Report

Current Biology

Somatosensory Cortex Efficiently Processes Touch Located Beyond the Body

Highlights

- Human sensorimotor system rapidly localizes touch on a hand-held tool
- Brain responses in a deafferented patient suggest vibrations encode touch location
- Somatosensory cortex efficiently extracts touch location from the tool's vibrations
- Somatosensory cortex reuses neural processes devoted to mapping touch on the body

Authors

Luke E. Miller, Cécile Fabio, Valeria Ravenda, ..., Nadia Bolognini, Vincent Hayward, Alessandro Farnè

Correspondence

l.miller@donders.ru.nl

In Brief

Using electroencephalography, Miller et al. found that where a hand-held tool is touched is rapidly represented by the dynamics of sensorimotor cortices. Primary somatosensory cortex efficiently extracts location information encoded by the tool's vibratory patterns. The brain reuses neural processes initially devoted to mapping touch on the body.

Résumé : En utilisant l'électroencéphalographie, Miller et collègues de l'équipe Impact du CRNL ont constaté que lorsqu'un outil tenu dans sa main est touché, l'endroit où ce contact se produit est représenté rapidement par l'activé du cortex sensorimoteur.

Le cortex somato-sensoriel primaire extrait efficacement les informations de localisation, codées par les motifs vibratoires transmit par l'outil.

En plus, la comparaison avec la dynamique cérébrale évoquée par le même toucher sur les bras des participants, a permis de révéler que le cerveau réutilise les processus neuronaux initialement consacrés à la carte tactile du corps pour localiser l'impact ayant lieu sur un outil.

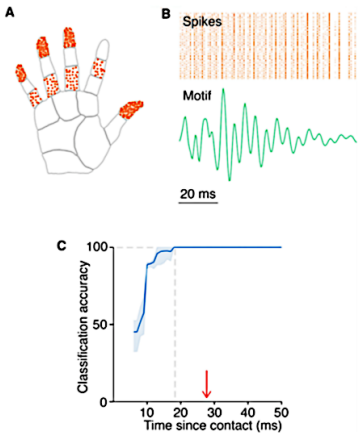

Figure 2. Afferent Simulations Demonstrated Efficient Encoding of Location During Tool-Extended Sensing

(A) We used a skin-neuron model (TouchSim) to simulate a population of 286 Pacinian corpuscles (PCs) in the hand.

(B) We simulated PC spikes (orange ticks) in response to a location-specific vibratory motif (green curve).

(C) Given the spike timing of the PC population, we could decode location with 100% accuracy given a window size of 18 ms (gray dashed line). We took this value to represent the minimal information needed to extract contact location if somatosensory encoding was maximally efficient. The red arrow indicates what we actually observed after removing the 20-ms conduction delay between the periphery and SI [21]. Shaded regions represent the range of accuracy for 100 permutations.

See also Figure S1.