

# Supplementary Materials for manuscript titled “Perturbed Gait Reveals Hierarchical Muscle Control: Reorganisation of Co-contraction Shares of Distal Muscles Amid Stable Global Synergies”

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## Co-contraction Share Statistical Analysis

Supplementary Tables A1-A3 present the complete statistical analysis results for all extracted co-contraction parameters across gait phases and perturbation conditions. The reported parameters include Co-contraction Share Sum (Table A1), Co-contraction Share Peak Value (Table A2), and Co-contraction Peak Location (Table A3) for distal and proximal lower-limb muscles during the Pre-Perturbation Stride (PPS), Perturbation Stride (PS), and Subsequent Stride (SS). Statistical comparisons are performed between Control trials and perturbation conditions, including Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC). Significant *post-hoc* differences ( $p < 0.05$ ) are reported for Tibialis Anterior (TA), Soleus (SOL), Gastrocnemius Lateralis (GAS), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris Long Head (HAM), Tensor Fasciae Latae (TFL), and Gluteus Maximus (GLU).

Supplementary Figures A1-A14 present heatmaps for the effect size, illustrating perturbation-induced changes across the left and right limbs and distal and proximal muscle groups for co-contraction shares (co-contraction share sum, co-contraction share peak location, and co-contraction share peak value), as well as for PCA parameters (peak location and peak value).

## Statistical Analysis for Principal Component Analysis

Statistical Analysis for extracted parameters (peak location and peak value) for Principal Components (PC1, PC2, and PC3) are presented in Supplementary Tables A4-A5 across gait phases and perturbation conditions. The reported parameters include PC Peak Value (Table A4) and Peak Location (Table A5) for distal and proximal lower-limb muscles during the PPS, PS, and SS. The tables report statistically significant *post-hoc* comparisons ( $p < 0.05$ ) between Control trials and perturbation conditions, including MI, MC, TI, and TC.

Table A1. Results of the statistical test for Co-contraction Sum, significant difference *post-hoc* test ( $p$ -value  $< 0.05$ ). PPS - Pre-perturbation Stride, PS - Perturbation stride, SS - Subsequent Stride. Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC). Tibialis Anterior (TA), Soleus (SOL), Gastrocnemius Lateralis (GAS), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris Long Head (HAM), Tensor Fasciae Latae (TFL), and Gluteus Maximus (GLU). Bold values indicate results that remained statistically significant after False Discovery Rate (FDR) correction.

Side	Limb	Muscle	Stride	Phase	Perturbation	$p$ -value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PPS	First double support	MC	$<0.05$	Cohen's $d$	0.80	large
left	lower	VL	PPS	First double support	TI	$<0.05$	Cohen's $d$	0.92	large
<b>left</b>	<b>lower</b>	<b>VL</b>	<b>PPS</b>	<b>First single support</b>	<b>MC</b>	<b><math>&lt;0.001</math></b>	<b>Cohen's <math>d</math></b>	<b>1.61</b>	<b>large</b>

