Supporting Information

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Fig. S1. Delta oscillation examples during the delay period between f2 and pu. LFP signals and coherence examples corresponding to session number 34 (*A*) and session number 36 (*B*). *Left* shows LFPs signals for three simultaneously recorded areas during the discrimination task. Each row is a trial. Raw LFPs are plotted in blue and filtered in black color. Top views of the monkey brain show the location of the cortical pairs from which coherence is calculated (green spots) during the delay period between f2 and pu (red boxes). Coherence spectra are plotted in *Right* and peaks at 2–3 Hz. SEM (±2) over trials at each point is indicated by error bars. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; and M1, primary motor cortex.



Fig. S2. Cortical coherence dynamics during the discrimination task for the whole frequency range filtered (1–45 Hz). (A) Parietal pair areas. (B) Frontal pair areas. (C) Parieto-frontal pair areas. Conventions are the same as in Fig. 2. Significant coherence for beta band (13–30 Hz) is clearly observed for two pairs of areas: left medial premotor cortex (MPC) and right primary motor cortex (M1), and right MPC and right M1. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; DPC, dorsal premotor cortex.



Fig. S3. Coherence differences between $f_2 > f_1$ and $f_2 < f_1$ trials during the discrimination task for groups of hit trials in which the f2 stimulus frequency is equal to 22 Hz. (A) Schematic view of the cortical pairs from which coherence was calculated (green spots). (B) For each recording session coherence is calculated, separately for $f_2 > f_1$ and $f_2 < f_1$, task conditions taking the same number of hit trials and the Fisher Z-transform of these differences was obtained. Time-frequency representations show coherence averaged over all sessions (n = 18) for both task conditions (*Left* and *Center*) and the corresponding averaged coherence differences (*Right*). S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; DPC, dorsal premotor cortex; M1, primary motor cortex.

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Fig. 54. Population measures of coherence during the postponed decision period. (*A*) Schematic view of the cortical pairs from which coherence was calculated (green spots). (*B*) Distribution of coherence values during three intervals of 1 s each during the postponed decision period. In each graph, the coherence values for f2 < f1 group of trials are plotted against the coherence values for f2 > f1 group of trials. Trials are hits in which the f2 stimulus frequency is equal to 22 Hz. The frequencies at which coherence values were obtained are listed in red (corresponding to the red line values in Fig. 3C). Each black circle represents one population. The number of populations is listed in the lower right of *Left*. Points above the diagonal indicate that coherence values were significantly higher when f2 was correctly judged higher than f1, whereas points below the diagonal indicate significantly higher coherence values when f2 was correctly judged lower than f1. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; DPC, dorsal premotor cortex; M1, primary motor cortex.



Fig. 55. Theta-band coherence between $f_2 > f_1$ and $f_2 < f_1$ for groups of hit trials in which the f_2 stimulus frequency is equal to 22 Hz. (A) Schematic view of the cortical pairs from which coherence is calculated (green spots). (B) Time course of coherence for each group of trials at 6 Hz frequency value. Error bars correspond to SEM (± 2) over recording sessions. (C) Distribution of coherence values across populations during three intervals of 1 s each, during the postponed decision period. In each graph, the coherence values for $f_2 < f_1$ group of trials are plotted against the coherence values for $f_2 > f_1$ group of trials. Trials are hits in which the f_2 stimulus frequency is equal to 22 Hz. The theta frequencies at which coherence values were obtained are listed in the upper left of each graph (5–8 Hz). Each circle represents one population. The number of populations is listed in the lower right of *Left*. Points above the diagonal indicate that coherence values were significantly higher when f2 was correctly judged higher than f1, whereas points below the diagonal indicate significantly higher coherence values when f2 was correctly judged lower than f1. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; MPC, medial premotor cortex.



Fig. 56. Significant power differences between $f_2 > f_1$ and $f_2 < f_1$ trials during the discrimination task for groups of hit trials in which the f_2 stimulus frequency is equal to 22 Hz. (A) Schematic view of the cortical areas from which power was calculated (green spots). (B) For each recording session, power is calculated, separately for $f_2 > f_1$ and $f_2 < f_1$ task conditions taking the same number of hit trials, and the Fisher Z-transform of these differences was obtained. Time-frequency representations show power averaged over all sessions (n = 18) for both task conditions (*Left* and *Center*) and the corresponding averaged power differences (*Right*). (C) Time-frequency representations showing the clusters where there were power differences between $f_2 > f_1$ minus $f_2 < f_1$ group of trials. Only significant clusters were plotted in red color (P < 0.05, two-sided test, *Materials and Methods*). Horizontal red lines indicate frequency values where the significant cluster had equal maximum length. (D) Time course of power for each group of trials at frequency values corresponding to horizontal red lines. If the cluster had equal maximum length in more than one frequency value, power was averaged. Black lines depict time task events: presentation of the first stimulus (0–0.5 s), presentation of the second stimulus (3.5–4 s), and probe up event (7 s). Error bars correspond to SEM (± 2) over recording sessions (n = 18). S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; and M1, primary motor cortex.



