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Bimanual Coupling in Left and Right Space: Which Hand Is Yoked to Which?

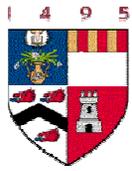
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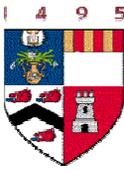
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Bimanual coupling in left and right space: Which hand is yoked to which?



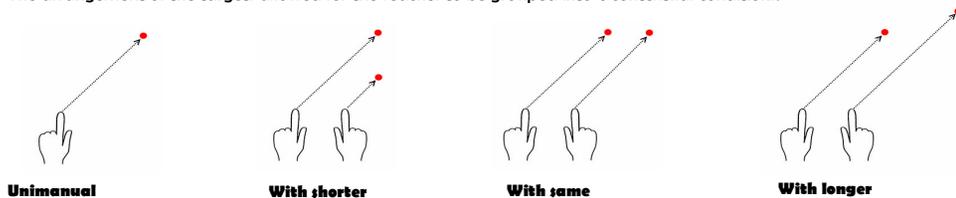
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Introduction

- Reaching across the body into contralateral space with one hand incurs a substantial cost on various measures of performance, compared to ipsilateral reaches of a similar amplitude (Carey, Hargreaves, & Goodale, 1996).
- When reaching with both hands, unimanual asymmetries disappear.
 - The hands take off and land concurrently (Kelso, Southard, & Goodman, 1979).
- To test if this 'yoking' is driven by the left or the right hand, participants performed reaches of different amplitudes.
- These reaches were made to the left or right side of space.
 - Further increasing the unimanual (baseline) asymmetries that get wiped out by the yoking.
- The hand which is **less** affected by the other's presence is likely to be driving the coupling.
- The strongest conclusions could be drawn from a **relative improvement of a contralateral reaching hand**, by the presence of an ipsilateral reaching counterpart.

Method

- Right handed participants (n=18) performed fast bimanual or unimanual reaches toward targets presented on a horizontal LED board.
- The arrangement of the targets allowed for the reaches to be grouped into 4 contextual conditions:



- To equate these conditions for the (unrelated) cost to performance of bimanual reaching, a constant was added to the unimanual values.
 - The mean unimanual score was subtracted from the mean with same score; the resulting value was added to the individual unimanual scores on all sides of space.
 - Unimanual reaction time was increased by 22 ms & unimanual movement duration was increased by 17 ms.
- This adjusted **unimanual** reaching context was compared to the **with shorter** reaching context.
- To increase the chances of demonstrating a performance improvement, only contralateral reaches were analysed.
- The hand that improves the most is more adaptable than its counterpart, therefore not 'in-charge' of the yoking.

References:

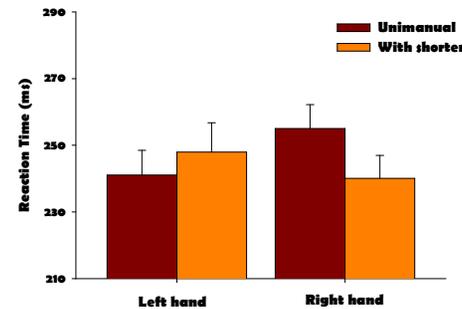
Carey, D. P., Hargreaves, E. L., & Goodale, M. A. (1996). Reaching to ipsilateral or contralateral targets: within-hemisphere visuomotor processing cannot explain hemispatial differences in motor control. *Experimental Brain Research*, 112, 496-504.
Kelso, J. A. S., Southard, D. L., & Goodman, D. (1979a). On the coordination of two-handed movements. *Journal of Experimental Psychology: Human Perception and Performance*, 5, 229-238.
Peters, M. (1981). Attentional asymmetries during concurrent bimanual performance. *Quarterly Journal of Experimental Psychology*, 33, 95-103.

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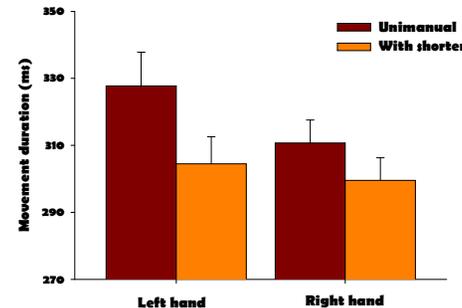
Results – reaching into contralateral space

Reaction time



- **15 ms; right hand contralateral improvement** when yoked with a shorter amplitude ipsilateral reach ($p < .025$).
- No significant contralateral improvement with the left hand.

Movement duration



- **23 ms; left hand contralateral improvement** when yoked with a shorter amplitude ipsilateral reach ($p < .025$).
- No significant contralateral improvement with the right hand.

Discussion

- Right hand appears to be yoked to the left hand for the reaction time measure.
 - Left hand in-charge for movement onset.
 - Possibly related to left hand reaction time advantages often seen in unimanual reaching studies.
- Left hand appears to be yoked to the right hand for movement duration measure (similar trend in peak velocity).
 - Right hand in-charge during movement output.
 - Strategic to cope with the increased attentional demands of bimanual reaching.
 - This directional yoking could be an expression of a rightward attentional bias during bimanual coordination (Peters, 1981).