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PPS	First single support	MI	<0.01	<i>r</i>	0.82	large
<b>left</b>	<b>lower</b>	<b>VL</b>	<b>PPS</b>	<b>First single support</b>	<b>TI</b>	<b>&lt;0.01</b>	<b>Cohen's <i>d</i></b>	<b>1.55</b>	<b>large</b>
left	lower	VL	PPS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.72	medium
right	lower	VL	PPS	First double support	MC	<0.01	Cohen's <i>d</i>	1.30	large
right	lower	VL	PPS	First double support	TI	<0.01	Cohen's <i>d</i>	1.09	large
right	lower	VL	PPS	First single support	MC	<0.05	Cohen's <i>d</i>	0.81	large
right	lower	VL	PPS	First single support	TI	<0.01	Cohen's <i>d</i>	1.16	large
right	lower	VL	PPS	Second single support	MC	<0.05	<i>r</i>	0.73	large
left	lower	TA	PPS	First double support	MC	<0.01	<i>r</i>	0.85	large
left	lower	TA	PPS	Second double support	MC	<0.05	Cohen's <i>d</i>	-1.03	large
left	lower	TA	PPS	Second double support	TI	<0.05	<i>r</i>	0.69	large
left	lower	TA	PPS	Second single support	TI	<0.01	<i>r</i>	0.85	large
<b>right</b>	<b>lower</b>	<b>TA</b>	<b>PPS</b>	<b>Second double support</b>	<b>MC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>1.53</b>	<b>large</b>
right	lower	TA	PPS	Second double support	TC	<0.05	Cohen's <i>d</i>	1.00	large
left	lower	SOL	PPS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.88	large
right	lower	SOL	PPS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.90	large
right	lower	SOL	PPS	First single support	TI	<0.05	<i>r</i>	0.66	large
right	lower	SOL	PPS	Second double support	MC	<0.05	Cohen's <i>d</i>	-0.92	large
right	lower	SOL	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.82	large
left	upper	RF	PPS	First double support	MC	<0.01	<i>r</i>	0.79	large
left	upper	RF	PPS	First double support	TI	<0.05	Cohen's <i>d</i>	0.94	large
left	upper	RF	PPS	First single support	MC	<0.05	Cohen's <i>d</i>	0.74	medium
left	upper	RF	PPS	First single support	MI	<0.05	Cohen's <i>d</i>	0.82	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	upper	RF	PPS	First single support	TI	<0.001	Cohen's <i>d</i>	1.87	large
left	upper	RF	PPS	Second single support	MI	<0.05	Cohen's <i>d</i>	0.86	large
left	upper	RF	PPS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.93	large
left	upper	HAM	PPS	First double support	MC	<0.01	<i>r</i>	0.85	large
left	upper	HAM	PPS	First double support	TI	<0.05	<i>r</i>	0.62	large
left	upper	HAM	PPS	First single support	MC	<0.05	<i>r</i>	0.66	large
left	upper	HAM	PPS	First single support	TI	<0.05	Cohen's <i>d</i>	0.84	large
left	upper	HAM	PPS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.86	large
left	upper	HAM	PPS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.74	medium
right	upper	HAM	PPS	First double support	MC	<0.05	Cohen's <i>d</i>	0.84	large
right	upper	GLU	PPS	First single support	TC	<0.05	Cohen's <i>d</i>	0.79	medium
right	upper	GLU	PPS	First single support	TI	<0.05	Cohen's <i>d</i>	0.96	large
right	upper	GLU	PPS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.84	large
left	lower	GAS	PPS	First double support	TC	<0.05	Cohen's <i>d</i>	0.81	large
left	lower	GAS	PPS	First double support	TI	<0.05	Cohen's <i>d</i>	0.72	medium
left	lower	GAS	PPS	First single support	MI	<0.05	Cohen's <i>d</i>	0.72	medium
left	lower	GAS	PPS	First single support	TI	<0.01	Cohen's <i>d</i>	1.16	large
left	lower	GAS	PPS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.80	medium
left	lower	GAS	PPS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.74	medium
right	lower	GAS	PPS	First single support	MI	<0.05	<i>r</i>	0.63	large
right	lower	GAS	PPS	Second double support	TI	<0.01	<i>r</i>	0.79	large
left	lower	VL	PS	First single support	TI	<0.01	Cohen's <i>d</i>	1.03	large
left	lower	VL	PS	Second double support	MC	<0.05	Cohen's <i>d</i>	-0.95	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PS	Second double support	MI	<0.01	Cohen's <i>d</i>	1.39	large
<b>left</b>	<b>lower</b>	<b>VL</b>	<b>PS</b>	<b>Second single support</b>	<b>MC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>-1.62</b>	<b>large</b>
left	lower	VL	PS	Second single support	TI	<0.01	Cohen's <i>d</i>	-1.23	large
<b>left</b>	<b>upper</b>	<b>TFL</b>	<b>PS</b>	<b>Second double support</b>	<b>TC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>-2.65</b>	<b>large</b>
right	upper	TFL	PS	Second double support	MI	<0.05	<i>r</i>	0.73	large
right	upper	TFL	PS	Second single support	TC	<0.01	<i>r</i>	0.89	large
left	lower	TA	PS	First double support	MC	<0.01	Cohen's <i>d</i>	1.24	large
left	lower	TA	PS	Second double support	TI	<0.01	Cohen's <i>d</i>	-1.18	large
left	lower	TA	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	-1.00	large
right	lower	TA	PS	Second double support	TC	<0.01	Cohen's <i>d</i>	1.52	large
left	lower	SOL	PS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.72	medium
<b>left</b>	<b>lower</b>	<b>SOL</b>	<b>PS</b>	<b>Second double support</b>	<b>MC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>1.68</b>	<b>large</b>
left	lower	SOL	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.78	medium
<b>left</b>	<b>lower</b>	<b>SOL</b>	<b>PS</b>	<b>Second double support</b>	<b>TC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>1.54</b>	<b>large</b>
left	lower	SOL	PS	Second single support	MC	<0.01	Cohen's <i>d</i>	1.26	large
left	lower	SOL	PS	Second single support	TC	<0.01	Cohen's <i>d</i>	1.10	large
left	lower	SOL	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.95	large
right	lower	SOL	PS	First double support	MC	<0.05	Cohen's <i>d</i>	0.93	large
right	lower	SOL	PS	First double support	MI	<0.01	Cohen's <i>d</i>	-1.11	large
left	upper	RF	PS	First double support	MC	<0.05	<i>r</i>	0.66	large
left	upper	RF	PS	First double support	TI	<0.05	<i>r</i>	0.66	large
