Integration and de-integration of bimanual movements

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Purpose

Research has suggested that bimanual movements are not the sum of two unimanual movements, but they reflect the integration of two unimanual movements into a bimanual movement.

Bimanual asymmetric movements in choice RT tasks take longer to prepare than symmetric movements, and this cost is likely caused by unifying both arms into a single bimanual movement.

The purpose of this study was to investigate the process of "integrating" unimanual movements into a bimanual movement and "de-integrating" bimanual movements into unimanual movements during movement preparation.

Methods

Participants performed unimanual and bimanual symmetric and asymmetric movements. The movements were forward reaches to long distance targets (20 cm) or backward reaches to short targets (10 cm). A small stimulus display indicated to participants the target conditions (Fig 1).

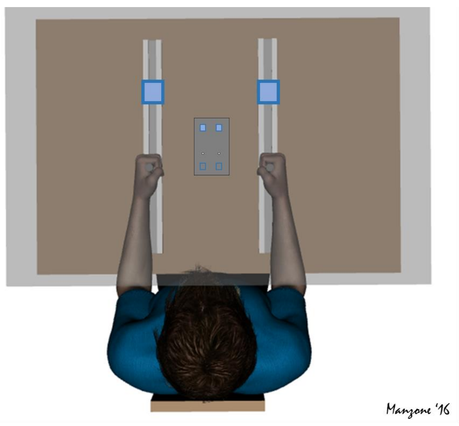


Fig 1: Overhead view showing movement apparatus, visual display and physical target locations.

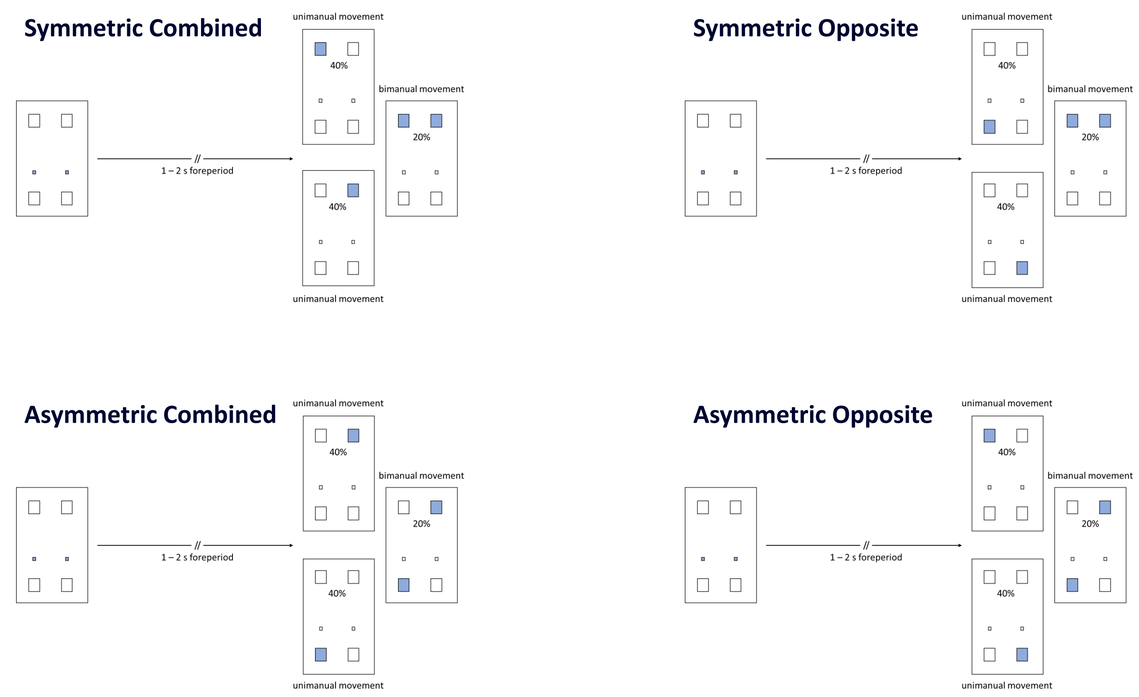
In Part 1 (n = 24) participants were asked to prepare two unimanual movements as one was required on 80% of trials. On 20% of trials, they were required to perform a bimanual movement.

In Part 2 (n = 24) participants were asked to prepare a bimanual movement as this was required on 80% of trials. On 20% of trials, they were required to perform a unimanual movement.

Discussion

There were preparation costs to integrate and de-integrate bimanual asymmetric movements and opposite movements. The results suggest that bimanual movements are the integration of two unimanual movements and that asymmetric movements and opposite movements take longer to integrate (and de-integrate) than symmetric and combined ones.

