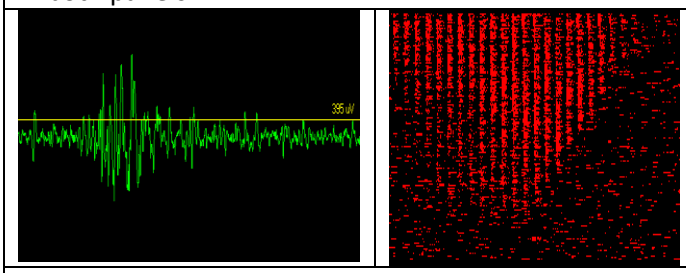
Supplementary Materials

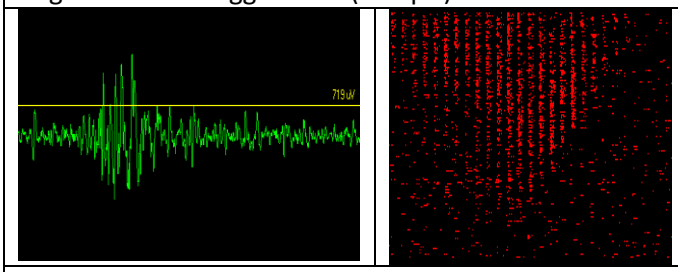
A common concern regarding the extracellular recordings of spike (SPK) and local field potential (LFP) is the "spillover" effect. To prevent this, we set a 100 Hz gap between our frequency filters for the SPK and LFP recordings. We also set the trigger level for picking up SPKs at 1.2 times higher than the noise level, the same level used for determining LFP. Here we provide additional data to show our methodology for avoiding contamination from a spillover effect.

We compared the receptive fields constructed on isolated SPKs using trigger voltage levels 1.2 times and 2 times higher than the noise level. Excluding the clearly lower SPK numbers, we found that the RF areas and bandwidths at the 1.2 times trigger level were similar to those at the 2 times trigger level (see Fig.1). Additionally, we examined the action potentials and field excitatory postsynaptic potentials (fEPSP) of single cortical neurons using loose patch clamp recordings (the impedance of electrode tip was 15 MΩ). As shown in Figure 2, the receptive fields constructed on these action potentials and fEPSPs were mostly identical. Our results strongly suggest that our SPK data were not contaminated or affected by LFP components.

Figure 1. An example of receptive fields from the same extracelluar multiunit in response to various tone frequencies and amplitudes. Spikes were selected using voltage trigger levels of 1.2 (A) and 2 (B) times higher than the noise level (about 360 μV) as indicated in both panels.

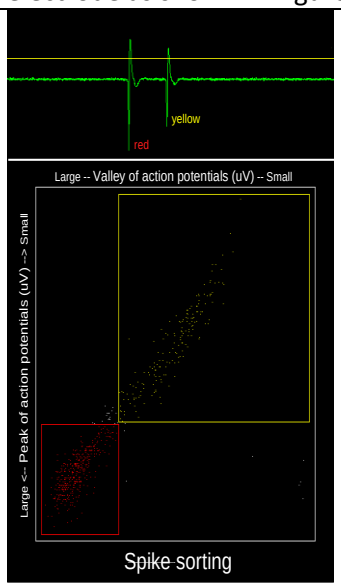


A. The trigger level was at 395 μV, a level about 1.2 times the noise level. The left panel shows the original recording trace and trigger level. The right panel shows the receptive field that was constructed on spikes larger than the trigger level (395 μV).

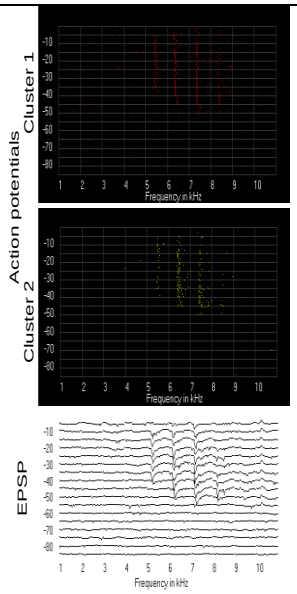


B. The trigger level was at 719 μV, a level about 2 times the noise level. The left panel shows the original recording trace and trigger level. The right panel shows the receptive field that was constructed on spikes larger than the trigger level (719 μV).

Figure 2. Example of action potential and fEPSP of single neurons recorded by the same electrode (loose patch clamp). The frequency filter settings for action potential and fEPSP were the same as those for multiple unit recordings using a low-impedance electrode as shown in Figure 1.



A. Two action potentials (SPKs) that were sorted with spike isolation (or cluster cutting).



B. Upper two panels show RFs constructed with the isolated SPK. Lower panel shows the RF constructed on fEPSP.