left	upper	RF	PS	First single support	MI	<0.05	<i>r</i>	0.63	large
left	upper	RF	PS	First single support	TC	<0.05	<i>r</i>	0.73	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	upper	RF	PS	First single support	TI	<0.05	Cohen's <i>d</i>	0.97	large
left	upper	RF	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.77	medium
left	upper	RF	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.91	large
right	upper	RF	PS	Second double support	MI	<0.01	<i>r</i>	0.79	large
left	upper	HAM	PS	First double support	MC	<0.01	<i>r</i>	0.82	large
left	upper	HAM	PS	First single support	MC	<0.01	Cohen's <i>d</i>	1.38	large
left	upper	HAM	PS	First single support	TI	<0.01	<i>r</i>	0.82	large
left	upper	HAM	PS	Second double support	TC	<0.01	Cohen's <i>d</i>	1.13	large
left	upper	HAM	PS	Second single support	TC	<0.01	Cohen's <i>d</i>	1.03	large
<b>right</b>	<b>upper</b>	<b>HAM</b>	<b>PS</b>	<b>Second single support</b>	<b>TC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>1.52</b>	<b>large</b>
right	upper	HAM	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	-0.91	large
right	upper	GLU	PS	First double support	MC	<0.05	Cohen's <i>d</i>	0.82	large
right	upper	GLU	PS	First single support	MC	<0.01	Cohen's <i>d</i>	1.36	large
right	upper	GLU	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.73	medium
left	lower	GAS	PS	First double support	MC	<0.05	<i>r</i>	0.89	large
left	lower	GAS	PS	First double support	TC	<0.01	Cohen's <i>d</i>	1.19	large
left	lower	GAS	PS	First double support	TI	<0.05	Cohen's <i>d</i>	0.87	large
left	lower	GAS	PS	First single support	TC	<0.01	Cohen's <i>d</i>	1.17	large
left	lower	GAS	PS	First single support	TI	<0.05	Cohen's <i>d</i>	0.78	medium
<b>left</b>	<b>lower</b>	<b>GAS</b>	<b>PS</b>	<b>Second double support</b>	<b>MC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>1.54</b>	<b>large</b>
<b>left</b>	<b>lower</b>	<b>GAS</b>	<b>PS</b>	<b>Second double support</b>	<b>MI</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>-1.56</b>	<b>large</b>
right	lower	GAS	PS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.74	medium
right	lower	GAS	PS	First single support	MC	<0.01	Cohen's <i>d</i>	1.11	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
right	lower	GAS	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	-0.72	medium
left	sum	VL	SS	First double support	MC	<0.05	Cohen's <i>d</i>	0.75	medium
left	lower	VL	SS	First double support	TI	<0.05	Cohen's <i>d</i>	0.99	large
left	lower	VL	SS	First single support	MC	<0.05	Cohen's <i>d</i>	0.75	medium
left	lower	VL	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.96	large
left	lower	VL	SS	Second double support	TC	<0.01	Cohen's <i>d</i>	1.32	large
right	lower	VL	SS	First double support	MC	<0.05	Cohen's <i>d</i>	0.86	large
right	lower	VL	SS	First double support	TC	<0.05	Cohen's <i>d</i>	0.90	large
left	lower	TFL	SS	First double support	MC	<0.05	<i>r</i>	0.69	large
left	upper	TFL	SS	First double support	TC	<0.05	<i>r</i>	0.73	large
left	upper	TFL	SS	First double support	TI	<0.01	<i>r</i>	0.79	large
left	lower	TA	SS	First double support	MC	<0.01	Cohen's <i>d</i>	1.46	large
<b>left</b>	<b>lower</b>	<b>TA</b>	<b>SS</b>	<b>First double support</b>	<b>MI</b>	<b>&lt;0.001</b>	Cohen's <i>d</i>	<b>-2.27</b>	<b>large</b>
right	lower	TA	SS	First double support	MI	<0.01	Cohen's <i>d</i>	1.37	large
right	lower	TA	SS	First double support	TC	<0.05	Cohen's <i>d</i>	0.79	medium
left	lower	SOL	SS	First double support	MI	<0.05	Cohen's <i>d</i>	0.76	medium
left	lower	SOL	SS	First double support	TI	<0.05	Cohen's <i>d</i>	0.75	medium
left	lower	SOL	SS	Second double support	MI	<0.01	Cohen's <i>d</i>	-1.47	large
<b>right</b>	<b>lower</b>	<b>SOL</b>	<b>SS</b>	<b>First double support</b>	<b>MI</b>	<b>&lt;0.001</b>	Cohen's <i>d</i>	<b>-1.62</b>	<b>large</b>
right	lower	SOL	SS	First double support	TC	<0.01	Cohen's <i>d</i>	-1.03	large
left	upper	RF	SS	First double support	MC	<0.01	<i>r</i>	0.89	large
left	upper	RF	SS	First double support	TI	<0.05	<i>r</i>	0.69	large
left	upper	RF	SS	First single support	MI	<0.01	<i>r</i>	0.79	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	upper	RF	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.96	large
left	upper	RF	SS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.87	large
left	upper	RF	SS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.82	large
right	upper	RF	SS	First double support	TC	<0.05	Cohen's <i>d</i>	0.80	medium
right	upper	RF	SS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.82	large
left	upper	HAM	SS	First double support	MC	<0.05	Cohen's <i>d</i>	0.95	large
left	upper	HAM	SS	First single support	MC	<0.05	Cohen's <i>d</i>	0.73	medium
left	upper	HAM	SS	First single support	MI	<0.05	Cohen's <i>d</i>	0.74	medium
left	upper	HAM	SS	First single support	TC	<0.01	Cohen's <i>d</i>	1.03	large
left	upper	HAM	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.77	medium
left	upper	HAM	SS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.88	large
left	upper	HAM	SS	Second single support	MI	<0.01	Cohen's <i>d</i>	1.12	large
left	upper	HAM	SS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.92	large
left	upper	GLU	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.72	medium
left	lower	GAS	SS	Second single support	MI	<0.01	Cohen's <i>d</i>	1.22	large
left	lower	GAS	SS	Second single support	TC	<0.01	Cohen's <i>d</i>	1.28	large
<b>right</b>	<b>lower</b>	<b>GAS</b>	<b>SS</b>	<b>First double support</b>	<b>MI</b>	<b>&lt;0.001</b>	Cohen's <i>d</i>	<b>-1.99</b>	<b>large</b>
right	lower	GAS	SS	First double support	TC	<0.01	Cohen's <i>d</i>	-1.06	large
right	lower	GAS	SS	Second double support	TI	<0.01	<i>r</i>	0.82	large

