

Supporting Information

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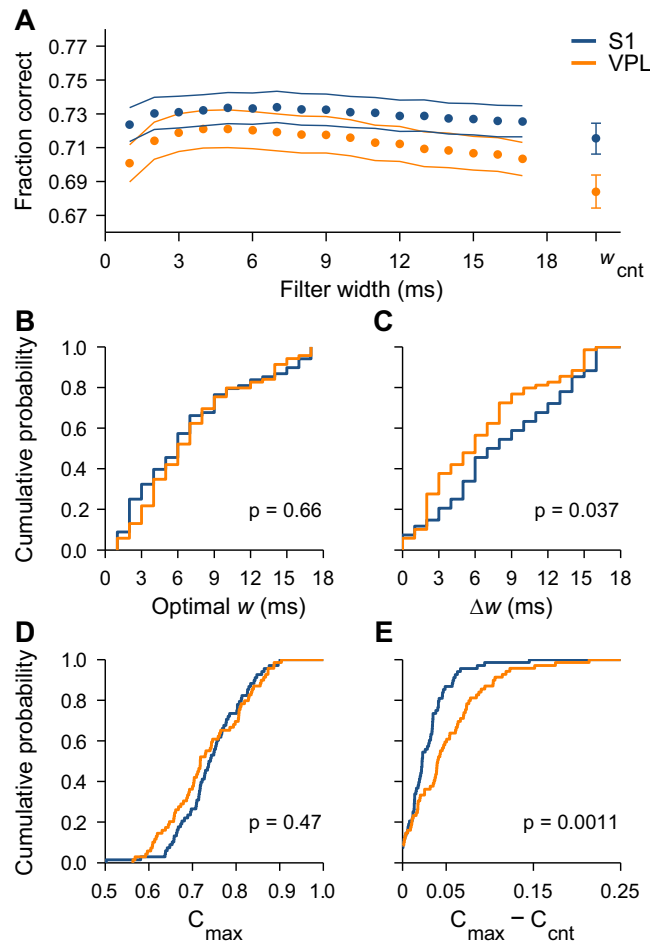


Fig. S1. Classification performance based only on the first few stimulus-evoked spikes. The format is identical to that of Fig. 4, except that only the responses in the first 70 ms of the stimulation period were considered by the classifier. (A) Mean fraction of correct classifications ($\pm 5\text{SE}$) as a function of the filter width used by the Poisson spike train classifier (PSTC). (B) Cumulative distributions of optimal filter widths. Optimal widths were similar for the ventral posterior lateral (VPL) and primary somatosensory cortex (S1) populations (VPL: 7.15 ± 0.53 ms, $n = 69$; S1: 6.80 ± 0.59 ms, $n = 68$; $P = 0.66$). (C) Cumulative distributions of Δw values. The range of optimal filter widths was significantly smaller in VPL than in S1 (VPL: 6.44 ± 0.56 ms, $n = 69$; S1: 8.23 ± 0.62 ms, $n = 68$; $P = 0.037$). (D) Cumulative distributions for the maximum fraction correct, C_{max} . There was no significant difference between areas (VPL: 0.73 ± 0.01 , $n = 69$; S1: 0.74 ± 0.01 , $n = 68$; $P = 0.47$). (E) Cumulative distributions for the difference between the maximum performance (C_{max} , obtained with the optimal filter) and the performance achieved by counting spikes (C_{cnt}). There was a significant difference between areas (VPL: 0.05 ± 0.005 , $n = 69$; S1: 0.02 ± 0.003 , $n = 68$; $P = 0.0011$).

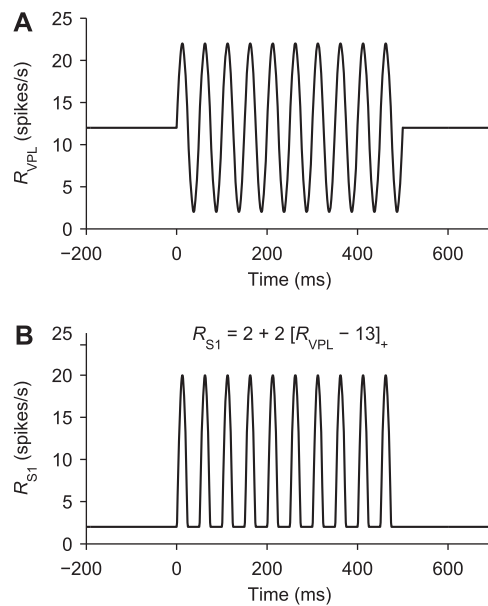


Fig. S2. A highly simplified model of the transformation between VPL and S1. (A) Firing rate of an idealized VPL neuron in response to a 20-Hz vibratory stimulus presented between $t = 0$ and $t = 500$. The VPL activity accurately tracks the stimulus waveform. The baseline firing rate is relatively high (12 spikes/s) and the mean firing rate during the stimulation period is equal to the baseline rate. (B) Firing rate of an idealized S1 neuron that is driven by the VPL activity shown in A. The response was calculated as indicated at the top, where the brackets $[\cdot]_+$ indicate rectification; that is, $[x]_+ = x$ if $x > 0$ and $[x]_+ = 0$ if $x \leq 0$. Thus, the transformation involves tonic inhibition (which decreases the input, R_{VPL}), rectification (which eliminates negative firing rates), and amplification (which scales the result to a maximum firing rate at ~ 20 spikes/s), all operations that are plausible within neural circuits. The baseline firing rate is lower (2 spikes/s) than in A, and the mean firing rate during the stimulation period (~ 7.4 spikes/s) is substantially higher than the baseline rate.