Supplementary Information on TMS/hd-EEG recordings: acquisition and preprocessing

Stability of the coil position was assured by using a software aiming device allowing the stimulation only when the deviation from the target was less than 2 mm. The intensity was chosen in order to assure an induced electrical field at the cortical level between 100 and 140 V/m (64-83% of the maximum stimulator output). The location of the maximum electric field induced by TMS on the cortical surface was always kept on the convexity of the targeted gyrus with the induced current perpendicular to its main axis. Biphasic TMS pulses were delivered with an interstimulus interval jittering randomly between 2000 and 2300 ms (0.4–0.5 Hz). Studies directly assessing the reproducibility of TEPs showed no changes after slower (0.3 Hz; (Lioumis et al., 2009)) and faster (1.1-1.4 Hz, (Casarotto et al., 2010)) TMS frequency. Since the inter-pulses interval we used falls within this range, we would consider unlikely the chance of having induced cortical excitability shifts by TMS alone.

Trigeminal stimulation and muscle artefacts were minimized by placing the coil on a scalp area close to the midline (Mutanen et al., 2013), far away from facial or temporal muscles and nerve endings. To prevent contamination of TMS-evoked EEG potentials by the auditory response to the coil's click, subjects wore earphones through which a noise masking was played throughout each TMS/hd-EEG session (ter Braack et al., 2015).

EEG was filtered (0.1350 Hz), and sampled at 725 Hz. Two additional electrodes were used to record the electrooculogram (Nexstim eXimia, Nexstim Plc, Finland). We prepared the EEG channels to each have an impedance of less than 5 k; during the experiment, we monitored the impedance of each channel and adjusted it when necessary.

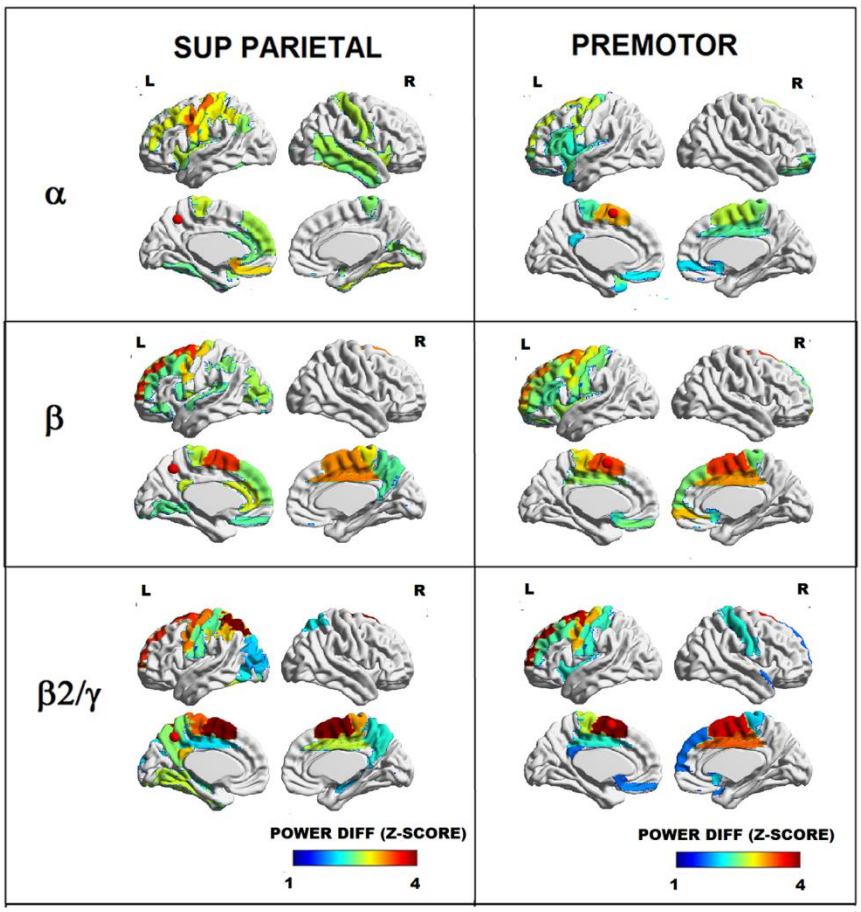

Fig. S1: Frequency specific power differences across cortical regions between post TMS and baseline. Rows: snapshot of z-scored group-averaged power differences between baseline and post TMS stimulus across cortical regions, for the three predefined frequency bands (α, β, $\beta 2/\gamma$, (Rosanova et al., 2009)) for the two sites of stimulation (columns). The red circles coarsely indicate the target areas of stimulation. Notably, the connectivity on the premotor site (Fig. 2, main text) follows the specific differences in the power spectrum, whereas the peaks of directed functional connectivity appears not to be specific of the differences in the frequency power.

