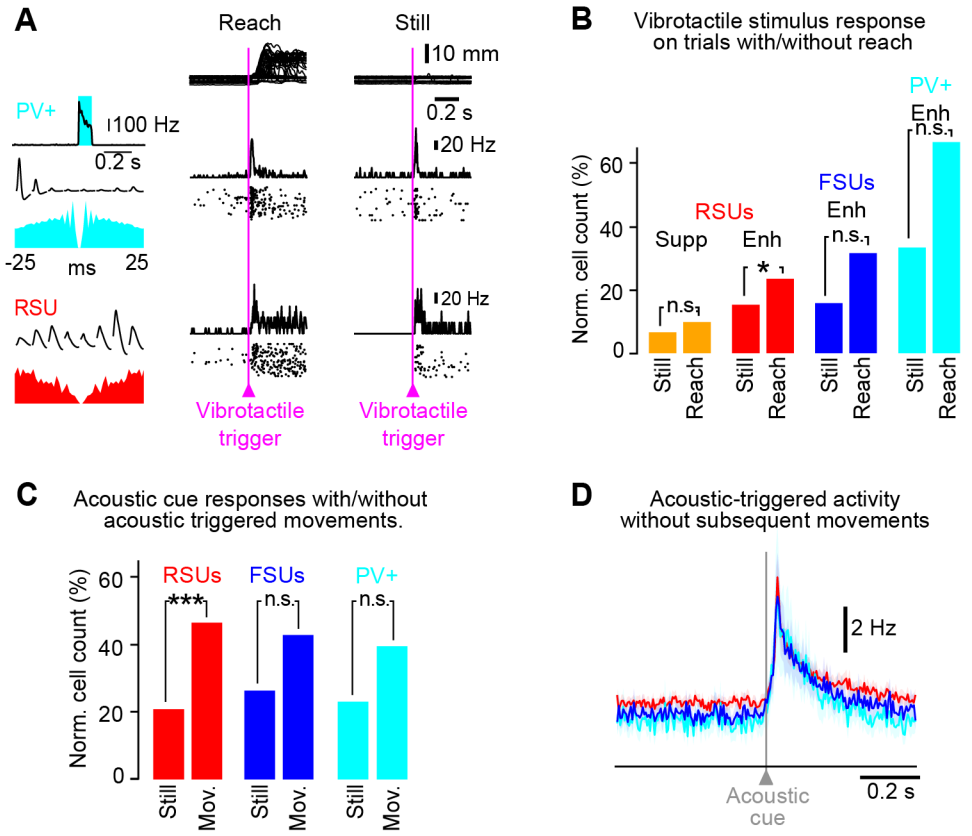

Figure S5. Proportion of neurons with vibrotactile and acoustic responses. Related to Figure 4.

(A) Example simultaneous recordings from one mouse showing a PV+ neuron and a RSU_{enh} that respond to the vibrotactile trigger both in trials with and without subsequent reaches. Left: shows mean PSTH response to light, autocorrelograms and mean spike shapes. Middle: forepaw movements, mean PSTH and raster plot aligned to the vibrotactile trigger stimulus for trials with a reach. Right: same as middle but for trials without reaches.

(B) PV+ neurons, RSUs and FSUs show vibrotactile stimulus-triggered activity both in trials that lead to a reach and in trials without reaches. RSU_{enh} show fewer responsive neurons during no-reach trials (Fisher's exact $p = 0.030$). In addition, when merging all trials, significantly more PV+ neurons than RSUs showed a vibrotactile stimulus response (Fisher's exact $p = 0.0040$).

(C) Proportion of RSUs, FSUs and PV+ neurons with responses to the acoustic cue in trials with the paw not moving both before and after acoustic cue onset (Still) and in trials with an acoustically-evoked forepaw movement (Mov.).

(D) Average acoustic responses without movements post acoustic cue onset. Lines: average acoustic cue-aligned PSTH. Light background: SEM.

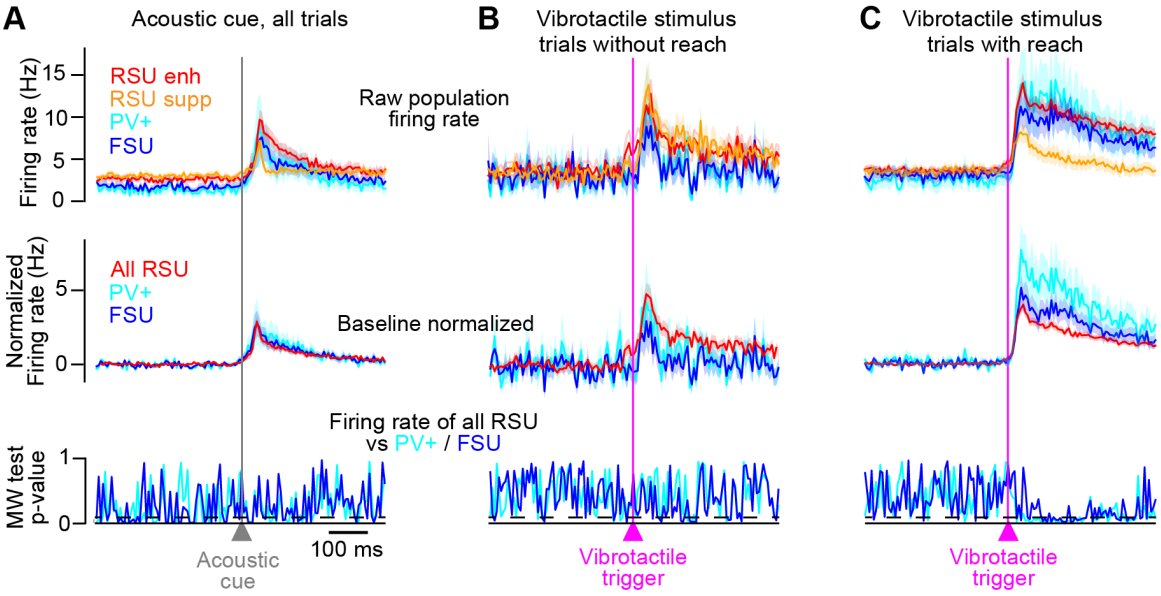

Figure S6. Dynamics of firing rate level differences of RSUs vs. PV+ neurons/FSUs. Related to Figure 7.

(A) Mean firing rate aligned on the acoustic cue. Top: mean population PSTH of RSUs with increased activity (red, Z score > 0), RSUs with decrease activity (orange, Z score < 0), FSUs (blue) and PV+ neurons (cyan), divided by the average firing rate during baseline. Light background shows SEM. Middle: Baseline subtracted firing rate of all RSUs (red), FSUs (blue) and PV+ neurons (cyan). Bottom: Mann-Whitney p-value of the difference between all RSUs vs. FSU (blue) and RSU vs. PV+ neurons (cyan). Dashed line: Mann-Whitney p = 0.05.

(B) Same as A, but aligned on the vibrotactile trigger stimulus, for trials that did not lead to a reach.

(C) Same as B, but for trials that led to a reach.