

Supplemental Information

Supplemental information contains 1 figure, 4 tables, and 2 movies.

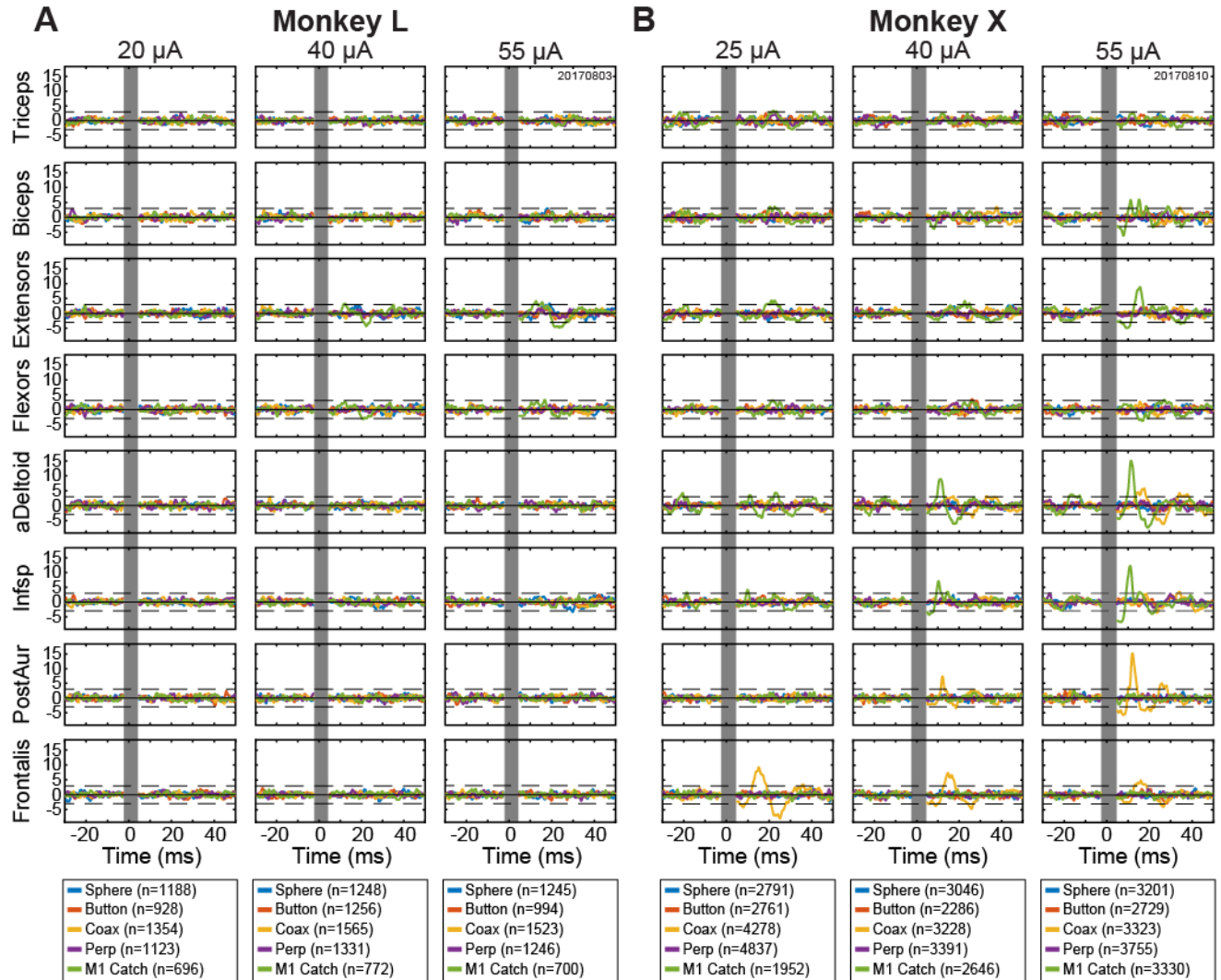


Figure S1. Related to Figure 4. Stimulus-triggered averages of EMG activity: Expanded search. Averages of rectified EMG activity from eight muscle groups of the upper extremity and head—Triceps, Biceps, forearm Extensors, and forearm Flexors, Infraspinatus (Infsp), anterior deltoid (aDeltoid), posterior auricular (PostAur), and Frontalis—were compiled for each monkey (**A**, monkey L; **B**, monkey X) using individual ICMS pulses at three different current amplitudes as triggers. Other ICMS parameters used for these sessions are given in Table S4. Separate averages (colors) were compiled for n pulses delivered through the PM electrode during LED-instructed trials involving the sphere, button, coaxial cylinder, or perpendicular cylinder, as well as for catch-trial pulses delivered in M1. The vertical gray bar indicates the interval during which the aligned stimulation artifacts have been blanked. Each trace has been z-scored. The dashed horizontal black lines represent ± 3 standard deviations from the bootstrap-adjusted baseline, i.e. the solid black horizontal line.

Table S1. Related to Figure 2. Stimulation Parameters for PM- and S1-ICMS during training.

	PM-ICMS	S1-ICMS
Monkey L		
Number of Electrodes	3	4 – 6
Period Frequencies	80, 100, 120, 150 Hz	50, 75, 125, 225 Hz
Amplitudes	18 – 28 μ A	20 – 60 μ A
Monkey X		
Number of Electrodes	3 – 4	3 – 5
Periodic Frequencies	50, 75, 125, 200 Hz	75, 100, 150, 225 Hz
Amplitudes	20 – 25 μ A	25 – 55 μ A

Table S2. Related to Figure 2. Performance with different instruction modalities.

	Success Rate (%) [N _{Success} /N _{Total}]	Reaction Time (ms) Median [25%,75%]	Movement Time (ms) Median [25%,75%]
Monkey L			
PM-ICMS	99.1 [1734 / 1750]	288 [260, 321]	189 [165, 213]
S1-ICMS	95.6 [1836 / 1920]	307 [269, 319]	231 [207, 265]
LED	99.1 [3348 / 3378]	298 [279, 363]	215 [191, 235]
Monkey X			
