Multiple spatial representations of touch: an MEG investigation

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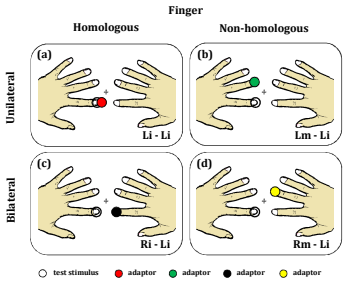
Introduction

An increasing amount of evidence in animals [1], as well as behavioural [e.g., 2] and neuroimaging studies in humans has documented the involvement of primary somatosensory cortices in coding the tactile stimuli coming from the two sides of the body. Using fMRI adaptation, we have shown in a previous experiment that the primary somatosensory cortex can homotopically integrate somatosensory inputs from the two sides of the body, despite its prominent contralateral response [3]. However, the low temporal resolution of fMRI does not allow determining the time course of the interaction between contralateral and ipsilateral hemispheres. The aim of the present study, using magnetoencephalography together with an adaptation paradigm, is to track the tactile information flow across the two hemisphere in the primary (SI) and secondary (SII) somatosensory cortices.

Experimental Conditions and Design

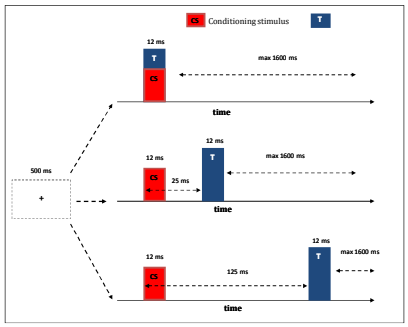


(a) Homologous Unilateral: the left index finger was stimulated twice (Li-Li);
(b) Non-Homologous Unilateral: the left middle and left index fingers were stimulated (Lm-Li);
(c) Homologous Bilateral: the right index and the left index were stimulated (Ri-Li);
(d) Non-Homologous Bilateral: the right middle and the left index fingers were stimulated (Rm-Li). The empty circle represents the test stimulus, the coloured circles represent the adaptor.

Simultaneous stimulation

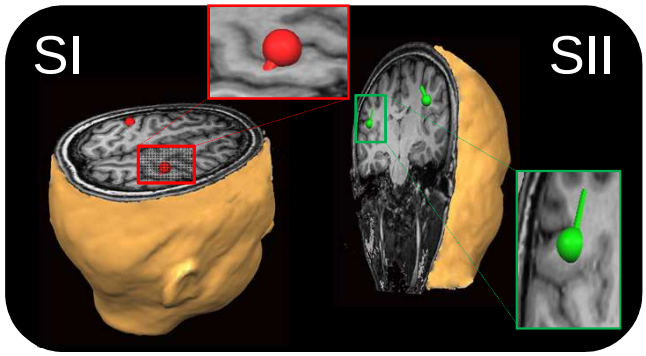
Inter-Stimulus Interval of 25 ms

Inter-Stimulus Interval of 125 ms

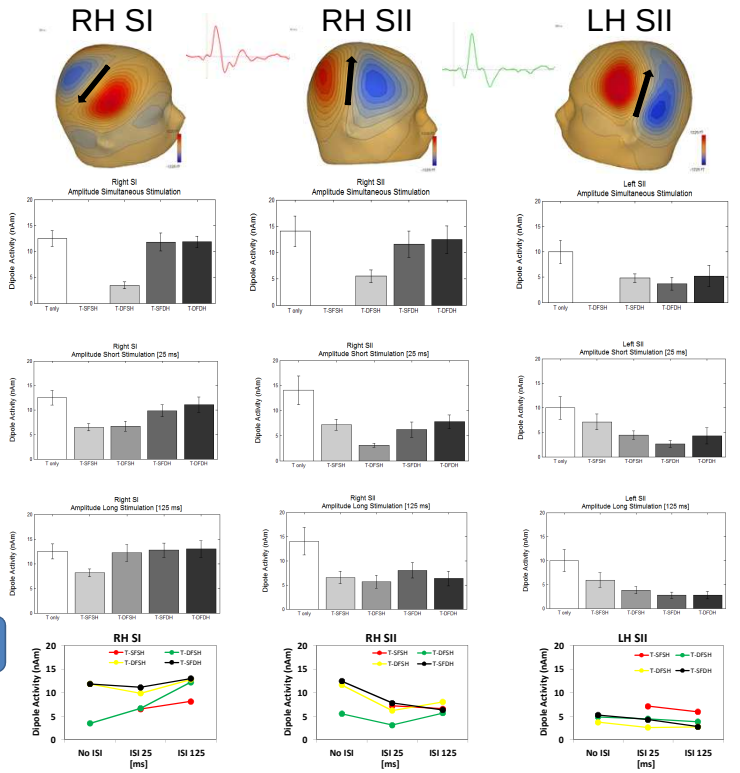


Analysis

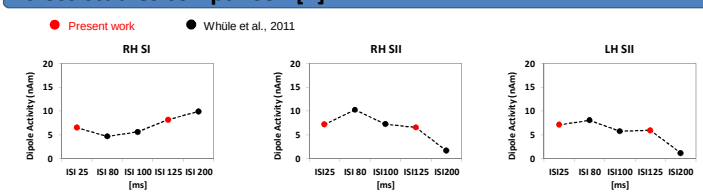
Data analysis focused on the relative changes in neuromagnetic responses evoked by the test stimulus (i.e., always the left index finger) alone and the test stimulus presented together with a conditioning stimulus (1) simultaneously, (2) 25 ms or (3) 125 ms before the test stimulus, respectively. The rational for this manipulation was to explore how the neuromagnetic activity of the test stimulus can be modulated by the conditioning stimulus delivered to different body parts (i.e., same or different fingers within and between the hands) with different timing, compared to the test stimulus presented alone.



Results



Across studies comparison [4]



Results and Conclusions

Results showed: **(a)** the presence of an adaptation effect selective for the stimulation onset asynchrony (25 ms); **(b)** the effect was selective for the pairs of fingers stimulated (i.e., homologous vs non-homologous) and **(c)** for the side of stimulation (unilateral vs bilateral). Finally, **(d)** the left index finger (test) showed a special response characteristics in the tested brain areas that differ from all the other fingers. We can conclude that tactile stimuli on the fingers are integrated, at an early stage in the somatosensory cortices following different neural pathways.

References

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