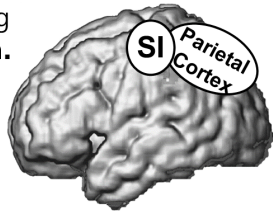


Abstract

Feeling directional tactile pulls is important for everyday life, allowing us to feel the weight of an object or be guided by our partner during a dance. We wanted to know what type of brain activity gives rise to the pulling sensation, specifically if it was generated in the primary somatosensory cortex (SI; area responsible for early processing of touch) or parietal cortex (area responsible for spatial and orientation processing). We generated pulling sensations via asymmetric vibration from a hand held device and recorded brain activity with electroencephalography (EEG; a technique for recording the brain's electrical activity from the scalp). We found that the pulling sensation is associated with brain activity 280ms post-stimulus in the parietal lobe. These results may benefit people with sensory impairments (e.g. blindness) or paralysis by helping researchers use vibration feedback for navigation and the control of prosthetic limbs.

How do we feel a pulling sensation?

You perceive a lot via feeling of directional force on skin.



Which part of the brain generates this sensation?

Hypothesis

Parietal cortex generates pulling sensations.

Brain activity relating to pull

We used "Illusory pulling sensation from asymmetric vibration".

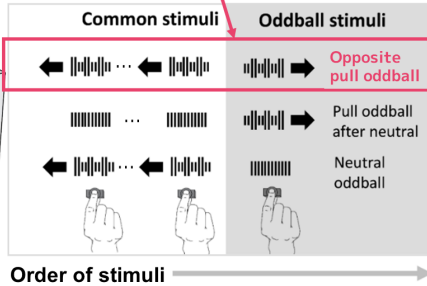


Three types of stimuli: Left, Right & Neutral pulls

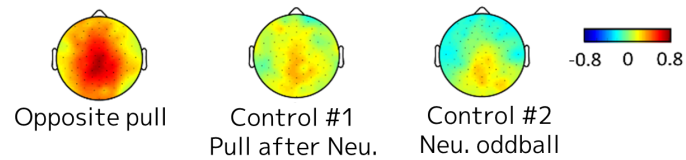
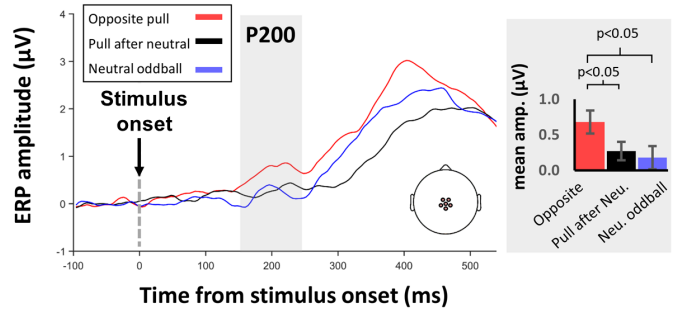
EEG was measured in oddball task*1 with pulls.

*1: response to rare stimulus in stream of commons

Critical condition = 'Opposite pull' (pull direction opposite to expectation)

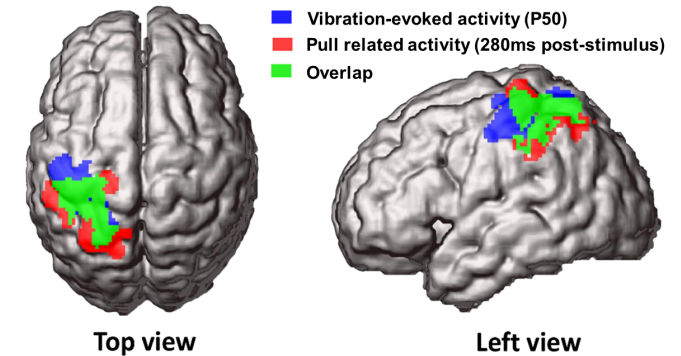


Results: parietal cortex generates pull



EEG P200 (for orientation and spatial processing) was larger for Opposite pulls than control.

→ Involvement of P200 in the pulling sensation.



Most pulling activity (red) was in parietal cortex, posterior to SI (blue).

References

[1] J. De Havas, S. Ito, S. Bestmann, H. Gomi, "Neural dynamics of illusory tactile pulling sensations," *bioRxiv*, 2021. <https://doi.org/10.1101/2021.10.12.464029>

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