Table A2. Results of the statistical test for Co-contraction Peak Value, significant difference *post-hoc* test ( $p$ -value > 0.05). PPS - Pre-perturbation Stride, PS - Perturbation stride, SS - Subsequent Stride. Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC). Tibialis Anterior (TA), Soleus (SOL), Gastrocnemius Lateralis (GAS), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris Long Head (HAM), Tensor Fasciae Latae (TFL), and Gluteus Maximus (GLU). Bold values indicate results that remained statistically significant after False Discovery Rate (FDR) correction.

Side	Limb	Muscle	Stride	Phase	Perturbation	$p$ -value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PPS	First single support	MC	<0.01	Cohen's $d$	1.18	large
left	lower	VL	PPS	First single support	TC	<0.05	Cohen's $d$	-0.82	large
left	lower	VL	PPS	First single support	TI	<0.05	Cohen's $d$	0.95	large
left	lower	VL	PPS	Second single support	TC	<0.05	Cohen's $d$	0.77	medium
right	lower	VL	PPS	First single support	MI	<0.05	Cohen's $d$	1.02	large
right	lower	VL	PPS	Second single support	MC	<0.05	Cohen's $d$	-0.78	medium
left	lower	TA	PPS	First single support	MC	<0.05	Cohen's $d$	-0.89	large
left	lower	TA	PPS	First single support	TI	<0.05	Cohen's $d$	-0.94	large
left	lower	TA	PPS	Second double support	MC	<0.01	Cohen's $d$	-1.20	large
left	lower	TA	PPS	Second double support	TC	<0.05	Cohen's $d$	1.36	large
left	lower	TA	PPS	Second double support	TI	<0.05	Cohen's $d$	-0.94	large
right	lower	TA	PPS	Second double support	MC	<0.01	Cohen's $d$	1.04	large
left	lower	SOL	PPS	First double support	TC	<0.05	Cohen's $d$	0.72	medium
left	lower	SOL	PPS	Second double support	MI	<0.05	Cohen's $d$	-0.96	large
<b>left</b>	<b>lower</b>	<b>SOL</b>	<b>PPS</b>	<b>Second double support</b>	<b>TC</b>	<b>&lt;0.01</b>	Cohen's $d$	<b>-2.14</b>	<b>large</b>
<b>left</b>	<b>lower</b>	<b>SOL</b>	<b>PPS</b>	<b>Second single support</b>	<b>MC</b>	<b>&lt;0.01</b>	Cohen's $d$	<b>-2.00</b>	<b>large</b>
left	lower	SOL	PPS	Second single	TI	<0.05	Cohen's $d$	-0.83	large



Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
				support					
right	lower	SOL	PPS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.74	medium
right	lower	SOL	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.91	large
left	upper	RF	PPS	Second single support	MC	<0.01	Cohen's <i>d</i>	-1.32	large
left	upper	RF	PPS	Second single support	MI	<0.05	Cohen's <i>d</i>	0.95	large
left	upper	RF	PPS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.80	large
left	upper	HAM	PPS	First double support	MC	<0.05	Cohen's <i>d</i>	0.75	medium
left	upper	HAM	PPS	First double support	MI	<0.05	Cohen's <i>d</i>	0.72	medium
left	upper	HAM	PPS	Second double support	TC	<0.01	Cohen's <i>d</i>	1.14	large
left	upper	HAM	PPS	Second single support	MC	<0.05	<i>r</i>	0.76	large
right	upper	GLU	PPS	First single support	TC	<0.05	Cohen's <i>d</i>	0.96	large
right	upper	GLU	PPS	Second single support	MI	<0.05	<i>r</i>	0.73	large
right	upper	GLU	PPS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.82	large
left	lower	GAS	PPS	First double support	TI	<0.05	Cohen's <i>d</i>	0.99	large
left	lower	GAS	PPS	Second double support	MC	<0.01	Cohen's <i>d</i>	1.09	large
left	lower	GAS	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.75	medium
right	lower	GAS	PPS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.75	medium
left	lower	VL	PS	Second double support	MI	<0.01	Cohen's <i>d</i>	1.21	large
left	lower	VL	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.74	medium

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PS	Second single support	MC	<0.01	Cohen's <i>d</i>	-1.23	large
right	lower	VL	PS	First single support	MI	<0.01	Cohen's <i>d</i>	1.07	large
<b>left</b>	<b>upper</b>	<b>TFL</b>	<b>PS</b>	<b>Second double support</b>	<b>TC</b>	<b>&lt;0.001</b>	<b>Cohen's <i>d</i></b>	<b>-2.60</b>	<b>large</b>
left	upper	TFL	PS	Second single support	TC	<0.05	Cohen's <i>d</i>	-0.90	large
right	upper	TFL	PS	First single support	MC	<0.05	Cohen's <i>d</i>	-0.84	large
right	upper	TFL	PS	Second double support	MI	<0.05	<i>r</i>	0.63	large
right	upper	TFL	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.78	medium
right	upper	TFL	PS	Second single support	TC	<0.01	Cohen's <i>d</i>	-1.06	large
right	upper	TFL	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.93	large
left	lower	TA	PS	First single support	MC	<0.05	Cohen's <i>d</i>	-0.90	large
left	lower	TA	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.80	medium
left	lower	TA	PS	Second single support	TI	<0.01	Cohen's <i>d</i>	-1.42	large
right	lower	TA	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.85	large
left	lower	SOL	PS	Second double support	MC	<0.01	Cohen's <i>d</i>	1.11	large
left	lower	SOL	PS	Second double support	TC	<0.01	Cohen's <i>d</i>	1.04	large
left	lower	SOL	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.87	large
right	lower	SOL	PS	First single support	MI	<0.05	Cohen's <i>d</i>	0.92	large
left	upper	RF	PS	First single support	MI	<0.05	Cohen's <i>d</i>	0.72	medium

