

## Supplementary Information

### **Kinematic profiles suggest differential control processes involved in bilateral in-phase and anti-phase movements**

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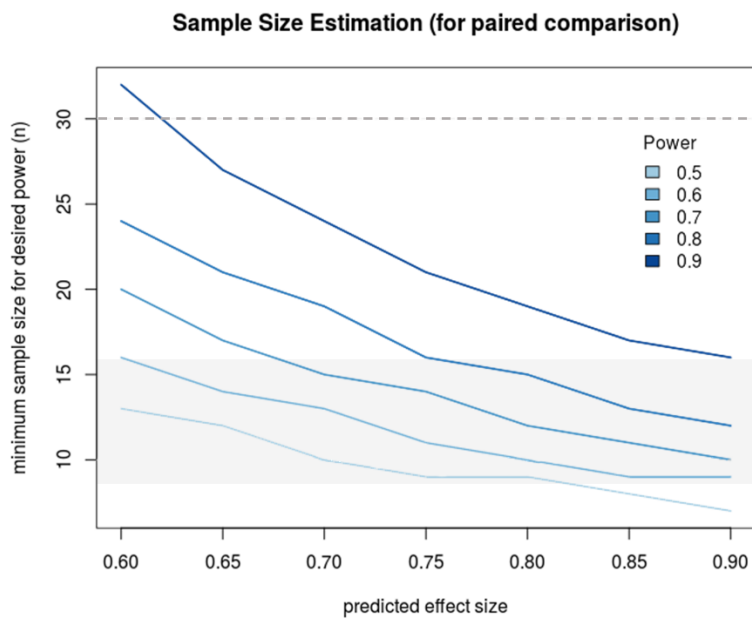
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## Supplementary material 1. Power estimation

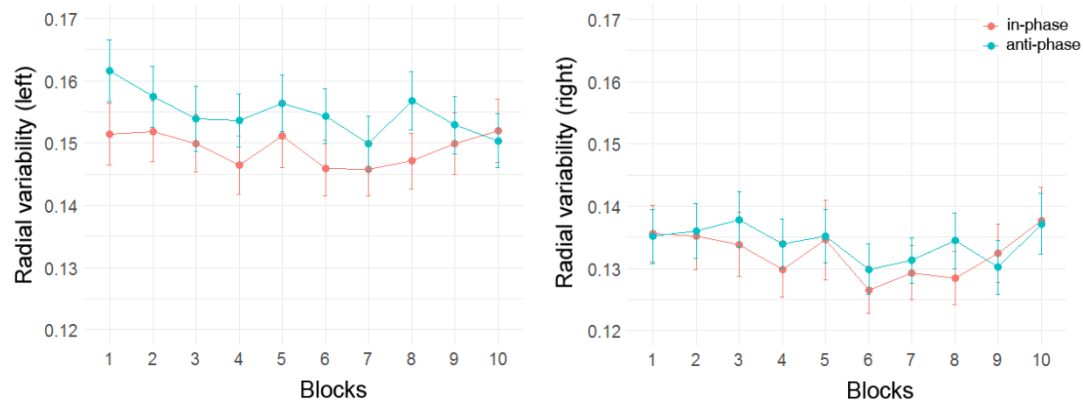
We conducted a power analysis to examine how effect size relates to the minimum sample size required for a given power and an alpha of 0.05. Most of the previous studies on bilateral coordination had a sample size between 8 to 16 participants and an effect size between 0.65 to 0.85 in the main result. However, this would provide a meager statistical power regardless if effect size is high (>0.8) or moderate (0.5 - 0.8). On the other hand, a sample size at 30 results in a high power. Therefore, our sample size allowed us to detect differences between movement conditions within a subject that may have been previously missed.