Fig. 57. Significant coherence differences between $f_2 > f_1$ and $f_2 < f_1$ group of trials during the control tests. (A) Schematic view of the cortical pairs from which coherence was calculated (green spots). (*B* and *C*) Results during visual instruction. (*D* and *E*) Results during passive stimulation. (*B* and *D*) Time-frequency plots showing the clusters where there were coherence differences between $f_2 > f_1$ minus $f_2 < f_1$ group of trials. No significant clusters were found in these conditions. (*C* and *E*) Time course of coherence for each group of trials averaged over all frequency range (1–8 Hz). Black lines depict time task events: presentation of the first stimulus (0–0.5 s), presentation of the second stimulus (3.5–4 s), and probe up event (7 s). Error bars correspond to SEM (± 2) over recording sessions (*n* = 18). S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; DPC, dorsal premotor cortex; M1, primary motor cortex.

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Fig. S8. Spike-triggered averages (STAs) during the postponed decision period reveal oscillatory cycles at delta frequencies around the spikes. (A) Three example trials of LFP signals filtered between 1 and 4 Hz (green traces) with the superimposed spikes (black vertical lines). (B) STA plots for three example neurons (green traces) during three intervals of 1 s each in the postponed decision period studied (4.5–6.5 s). STAs were calculated by averaging LFP segments \pm 1 s around every spike recorded in correct hit trials (*Materials and Methods*). The number of trials included is listed in the lower right of *Left*. (C) STAs averages over neurons for each recorded area (black traces) during the central interval (5–6 s) of the postponed decision period. The number of trials included is listed in Legend continued on following page

the lower right of each graph. The number of neurons included in each STA area analysis is as follows: left S1, n = 20; left S2, n = 11; left MPC, n = 4; right MPC, n = 11; left DPC, n = 13 and right M1, n = 20. Gray curves in the background of *B* and *C* are the traces of the 100 STA permutations (*Materials and Methods*). This permutation test means that the point wise probability that the true STAs (green or black curves) would take more extreme values than the permuted curves is less than 0.01. (*D*) STAs average differences between f2 > f1 and f2 < f1 groups of hit trials in which the f2 stimulus frequency is equal to 22 Hz. Results are shown for each recorded area during the central interval (5–6 s) of the postponed decision period. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; DPC, dorsal premotor cortex; M1, primary motor cortex.

Table S1.	Delta-band coherence comparison between	
discrimination task and control tests		

Cortical pairs	One-way ANOVA		Post hoc tests	
Left DPC – right MPC	$F_{(2, 84)} = 18.99$	P < 0.001	1 vs. 2, 3	
Left DPC – right M1	$F_{(2, 84)} = 62.37$	<i>P</i> < 0.001	1 vs. 2, 3	
Left S1 – right MPC	$F_{(2, 84)} = 80.69$	<i>P</i> < 0.001	1 vs. 2, 3	
Left S1 – left DPC	$F_{(2, 84)} = 148.33$	<i>P</i> < 0.001	1 vs. 2, 3	
Left S1 – right M1	$F_{(2, 84)} = 239.6$	<i>P</i> < 0.001	1 vs. 2, 3	
Left S2 – right MPC	$F_{(2, 84)} = 31.52$	<i>P</i> < 0.001	1 vs. 2, 3	
Left S2 – right M1	$F_{(2, 84)} = 64.14$	<i>P</i> < 0.001	1 vs. 2, 3	

For each cortical pair, a one-way ANOVA was performed, which tested the effect of task type on coherence values at 2 Hz during the postponed decision period. Post hoc comparisons using Tukey–Kramer test revealed that average coherence for delta-band in the discrimination task is significantly different compared with both control sets coherence averages. S1, primary somatosensory cortex; S2, secondary somatosensory cortex; MPC, medial premotor cortex; DPC, dorsal premotor cortex; M1, primary motor cortex; 1, discrimination task; 2, visual instruction; 3, passive stimulation.