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	upper	RF	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	-1.03	large
right	upper	RF	PS	First single support	TC	<0.05	Cohen's <i>d</i>	-0.73	medium
right	upper	RF	PS	Second double support	MI	<0.01	<i>r</i>	0.82	large
left	upper	HAM	PS	First double support	MC	<0.05	Cohen's <i>d</i>	0.84	large
left	upper	HAM	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.74	medium
right	upper	HAM	PS	Second single support	TC	<0.01	Cohen's <i>d</i>	1.55	large
right	upper	GLU	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.76	medium
right	upper	GLU	PS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.84	large
left	lower	GAS	PS	Second double support	MC	<0.01	Cohen's <i>d</i>	1.27	large
left	lower	GAS	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.98	large
left	lower	GAS	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.95	large
left	lower	GAS	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	1.01	large
left	lower	GAS	PS	Second single support	MC	<0.05	Cohen's <i>d</i>	-0.80	large
right	lower	GAS	PS	First single support	MC	<0.01	Cohen's <i>d</i>	1.26	large
right	lower	GAS	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.72	medium
right	lower	GAS	PS	Second single support	TC	<0.05	Cohen's <i>d</i>	-0.93	large
left	lower	VL	SS	First double support	TI	<0.05	Cohen's <i>d</i>	0.77	medium
left	lower	VL	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.86	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	SS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.77	medium
left	lower	VL	SS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.72	medium
right	lower	VL	SS	First single support	TC	<0.01	<i>r</i>	0.89	large
left	upper	TFL	SS	First double support	TI	<0.05	Cohen's <i>d</i>	-0.76	medium
left	upper	TFL	SS	First single support	MI	<0.05	<i>r</i>	0.69	large
left	upper	TFL	SS	First single support	TC	<0.05	<i>r</i>	0.73	large
left	lower	TA	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.74	medium
left	lower	SOL	SS	First double support	MC	<0.01	Cohen's <i>d</i>	1.49	large
left	lower	SOL	SS	First double support	TI	<0.01	Cohen's <i>d</i>	1.45	large
left	lower	SOL	SS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.85	large
left	lower	SOL	SS	Second single support	MI	<0.01	Cohen's <i>d</i>	-1.19	large
left	upper	RF	SS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.77	medium
left	upper	RF	SS	Second double support	TI	<0.01	Cohen's <i>d</i>	1.05	large
left	upper	RF	SS	Second single support	MC	<0.01	Cohen's <i>d</i>	1.18	large
left	upper	RF	SS	Second single support	MI	<0.05	Cohen's <i>d</i>	-0.95	large
left	upper	RF	SS	Second single support	TI	<0.001	Cohen's <i>d</i>	1.57	large
left	upper	HAM	SS	First single support	MI	<0.05	Cohen's <i>d</i>	0.76	medium
left	upper	HAM	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.82	large
left	upper	HAM	SS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.90	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	upper	HAM	SS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.88	large
right	upper	GLU	SS	First single support	MI	<0.05	Cohen's <i>d</i>	0.73	medium
left	lower	GAS	SS	First double support	MC	<0.05	Cohen's <i>d</i>	-0.91	large
left	lower	GAS	SS	First double support	TI	<0.05	Cohen's <i>d</i>	-0.75	medium
left	lower	GAS	SS	First single support	MI	<0.05	Cohen's <i>d</i>	0.84	large
left	lower	GAS	SS	First single support	TC	<0.05	Cohen's <i>d</i>	1.01	large
left	lower	GAS	SS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.72	medium
right	lower	GAS	SS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.80	large
right	lower	GAS	SS	First double support	TC	<0.05	Cohen's <i>d</i>	-0.93	large

Table A3. Results of the statistical test for Co-contraction Peak Location, significant difference *post-hoc* test ( $p$ -value > 0.05). PPS - Pre-perturbation Stride, PS - Perturbation stride, SS - Subsequent Stride. Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC). Tibialis Anterior (TA), Soleus (SOL), Gastrocnemius Lateralis (GAS), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris Long Head (HAM), Tensor Fasciae Latae (TFL), and Gluteus Maximus (GLU)

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	VL	PPS	First single support	MC	<0.05	Cohen's <i>d</i>	0.81	large
left	lower	VL	PPS	First single support	TI	<0.05	<i>r</i>	0.76	large
left	lower	VL	PPS	Second single support	MC	<0.01	<i>r</i>	0.89	large
left	lower	VL	PPS	Second single support	MI	<0.01	<i>r</i>	0.89	large
right	lower	VL	PPS	First single support	MC	<0.01	<i>r</i>	0.89	large
right	lower	VL	PPS	First single support	TI	<0.05	<i>r</i>	0.76	large
left	upper	TFL	PPS	Second	MI	<0.05	<i>r</i>	0.73	large

