EEG spectrum modulation during standing induced by optic flow and light finger touch

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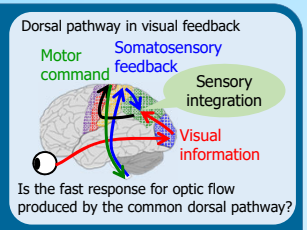
Contribution of vision in postural control

- Optic flow induces involuntary postural readjustment (Lestienne, 1977).
- The response of muscle activity for optic flow is fast (100-150 ms) (Nashner, 1978).

Contribution of somatosensory feedback

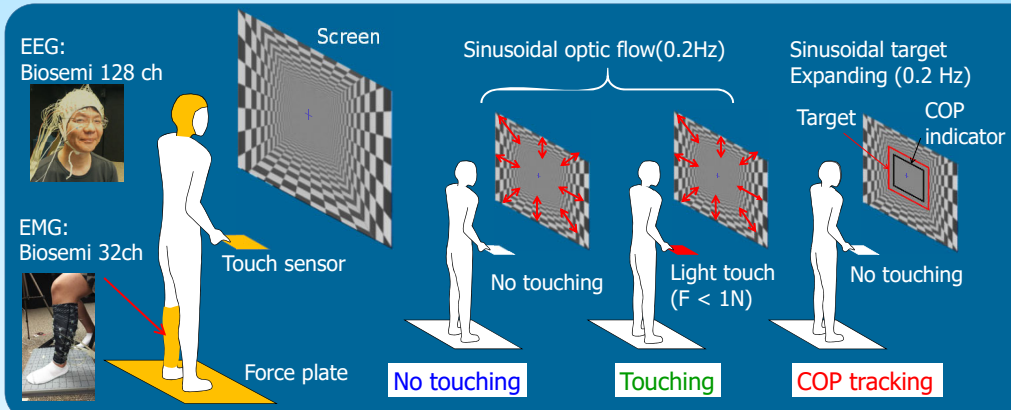
- Light finger touch suppresses postural sway (Jeka 1994).



MoBI: Mobile Brain/Body Imaging (Makeig, 2009)

- Simultaneous recording of dense-array EEG and behavioral data (Mocap, EMG, Force plate, etc) during natural unconstrained movements.
- Independent component analysis and source localization can separate signals of independent neural activities and other artifacts (EOG, eye-blink, EMG, etc).

MobI for neural processing in visually-induced postural sway



No touching vs. Touching

The same visual stimulus, but different behaviors

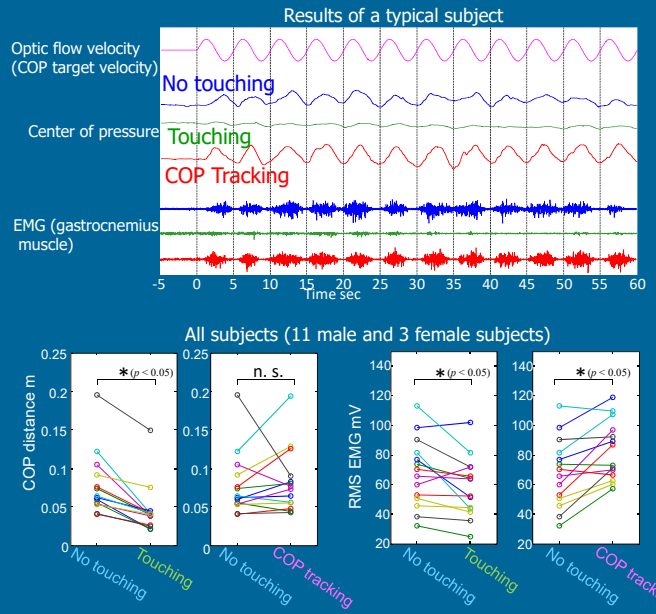
Neural process for integration of somatosensory and visual inputs in relation to the self-motion perception.

No touching vs. COP tracking

Different task requirements, but similar behaviors

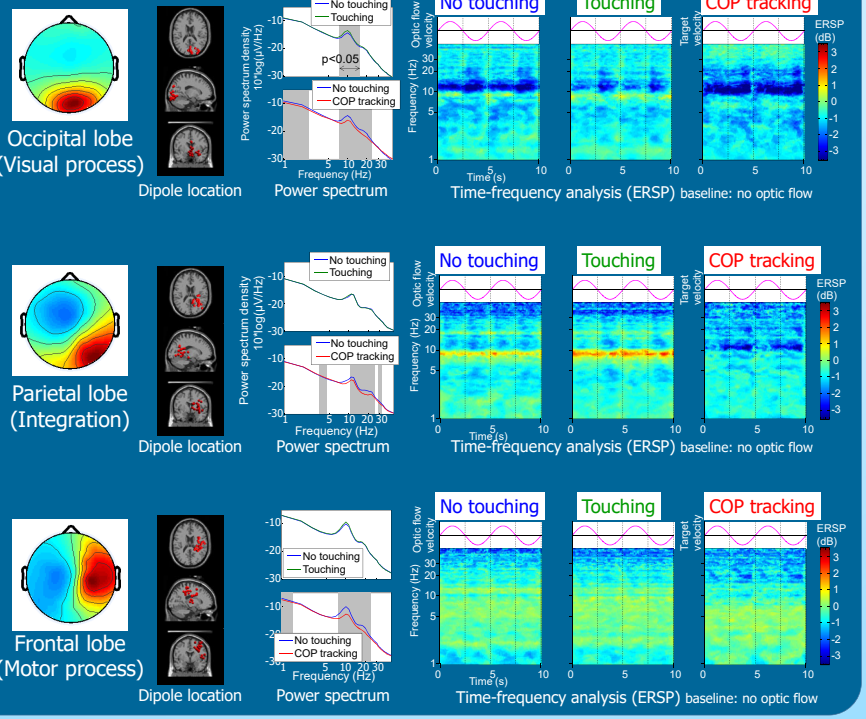
Different neural process between involuntary and voluntary postural movements

Behavioral Results



1. Optic flow induced activities of ankle muscles and increase of COP displacement.
2. Light finger touch suppressed the EMG and postural sway.
3. Similar behavior between "No touching" and "COP tracking"

EEG Results



Spectrum modulation by optic flow

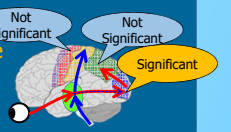
EEG oscillation reflects synchronized activities of large population of neurons. Modulation of alpha (8-13 Hz) and beta (14-30 Hz) band power related to the optic flow velocity and the postural sway could be captured by the MoBI framework.

No touching vs. Touching (sensory integration)

Behavioral data showed light-touch suppressed postural sway, but significant difference was found only in visual area

Touch information modulates the early stage of the visual process.

Thalamic nuclei convey diverse contextual information to layer 1 of visual cortex (Roth et al 2015).



Neural activities in parietal and motor area were similar among with and without touching conditions.

No touching vs. COP tracking (involuntary process)

Behavioral data were similar, but significant differences of EEG spectrum were found in motor, parietal and visual areas.

Some shortcut without motor preparation for fast response to optic flow