

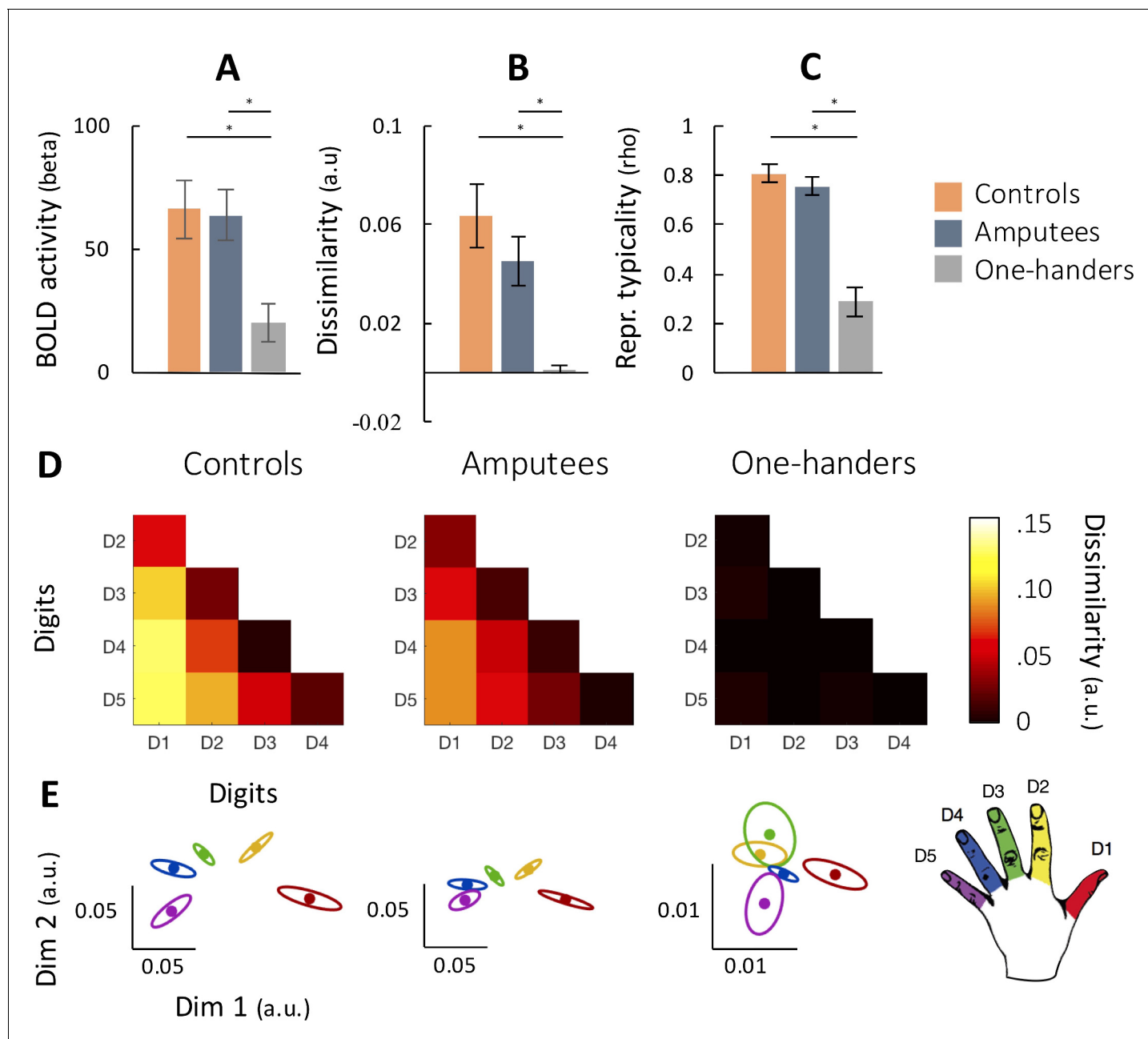


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## Figures and figure supplements