Side	Limb	Muscle	Stride	Phase	Perturbation	<i>p</i> -value	Effect Size	Effect Size Value	Interpretation
				double support					
left	upper	TFL	PPS	Second single support	TI	<0.05	Cohen's <i>d</i>	-0.99	large
right	upper	TFL	PPS	First double support	MC	<0.05	<i>r</i>	0.66	large
right	upper	TFL	PPS	Second double support	TI	<0.05	<i>r</i>	0.69	large
right	upper	TFL	PPS	Second single support	MI	<0.05	<i>r</i>	0.66	large
right	upper	TFL	PPS	Second single support	TC	<0.01	<i>r</i>	0.79	large
left	lower	TA	PPS	First double support	MC	<0.05	Cohen's <i>d</i>	0.76	medium
left	lower	TA	PPS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.78	medium
left	lower	TA	PPS	Second double support	TI	<0.01	Cohen's <i>d</i>	1.13	large
left	lower	TA	PPS	Second single support	MC	<0.05	Cohen's <i>d</i>	0.99	large
left	lower	TA	PPS	Second single support	TI	<0.05	<i>r</i>	0.63	large
right	lower	TA	PPS	Second double support	MC	<0.01	<i>r</i>	0.89	large
right	lower	TA	PPS	Second double support	TC	<0.01	<i>r</i>	0.89	large
right	lower	TA	PPS	Second double support	TI	<0.05	<i>r</i>	0.89	large
right	lower	TA	PPS	Second single support	MI	<0.01	Cohen's <i>d</i>	-1.07	large
left	lower	SOL	PPS	Second double support	MI	<0.05	<i>r</i>	0.89	large
left	lower	SOL	PPS	Second double support	TC	<0.01	<i>r</i>	0.89	large
right	lower	SOL	PPS	First	MC	<0.05	Cohen's <i>d</i>	0.95	large

Side	Limb	Muscle	Stride	Phase	Perturbation	<i>p</i> -value	Effect Size	Effect Size Value	Interpretation
				double support					
right	lower	SOL	PPS	First double support	TI	<0.05	<i>r</i>	0.76	large
right	lower	SOL	PPS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.75	medium
right	lower	SOL	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.72	medium
left	upper	RF	PPS	First double support	TC	<0.05	<i>r</i>	0.76	large
left	upper	RF	PPS	First single support	MI	<0.01	<i>r</i>	0.85	large
left	upper	RF	PPS	First single support	TI	<0.05	<i>r</i>	0.63	large
left	upper	RF	PPS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.89	large
left	upper	RF	PPS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.76	medium
right	upper	RF	PPS	Second double support	MC	<0.01	<i>r</i>	0.89	large
right	upper	RF	PPS	Second double support	TI	<0.01	<i>r</i>	0.89	large
left	upper	HAM	PPS	Second double support	MI	<0.05	<i>r</i>	0.69	large
left	upper	HAM	PPS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.97	large
right	upper	HAM	PPS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.79	medium
right	upper	HAM	PPS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.83	large
left	upper	GLU	PPS	Second double support	TC	<0.01	<i>r</i>	0.89	large
right	upper	GLU	PPS	First double support	MI	<0.05	<i>r</i>	0.66	large
right	upper	GLU	PPS	First	MC	<0.05	Cohen's <i>d</i>	0.92	large

Side	Limb	Muscle	Stride	Phase	Perturbation	<i>p</i> -value	Effect Size	Effect Size Value	Interpretation
right	upper	GLU	PPS	single support Second double support	MC	<0.05	Cohen's <i>d</i>	0.72	medium
left	lower	GAS	PPS	First single support	MI	<0.05	<i>r</i>	0.66	large
left	lower	GAS	PPS	Second double support	MI	<0.01	<i>r</i>	0.85	large
right	lower	GAS	PPS	First double support	MC	<0.01	Cohen's <i>d</i>	1.62	large
right	lower	GAS	PPS	First double support	TI	<0.05	<i>r</i>	0.73	large
right	lower	GAS	PPS	Second double support	MC	<0.05	<i>r</i>	0.66	large
right	lower	GAS	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.86	large
left	lower	VL	PS	Second double support	MC	<0.001	Cohen's <i>d</i>	-1.56	large
left	lower	VL	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.81	large
left	lower	VL	PS	Second single support	MI	<0.05	<i>r</i>	0.63	large
right	lower	VL	PS	First single support	MC	<0.01	<i>r</i>	0.89	large
right	lower	VL	PS	First single support	TI	<0.05	<i>r</i>	0.76	large
right	lower	VL	PS	Second double support	MC	<0.01	Cohen's <i>d</i>	1.11	large
right	lower	VL	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.87	large
left	upper	TFL	PS	First single support	TI	<0.05	<i>r</i>	0.66	large
left	upper	TFL	PS	Second double support	TI	<0.05	<i>r</i>	0.66	large
left	upper	TFL	PS	Second	MC	<0.05	Cohen's <i>d</i>	-0.73	medium