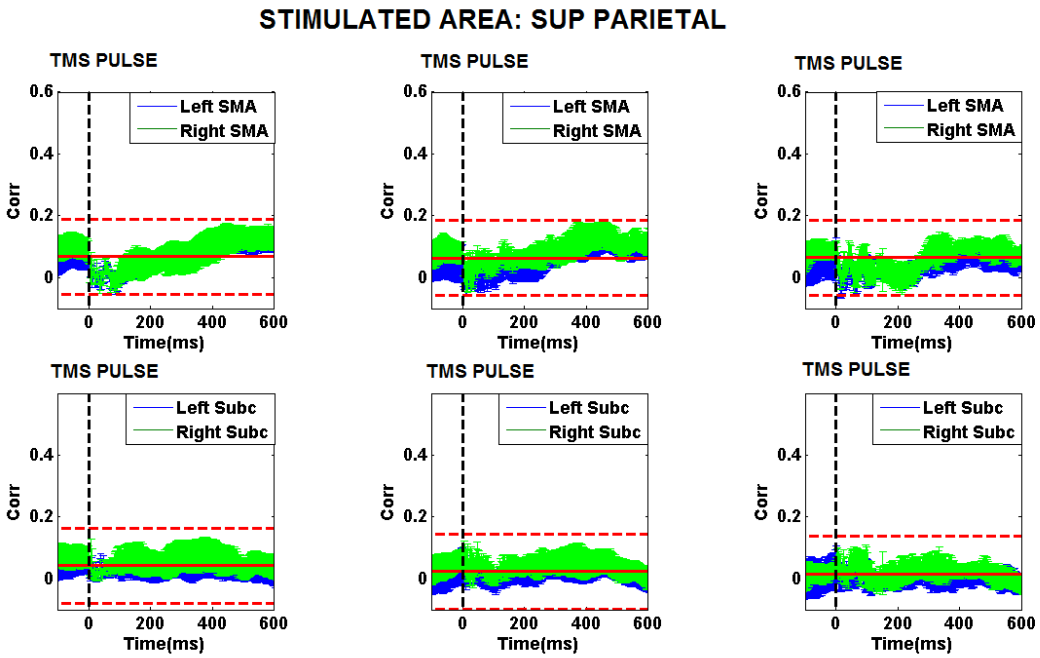

Fig. S2: Time-varying spatial correlation for the non-stimulated site and a "control" (i.e. subcortical, namely the putamen) region. Each row shows the average over subjects of the dynamic spatial correlation (blue and green line, standard error in shaded blue and green) between the directed functional connectivity (swADTF) and structural connectivity (SC) for the AAL ROIs comprising left and right premotor areas and a left and right subcortical region respectively, for the three different frequency bands (i.e. alpha, beta, beta2/gamma respectively (Rosanova et al., 2009)), when the superior parietal cortex is stimulated. The continuous red line indicates the mean baseline value, the dashed lines represent 95% confidence interval of the empirical baseline distribution (see Materials and Methods).