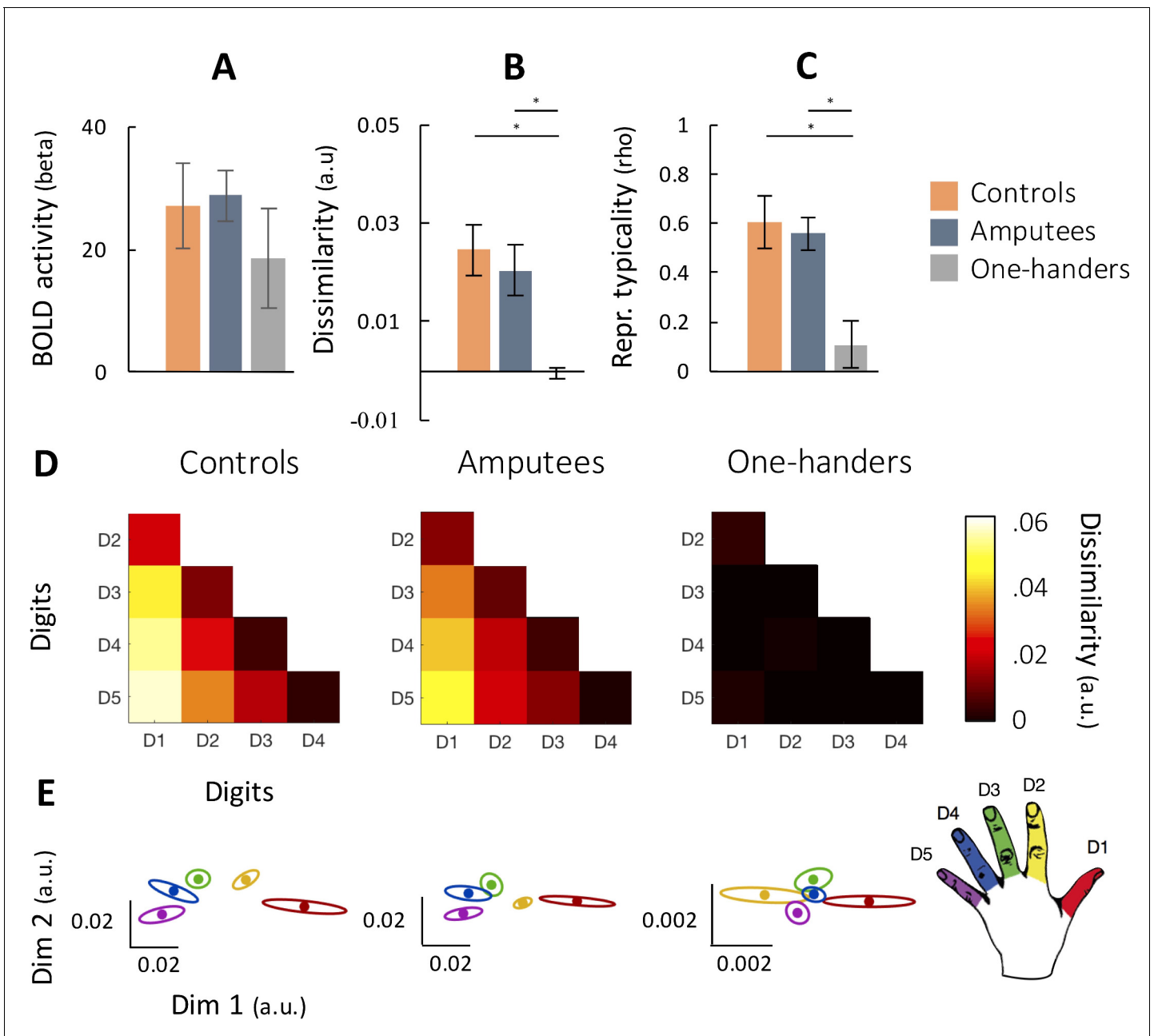
Obtaining and maintaining cortical hand representation as evidenced from acquired and congenital handlessness