PM-ICMS	88.7 [1438 / 1622]	438 [376, 545]	155 [139, 209]
S1-ICMS	83.1 [965 / 1161]	559 [451, 918]	143 [129, 173]
LED	88.8 [2420 / 2725]	647 [450, 1061]	159 [141, 195]

Table S3. Related to Figure 3. PM-ICMS parameter used during sweeping experiments.

	Constant Parameter	Swept Parameter
Monkey L		
Periodic Frequency		20 – 100 Hz
Inter-pulse Interval Range	12.5 – 40 ms	
Amplitude	10 – 28 μ A	2 – 20 μ A
Train Duration	Until target object contact	50 to 1000 ms
Monkey X		
Periodic Frequency		20 – 100 Hz
Inter-pulse Interval Range	12.5 – 30 ms	
Amplitude	20 – 25 μ A	5 – 25 μ A
Train Duration	Until target object contact	50 to 1000 ms

Table S4. Related to Figure 4. ICMS parameters used for stimulus-triggered averaging.

	PM-ICMS	M1-ICMS
Monkey L		
Number of Sessions		2
Number of Electrodes	1	1
Amplitudes	20 μ A	20 μ A
Inter-pulse intervals	12.5 to 40 ms	12.5 to 40 ms
Success Rate	98.2%	22.1%
Monkey X		
Number of Sessions		4
Number of Electrodes	1	1
Amplitudes	25 μ A	25 μ A
Inter-pulse intervals	12.5 to 30 ms	12.5 to 30 ms
Success Rate	91.6%	10.6%

Movie Legends

Movie S1. Related to Figure 2. Interleaved PM-ICMS and LED Instructions. Monkey L performed pseudorandomly interleaved trials instructed by either PM-ICMS or LEDs. During PM-ICMS instructions, PM-ICMS was delivered but blue LEDs at the base of the target object were turned OFF. During LED instructions, no PM-ICMS was delivered but blue LEDs at the base of the target object were turned ON. With either type of instruction, blue LEDs at the base of the home object turn ON to indicate that the monkey can begin a new trial and turn OFF at the end of the initial hold period simultaneous with the onset of the instruction. The high-pitched tone indicates that the trial was a success and a reward is being delivered; the low-pitched tone indicates that an error was made.

Movie S2. Related to Figure 2. Interleaved PM-ICMS and LED Instructions with Annotated Trials. Same video as Movie S1 with annotations of the instruction for each trial.