Multiple representations of touch

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Touch is represented in multiple reference frames in the brain. On an early level of processing, tactile input is coded in a somatotopic frame preserving the neighbourhood relation of adjacent skin areas. On higher levels, touch is represented in references frames related to limb function, body orientation and external space. The goal of the present study was to infer the anatomical substrate for different reference frames using functional neuroimaging. Assuming that the processing of a stimulus is affected by a distracter stimulus as long as they share a common representation, the brain areas for different reference frames can be identified by their interaction. Here, left index finger served as target location. Tactile distracters were applied to the left middle, the right middle and the right index finger with a stimulus onset asynchrony (SOA) of 0, 25 and 125 ms. Activation of left and right primary (SI) and secondary somatosensory (SII) cortex could be identified using neuromagnetic source imaging. On the level of SI, an effect of distracters applied to the other hand was found.

Yet, SII responses to the target stimulus were diminished by stimulating fingers of the other hand. The reduction was stronger for stimulation of the non-homolog than the homolog finger. Increasing SOAs between distracters and target stimuli revealed that SII responses to the target were delayed by the previously applied distracter only for the SOA of 125 ms. Results indicate that on the level of SII, there exist shared representations integrating information from homologuous regions of the left and right half of the body implying a common reference frame for homolog limbs. Effects of SOA suggest that SII plays a role in the analysis of the temporal structure of the stimuli.