Decoding single finger movements versus movement sequences

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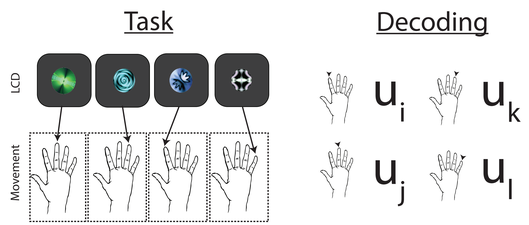
Motivation

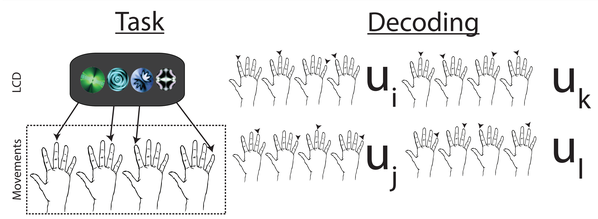
Sequences of movements can be learned in multiple reference frames e.g. visual or motoric which are thought to involve distinct networks (Hikosaka, 2002).

Here we distinguish the neural representations of finger sequences and cue sequences as well as how these compare to single finger movements across the brain.

Single cued-finger



Finger sequences



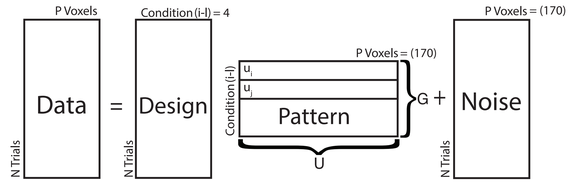
Cue sequences

Methods

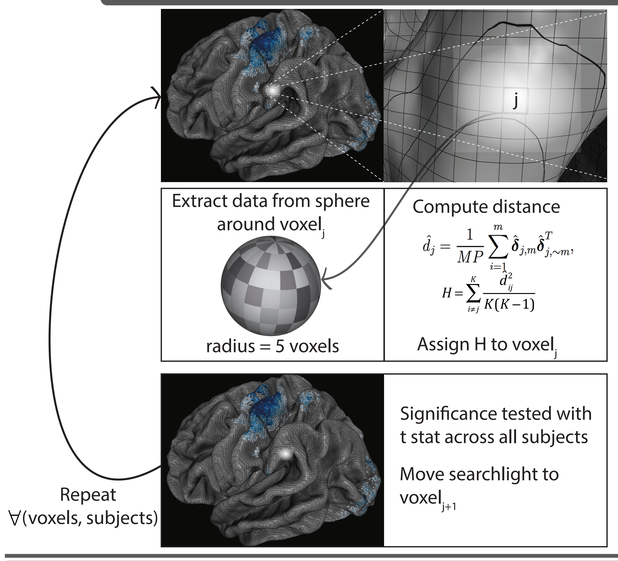
Datasets:
Single cued-finger: 18 Neurologically healthy adults (aged 21-37) 6 female
Finger/Cue sequence: 20 Neurologically healthy adults (aged 21-37) 10 female

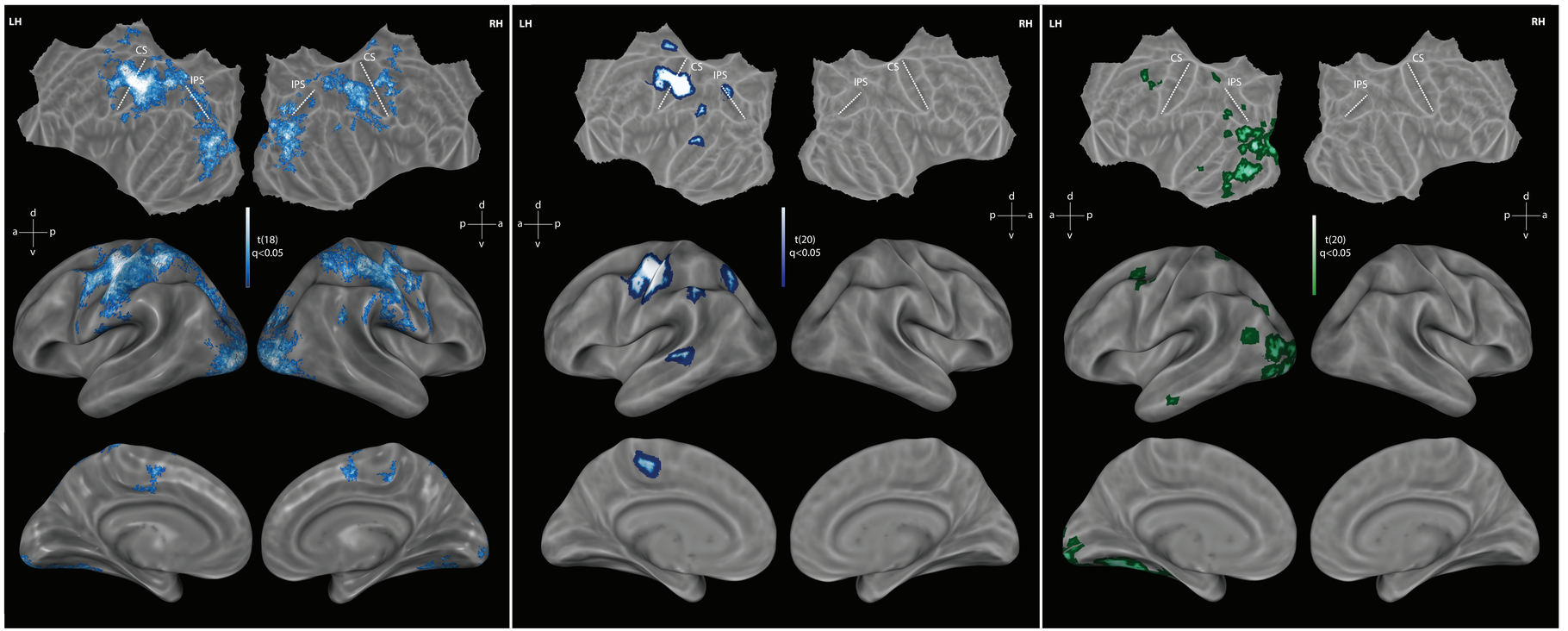
Imaging Parameters:
3T (SIBR), TR: 2000ms, MB=3, 66 slices, 2mm^3, Single finger: 6 runs, Seq.: 8 runs

Representational Similarity Analysis



Searchlight





Conclusions

Sequences of movements and sequences of cues exhibit dissociable decoding networks

Finger sequences are reliably decoded in primary motor and somatosensory cortex (M1 and S1), supplementary motor area but not visual or premotor cortex

Cue sequences are reliably decoded in dorsal premotor cortex and visual cortex, but not M1 or S1

References

1. Hikosaka O, Nakamura K, Sakai K, Nakahara H. Central mechanisms of motor skill learning. Curr Opin Neurobiol. 2002 Apr;12(2):217-22.

2. Lynch B, Beukema P, Verstynen T (2017) Differentiating Visual from Response Sequencing During Long-term Skill Learning. J Cogn Neurosci 29:125–136.

3. Diedrichsen, J. & Kriegeskorte, N. Representational models: A common framework for understanding encoding, pattern-component, and representational-similarity analysis. PLoS Comput. Biol. 13, e1005508 (2017).