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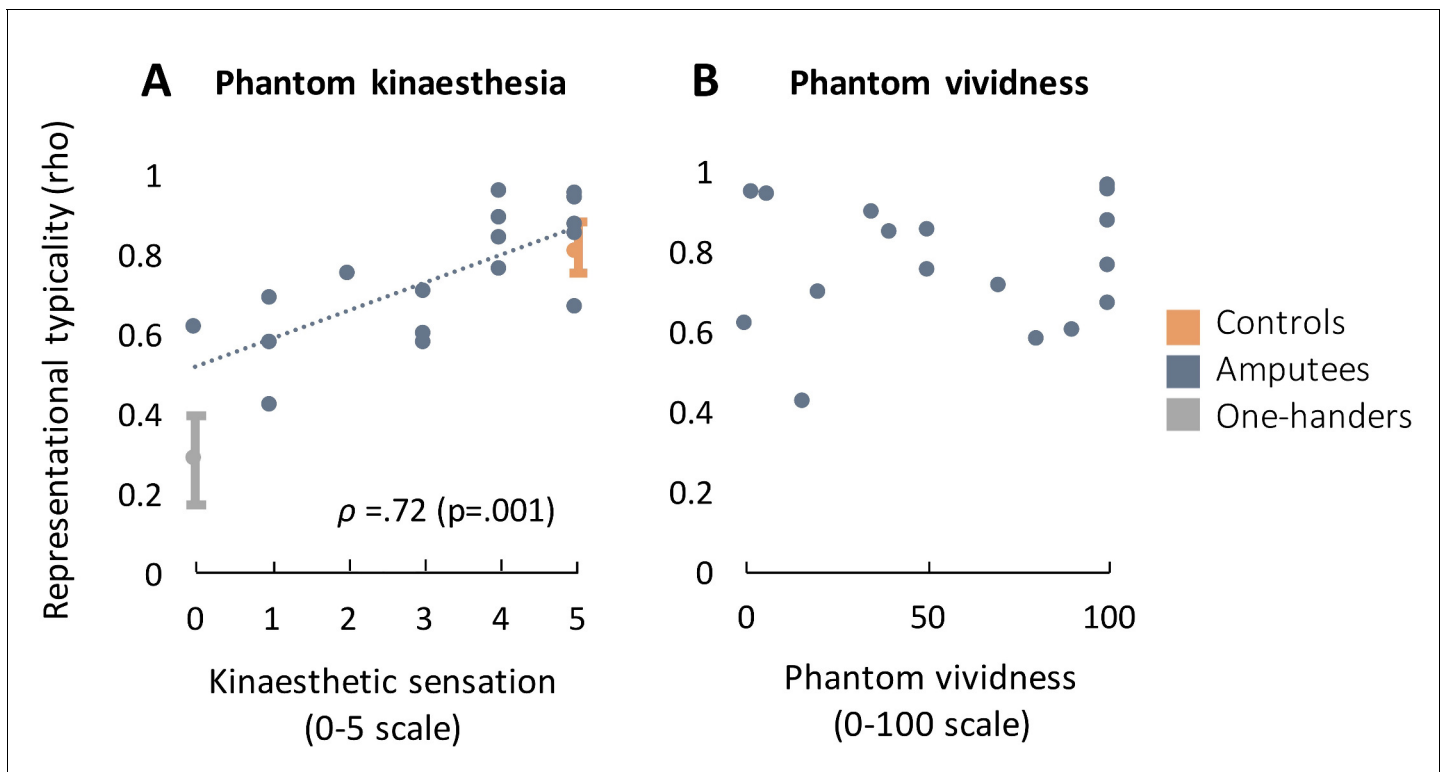
**Figure 1.** Similar representation in primary somatosensory cortex (SI) for amputees' missing hand and controls' nondominant hand, but not for congenital one-handers' missing hand. (A) Activity (averaged digit movement versus rest) in SI for amputees ( $n = 18$ ), two-handed controls ( $n = 12$ ), and congenital one-handers ( $n = 13$ ). (B–C) Mean dissimilarity and typicality of the representational structure of contralateral SI activity for the three groups. (D) Representational dissimilarity matrices for the three groups. D1–D5 correspond to the five digits (thumb–little finger). (E) Two-dimensional projection of the representational structure (D) (using multi-dimensional scaling; note that this is included for visualisation purposes only and was not used for statistical analysis). Dissimilarity is reflected by distance in the two dimensions; individual digits are reflected by different colours (see colour key, bottom right); and ellipses reflect the between-subject standard error after Procrustes alignment. Please note the different scale for one-handers compared to amputees and controls. Abbreviations: a.u.: arbitrary unit; \*: significant difference, after accounting for multiple comparisons.