Part 1: Integration



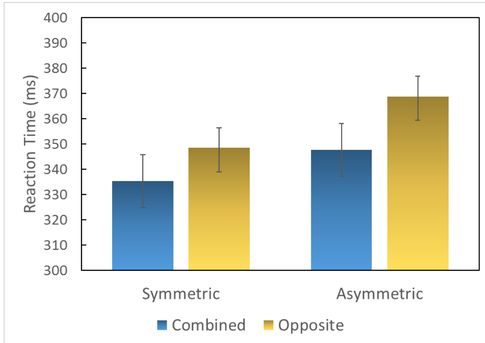
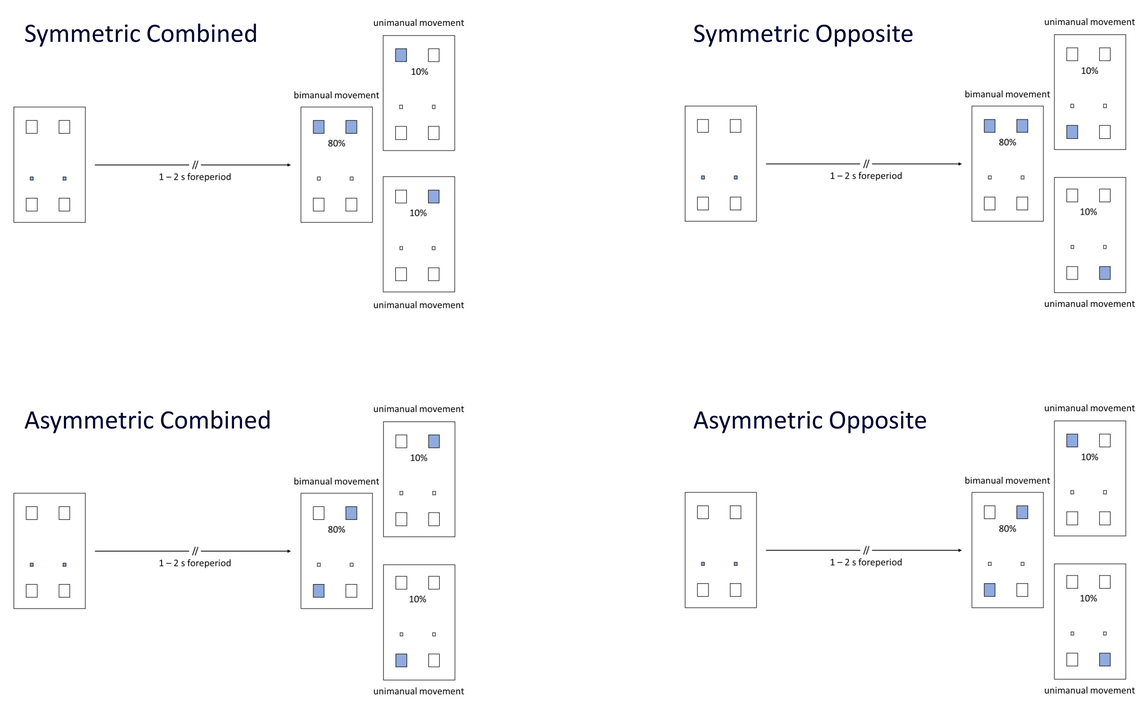


Fig 2: RTs of bimanual movements. The results supported our predictions that bimanual asymmetric movements would take longer to integrate than symmetric movements, $F(1,23) = 14$, $p = .001$, and that bimanual opposite movements would take longer to integrate than combined movements, $F(1,23) = 11$, $p = .003$.

Part 2: De-integration



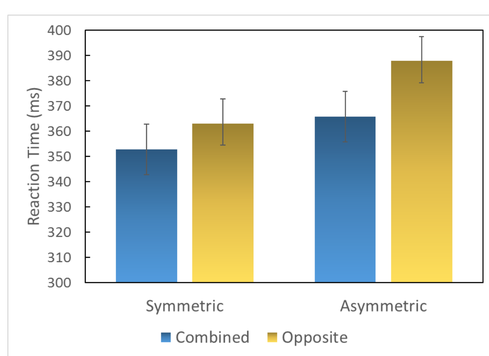


Fig 2: RTs of unimanual movements. The results supported our predictions that bimanual asymmetric movements would take longer to de-integrate than symmetric movements, $F(1,23) = 47$, $p < .001$, and that bimanual opposite movements would take longer to de-integrate than combined movements, $F(1,23) = 7.0$, $p = .014$.

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