Supplementary data

<table>
<thead>
<tr>
<th>Animal ID</th>
<th>Sex</th>
<th>Age</th>
<th>Weight</th>
<th>SCI</th>
<th>Anesthetized Experiments</th>
<th>Behavioral experiments</th>
<th>Brain array position</th>
<th>Brain - Controlled EES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mk-Sa</td>
<td>F</td>
<td>9 Yr</td>
<td>4 kg</td>
<td>yes</td>
<td>Recruitment curves</td>
<td>Reach only</td>
<td>M1 and PMd</td>
<td>no</td>
</tr>
<tr>
<td>Mk-Br</td>
<td>F</td>
<td>3 Yr</td>
<td>3.4 kg</td>
<td>yes</td>
<td>Recruitment curves and single joint movements</td>
<td>Reach and pull</td>
<td>S1, M1 and PMv</td>
<td>yes</td>
</tr>
<tr>
<td>Mk-Yg</td>
<td>F</td>
<td>3 Yr</td>
<td>2.9 kg</td>
<td>yes</td>
<td>Recruitment curves and single joint movements</td>
<td>Reach and pull</td>
<td>S1, M1 and PMv</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Supplementary Table 1:** Identification information, license numbers, characteristics and type of procedure performed for the three monkeys involved in the study.

**Video 1:** Single-joint movements elicited by pulse trains of EES at different segmental locations. Shoulder abduction: stimulation at C5; Elbow extension: stimulation at C7; Finger flexion: stimulation at T1; reach, grasp and pull sequence: cascade stimulation at C7, T1 and C5.

**Video 2:** Effects of EES on reach movement performance on Mk-Sa. Top left: lateral vision of the animal performing the task; Bottom left: delivered stimulation pulses; Top right: electromyographic activity from Deltoid, Biceps and Triceps muscles; Bottom right: neural activity from M1 and PMd cortex.

**Video 3:** Effects of brain-controlled EES on reach and pull movement performance on Mk-Br. Top left: lateral vision of the animal performing the task; Middle left: delivered stimulation pulses; Bottom left: pulling force applied on the robot end effector; Top right: neural activity from S1, M1 and PMd cortex; Bottom right: electromyographic activity from Deltoid, Flexor Carpi radialis and Abductor Pollicis.

**Video 4:** Effects of EES on pull movement performance on Mk-Yg. Top left: lateral vision of the animal performing the task; Middle left: delivered stimulation pulses; Bottom left: pulling force applied on the robot end effector; Top right: neural activity from S1, M1 and PMd cortex; Bottom right: electromyographic activity from Biceps, Triceps, Extensor Digitorium Communis and Flexor Digitorium Superficialis.

**Video 5:** Effects of a EES burst optimized to recover pull, delivered during a reach movement on Mk-Yg. Lateral view of the animal performing the task.
Supplementary Figure 1: Position of intracortical arrays. Location of intracortical arrays implanted in the sensory (S1), Motor (M1) and dorsal or ventral premotor (PMd, PMv) cortex in the three monkeys.