## Supplementary material 2. Participants' performance across blocks of task execution.

### Radial variability

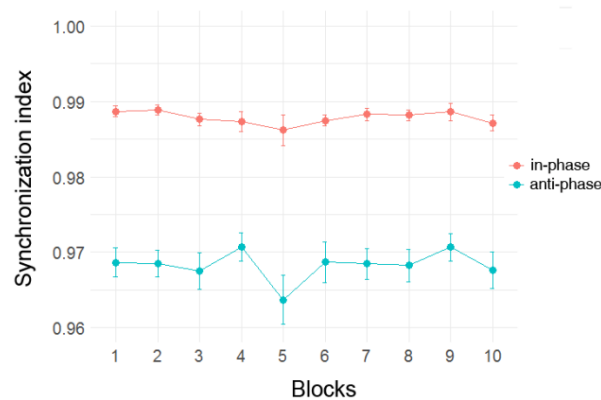
A one-way repeated-measure ANOVA was used to determine the effect of BLOCK on each condition/hand. As shown in the figure below, no learning effects were found in both anti-phase and in-phase conditions, and in left and right hand performance.



Condition	Statistical result
Anti-phase (left hand)	$F_{(9,261)} = 1.001$ , $p = 0.439$ , $\eta^2 = 0.033$
Anti-phase (right hand)	$F_{(9,261)} = 1.604$ , $p = 0.114$ , $\eta^2 = 0.052$
In-phase (left hand)	$F_{(9,261)} = 1.540$ , $p = 0.161$ , $\eta^2 = 0.050$
In-phase (right hand)	$F_{(9,261)} = 1.868$ , $p = 0.090$ , $\eta^2 = 0.061$

### Synchronization index

We performed one-way repeated-measure ANOVA was used to determine the effect of BLOCK on anti-phase and in-phase movements respectively. No learning effects were found across the blocks in both anti-phase and in-phase conditions as shown in the figure below.



Condition	Statistical result
Anti-phase	$F_{(9,261)} = 1.604$ , $p = 0.114$ , $\eta^2 = 0.052$
In-phase	$F_{(9,261)} = 1.047$ , $p = 0.403$ , $\eta^2 = 0.035$

### Supplementary material 3. Comparison of clockwise and counterclockwise movement directions.

#### Radial variability

Unilateral condition	Clockwise	Counterclockwise	Paired-t test
Left hand	0.166±0.033	0.144±0.024	t=6.1201, p<0.001
Right hand	0.134±0.026	0.138±0.032	t=-2.4314, p=0.0263

Anti-phase condition	Bilateral clockwise	Bilateral counterclockwise	Paired-t test
Left hand	0.161±0.032	0.155±0.021	t=2.4938, p=0.0186
Right hand	0.137±0.025	0.137±0.031	t= 0.1767, p=0.8617

In-phase condition	left clockwise / right counterclockwise	left counterclockwise / right clockwise	Paired-t test
Left hand	0.158±0.033	0.142±0.022	t=5.3041, p<0.001
Right hand	0.136±0.032	0.134±0.028	t=1.0794, p=0.2893

#### Synchronization index

Anti-phase condition	Bilateral clockwise	Bilateral counterclockwise	Paired-t test
Synchronization index	0.965±0.001	0.963±0.001	t= -1.6214, p=0.1158

In-phase condition	left clockwise / right counterclockwise	left counterclockwise / right clockwise	Paired-t test
Synchronization index	0.984±0.001	0.985±0.001	t= -1.1266, p=0.2692

**Supplementary material 4. Centroid offset during the in-phase and anti-phase conditions**

Centroid offset	Left hand	Right hand
Anti-phase	0.789±0.1270	0.6760±0.1228
In-phase	0.7273±0.1305	0.6591±0.1190

2x2 repeated-measured ANOVA

	F-value	P-value
CONDITION*SIDE	4.4865	<0.0360
CONDITION	13.904	0.0003
SIDE	74.225	<0.001

**Supplementary material 5. Supplementary Material 4. Comparison of phase synchronization index and standard deviation of the relative phase difference**

Phase synchronization

Cond	Mean ± SD	t	P
In-phase	0.98±.001	8.276	<0.001
Anti-phase	0.96±.001		

SD of the relative phase difference

Cond	Mean ± SD	t	P
In-phase	9.69±6.03	5.205	<0.001
Anti-phase	14.33±2.93		