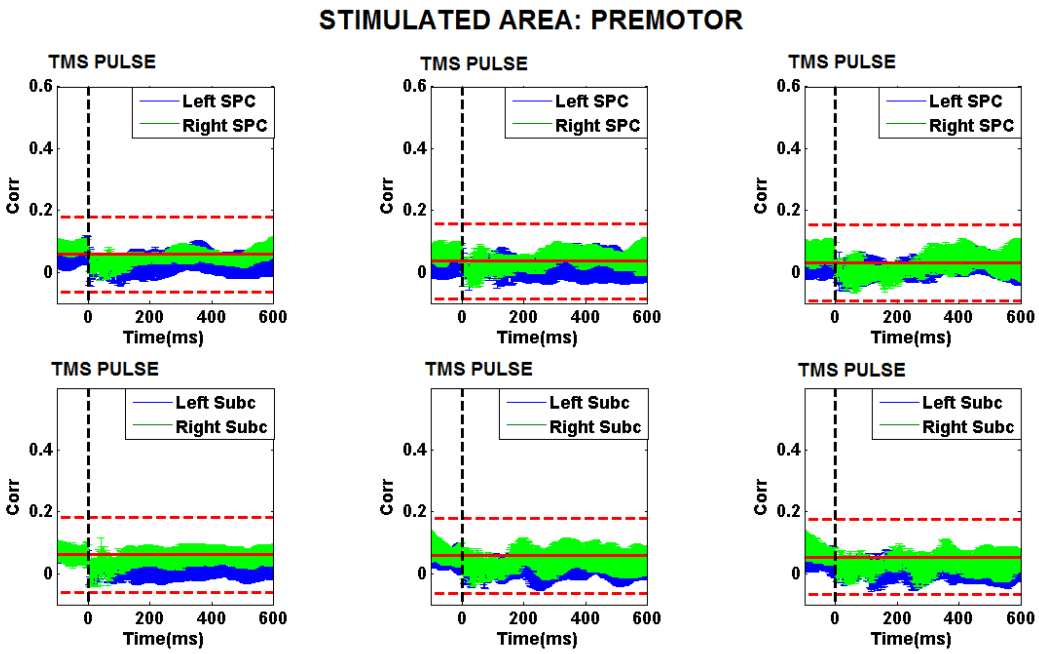

Fig. S3: Time-varying spatial correlation for the non-stimulated site and a "control" (i.e. subcortical) region. Each row shows the average over subjects of the dynamic spatial correlation (blue and green line, standard error in shaded blue and green) between the directed functional connectivity (swADTF) and structural connectivity (SC) for the AAL ROIs comprising left and right superior parietal areas and a left and right subcortical region respectively, for the three different frequency bands (i.e. alpha, beta, beta2/gamma respectively (Rosanova et al., 2009)), when the premotor cortex is stimulated. The continuous red line indicates the mean baseline value, the dashed lines represent 95% confidence interval of the empirical baseline distribution (see Materials and Methods).

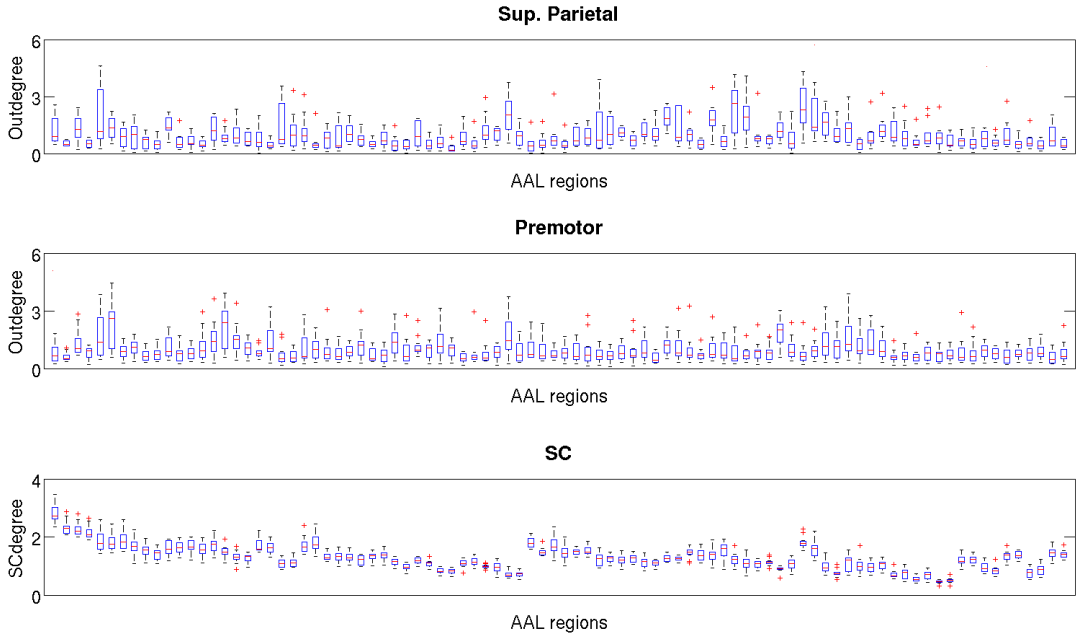

Fig. S4: Within-subject variability of the functional and structural connectivity profiles. First two rows: boxplots show the Outdegree variability for the two sites of stimulation regions across AAL brain regions. The third row depicts the within-subject variability of the SCdegree across AAL brain regions. The tops and bottoms of each "box" are the 25th and 75th percentiles of the samples, respectively. The line in the middle of each box is the sample median. The whiskers are drawn from the ends of the interquartile ranges to the furthest observations within the whisker length (the adjacent values). Red crosses indicate outliers. Note how both functional and structural connectivity profiles appear to be stable over subjects.

Caption for the movies: movies of significant Outdegree across cortical regions, for both sites of stimulation, from 27 ms before to 214 ms after the pulse. The first 20 ms were discarded to avoid the effect of possible artifacts occurring at the time of stimulation (Rosanova et al., 2009). The temporal dynamics of the Outdegree for the three predefined frequency bands (alpha, beta, beta2/ gamma (Rosanova et al., 2009)) is illustrated. The red circles coarsely represent the areas of stimulation. A grand average plot of the EEG reconstructed sources is also shown. To red marker denotes the time instant along the ERP time series.

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