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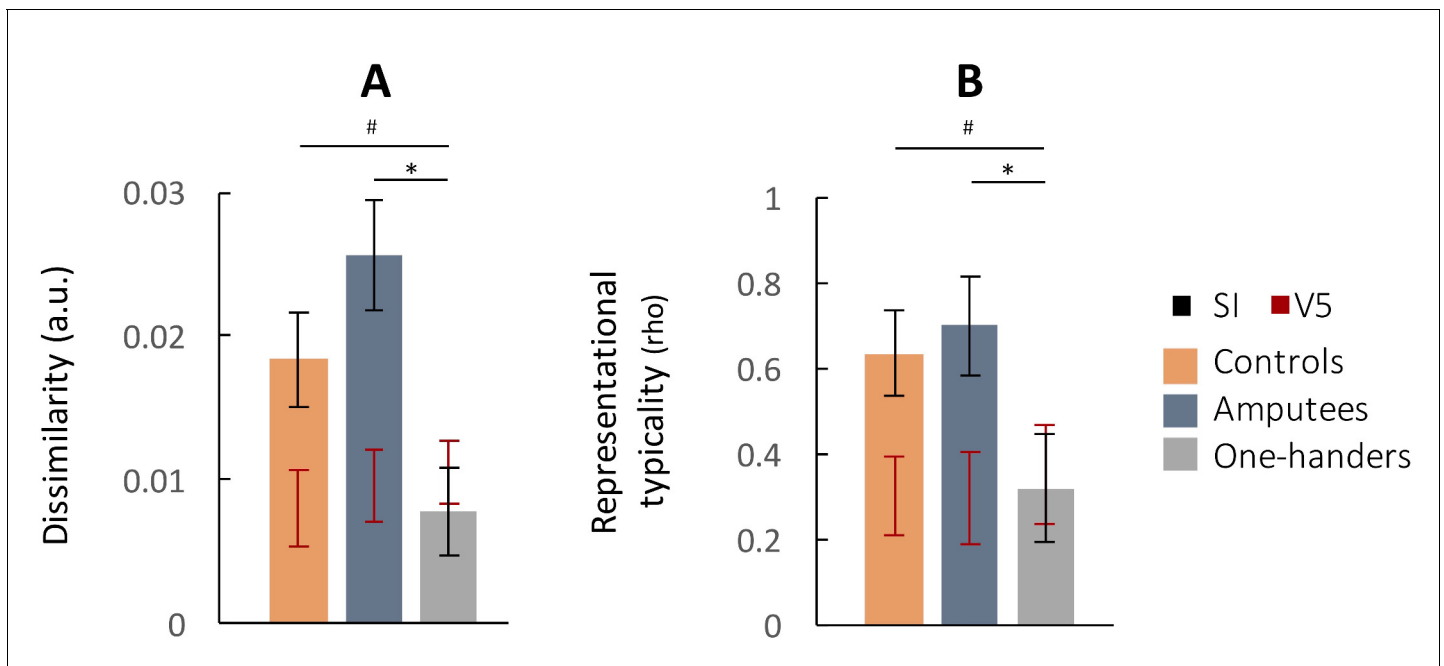
**Figure 1—figure supplement 1.** Similar representation in primary motor cortex (M1) for amputees' missing hand and controls' nondominant hand, but not for the congenital one-handers' missing hand. All annotations are detailed in main text **Figure 1**.

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**Figure 2.** Kinaesthetic sensations during individuated phantom hand movements in amputees correlate with typicality in the missing hand's primary somatosensory cortex (SI). Typicality is the correlation coefficient of the representational dissimilarity matrix (RDM) with an independent hand RDM in controls. Phantom kinaesthesia (A) shows the number of digits that produced a sensation of movement during volitional phantom digit movements, based on amputees' self-reports. Grey and orange ranges show the mean and confidence intervals for typicality in one-handers and controls, respectively. The regression line is only presented for visualisation. Nonpainful phantom vividness (B) conveys the chronicity of the experience of the existence of a missing hand, where 0 indicates no sensations and 100 sensations identical to the intact hand.

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**Figure 3.** Similar ipsilateral hand representation in primary somatosensory cortex (SI) for amputees' and controls' intact hand. (A–B) Mean dissimilarity and typicality of the representational structure of ipsilateral SI activity for the three groups. Both dissimilarity and typicality of ipsilateral hand representation indicate a difference between missing hand representation in congenital one-handers and amputees, independent of missing hand motor skill. The red error bars indicate the dissimilarity and typicality values (standard error of the mean) in a visual control area V5 for the same groups, designed to capture visuomotor representation that is not strictly somatosensory. While amputees and controls showed significantly greater digit representation in SI than V5 (both in terms of dissimilarity and typicality), congenital one-handers did not, further indicating reduced SI digit representation. Abbreviations: a.u.: arbitrary unit; \*: significant difference; #: trending difference ( $.02 < p < 0.05$ ).

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