Side	Limb	Muscle	Stride	Phase	Perturbation	<i>p</i> -value	Effect Size	Effect Size Value	Interpretation
				single support					
left	upper	TFL	PS	Second single support	TI	<0.01	Cohen's <i>d</i>	-1.17	large
left	lower	TA	PS	First single support	TI	<0.05	<i>r</i>	0.66	large
left	lower	TA	PS	Second double support	TC	<0.05	<i>r</i>	0.66	large
right	lower	TA	PS	Second double support	MC	<0.01	<i>r</i>	0.85	large
right	lower	TA	PS	Second double support	TI	<0.01	<i>r</i>	0.85	large
left	lower	SOL	PS	First double support	TI	<0.05	<i>r</i>	0.79	large
left	lower	SOL	PS	Second double support	TI	<0.05	<i>r</i>	0.69	large
left	lower	SOL	PS	Second single support	TC	<0.01	Cohen's <i>d</i>	-1.04	large
right	lower	SOL	PS	First double support	MI	<0.01	<i>r</i>	0.79	large
right	lower	SOL	PS	Second double support	MC	<0.05	<i>r</i>	0.63	large
right	lower	SOL	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.87	large
left	upper	RF	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.78	medium
right	upper	HAM	PS	Second double support	TC	<0.05	<i>r</i>	0.73	large
right	upper	HAM	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.72	medium
left	upper	GLU	PS	Second double support	TI	<0.01	<i>r</i>	0.89	large
right	upper	GLU	PS	First double support	MC	<0.05	<i>r</i>	0.73	large
right	upper	GLU	PS	Second	TI	<0.05	Cohen's <i>d</i>	0.78	medium

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
				double support					
right	upper	GLU	PS	Second single support	TC	<0.05	<i>r</i>	0.79	large
left	lower	GAS	PS	First single support	MC	<0.01	<i>r</i>	0.79	large
left	lower	GAS	PS	Second double support	MI	<0.001	Cohen's <i>d</i>	1.81	large
left	lower	GAS	PS	Second double support	TC	<0.01	<i>r</i>	0.89	large
left	lower	GAS	PS	Second double support	TI	<0.05	<i>r</i>	0.66	large
right	lower	GAS	PS	First double support	MI	<0.05	Cohen's <i>d</i>	-1.02	large
right	lower	GAS	PS	First single support	MC	<0.05	Cohen's <i>d</i>	0.86	large
right	lower	GAS	PS	Second double support	TC	<0.01	<i>r</i>	0.85	large
right	lower	GAS	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.87	large
left	lower	VL	SS	First double support	MI	<0.01	Cohen's <i>d</i>	1.04	large
left	lower	VL	SS	First double support	TI	<0.01	Cohen's <i>d</i>	-1.07	large
left	lower	VL	SS	First single support	MC	<0.05	Cohen's <i>d</i>	0.78	medium
left	lower	VL	SS	Second single support	MC	<0.01	<i>r</i>	0.89	large
right	lower	VL	SS	First double support	MI	<0.01	Cohen's <i>d</i>	1.33	large
right	lower	VL	SS	First single support	MI	<0.05	<i>r</i>	0.73	large
left	upper	TFL	SS	First double support	TI	<0.05	<i>r</i>	0.79	large
left	upper	TFL	SS	Second	TI	<0.01	<i>r</i>	0.79	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
				double support					
right	upper	TFL	SS	First double support	MI	<0.01	Cohen's <i>d</i>	1.04	large
left	lower	TA	SS	Second double support	TC	<0.05	<i>r</i>	0.76	large
left	lower	TA	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.94	large
left	lower	SOL	SS	First double support	MI	<0.05	Cohen's <i>d</i>	0.82	large
right	lower	SOL	SS	Second double support	MC	<0.05	<i>r</i>	0.66	large
right	lower	SOL	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.87	large
left	upper	RF	SS	First single support	MI	<0.05	<i>r</i>	0.76	large
left	upper	RF	SS	Second double support	MI	<0.001	Cohen's <i>d</i>	-1.12	large
left	upper	RF	SS	Second double support	TC	<0.01	Cohen's <i>d</i>	-1.04	large
right	upper	RF	SS	Second double support	MC	<0.05	<i>r</i>	0.63	large
left	upper	HAM	SS	Second double support	MC	<0.05	<i>r</i>	0.73	large
left	upper	HAM	SS	Second double support	TC	<0.01	Cohen's <i>d</i>	-1.14	large
left	upper	HAM	SS	Second single support	MI	<0.05	Cohen's <i>d</i>	-0.75	medium
right	upper	HAM	SS	First double support	TC	<0.05	<i>r</i>	0.89	large
right	upper	HAM	SS	First single support	TC	<0.05	Cohen's <i>d</i>	0.84	large
right	upper	HAM	SS	Second double support	MI	<0.05	<i>r</i>	0.63	large
left	upper	GLU	SS	First	TC	<0.05	<i>r</i>	0.73	large

Side	Limb	Muscle	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
right	upper	GLU	SS	single support First double support	TC	<0.01	<i>r</i>	0.89	large
left	lower	GAS	SS	Second double support	MI	<0.05	<i>r</i>	0.63	large
right	lower	GAS	SS	Second double support	TC	<0.05	<i>r</i>	0.73	large
right	lower	GAS	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.98	large
right	lower	GAS	SS	Second single support	MI	<0.05	<i>r</i>	0.63	large

Table A4. Results of the statistical test for PC Peak Location, significant difference *post-hoc* test (*p*-value > 0.05). PPS - Pre-perturbation Stride, PS - Perturbation stride, SS - Subsequent Stride. Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC). Tibialis Anterior (TA), Soleus (SOL), Gastrocnemius Lateralis (GAS), Vastus Lateralis (VL), Rectus Femoris (RF), Biceps Femoris Long Head (HAM), Tensor Fasciae Latae (TFL), and Gluteus Maximus (GLU)

