Electro-cortical correlates of bimanual coordination in adults: motor inhibition in a selective stop task

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INTRODUCTION
Successfully performing a bimanual task requires the simultaneous activation of homologous and/or non-homologous muscles of the two limbs. To avoid interference between the two motor commands, selective motor inhibition mechanisms are necessary. The aim of this study is to identify the cortical areas involved in these mechanisms.

RESULTS
1 / behavioral performance
Whatever the condition of switching, the stability of the first unimanual tapping, immediately following the transition, is significantly perturbed.

2 / TRPow

<table>
<thead>
<tr>
<th>ROI 1 : C3 + CP3</th>
<th>ROI 4 : CPz + Pz</th>
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<tbody>
<tr>
<td>IN PHASE</td>
<td>STOP</td>
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<tr>
<td>STOP Right</td>
<td>Left</td>
</tr>
<tr>
<td>STOP Left</td>
<td>Right</td>
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Grand average of the TRPow values in % St. Maps correspond to transitional state from in-phase bimanual to unimanual movements: TRPow decreases (area of ‘activation’, negative TRPow values) are coded in blue and TRPow increases (positive TRPow values) are coded in red.

In the alpha band (8 – 12 Hz):
- The transition from in-phase to right hand stop shows significant increase in ROI 1, $(F(1, 8) = 17.34, p < .01)$ only.
- The transition from in-phase to left hand stop shows significant increase in ROI 1, $(F(1, 8) = 14.65, p < .01)$ and ROI 4, $(F(1, 8) = 15.71, p < .01)$.
- The transitions from anti-phase pattern do not yield significant changes, whatever the ROI.

PROCEDURE AND METHODS
- Indexes tapping / switching from bimanual to unimanual
  - Tempo of the auditory metronome = 700 ms (-14 Hz).
  - 9 right-handed adults (4 women) aged from 24 to 38 years.
  - 4 experimental conditions of switching (each: 2 x 24 trials)

DISCUSSION
These results provide an electrophysiological correlate to recent EEG and fMRI findings suggesting the involvement of the posterior parietal cortex in motor transitions either to enable the change of motor program (Deiber et al., 2001) and/or for resisting to motor interferences between the two limbs (Wenderoth et al., 2005). In addition, they suggest that selective motor inhibition manifests itself as changes in the functional coupling between lateral and medial cortical areas.

REFERENCES