Side	Limb	PC	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	1	PPS	Second double support	TI	<0.01	Cohen's <i>d</i>	1.09	large
left	lower	1	PPS	Second single support	MI	<0.05	<i>r</i>	0.79	large
left	lower	1	PPS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.80	medium
left	lower	3	PPS	Second single support	MI	<0.01	Cohen's <i>d</i>	-1.13	large
left	lower	3	PPS	Second single support	TC	<0.05	<i>r</i>	0.7	large
right	lower	1	PPS	Second double support	TI	<0.01	<i>r</i>	0.79	large
right	upper	1	PPS	First double support	MC	<0.05	<i>r</i>	0.66	large
right	lower	2	PPS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.80	medium
right	upper	2	PPS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.74	medium
left	lower	1	PS	First single support	MI	<0.05	<i>r</i>	0.63	large
left	lower	1	PS	Second double support	TC	<0.05	Cohen's	-0.85	large

Side	Limb	PC	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
							<i>d</i>		
left	lower	2	PS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.91	large
left	lower	3	PS	First single support	TC	<0.05	<i>r</i>	0.73	large
right	lower	1	PS	First single support	MC	<0.01	<i>r</i>	0.82	large
right	lower	1	PS	Second double support	TI	<0.05	<i>r</i>	0.76	large
right	lower	1	PS	Second single support	MC	<0.05	<i>r</i>	0.66	large
right	lower	2	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.96	large
right	lower	3	PS	First double support	MC	<0.01	<i>r</i>	0.82	large
right	lower	3	PS	First single support	MC	<0.01	<i>r</i>	0.85	large
right	lower	3	PS	Second single support	TI	<0.05	<i>r</i>	0.73	large
left	lower	1	PS	First single support	MI	<0.05	<i>r</i>	0.63	large
left	lower	1	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.85	large
left	lower	2	PS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.91	large
left	upper	1	PS	First single support	MC	<0.01	<i>r</i>	0.85	large
left	upper	1	PS	First single support	TI	<0.01	<i>r</i>	0.79	large
left	upper	1	PS	Second double support	TC	<0.01	Cohen's <i>d</i>	-1.11	large
left	upper	1	PS	Second single support	TC	<0.05	<i>r</i>	0.79	large
left	upper	1	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	0.77	medium
left	upper	2	PS	First double support	TC	<0.05	Cohen's <i>d</i>	-0.73	medium
left	upper	2	PS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.87	large
left	upper	3	PS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.84	large
right	upper	2	PS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.76	medium
right	upper	2	PS	Second single support	MI	<0.05	Cohen's <i>d</i>	0.72	medium

Side	Limb	PC	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
right	upper	2	PS	Second single support	TC	<0.05	Cohen's <i>d</i>	0.89	large
left	lower	1	SS	Second single support	TC	<0.05	Cohen's <i>d</i>	-0.96	large
left	lower	2	SS	First single support	TI	<0.05	<i>r</i>	0.76	large
left	lower	3	SS	Second double support	MC	<0.05	Cohen's <i>d</i>	0.79	medium
right	lower	1	SS	First single support	TI	<0.05	<i>r</i>	0.73	large
right	lower	2	SS	Second double support	MI	<0.05	<i>r</i>	0.73	large
right	lower	3	SS	First single support	MC	<0.01	<i>r</i>	0.85	large
right	upper	1	SS	First single support	TC	<0.01	Cohen's <i>d</i>	-1.11	large
right	upper	1	SS	First single support	TI	<0.05	Cohen's <i>d</i>	-0.93	large
right	upper	2	SS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.83	large
right	upper	3	SS	First double support	TC	<0.01	<i>r</i>	0.89	large
right	upper	3	SS	First double support	TI	<0.05	Cohen's <i>d</i>	-0.84	large

Table A5. Results of the statistical test for PC Peak Value, significant difference *post-hoc* test ( $p$ -value > 0.05). PPS - Pre-perturbation Stride, PS - Perturbation stride, SS - Subsequent Stride. Midstance Ipsilateral (MI), Midstance Contralateral (MC), Touchdown Ipsilateral (TI), and Touchdown Contralateral (TC).

Side	Limb	PC	Stride	Phase	Perturbation	p-value	Effect Size	Effect Size Value	Interpretation
left	lower	1	PPS	First double support	TI	<0.05	Cohen's <i>d</i>	-0.95	large
left	lower	1	PPS	First single support	TC	<0.05	Cohen's <i>d</i>	-0.73	medium
left	lower	1	1	First double support	MC	<0.05	Cohen's <i>d</i>	0.94	large
left	lower	1	1	First single support	TC	<0.05	Cohen's <i>d</i>	-0.73	medium
left	lower	2	1	First double support	TI	<0.01	<i>r</i>	0.85	large
left	lower	2	1	First single support	TC	<0.05	Cohen's <i>d</i>	-0.79	medium
left	lower	2	1	Second	MI	<0.05	Cohen's <i>d</i>	0.72	medium

				double support					
left	lower	3	1	Second double support	MC	<0.05	Cohen's <i>d</i>	0.87	large
left	lower	3	1	Second single support	TI	<0.01	<i>r</i>	0.79	large
left	upper	1	PPS	First single support	MC	<0.01	<i>r</i>	0.89	large
left	upper	1	PPS	First single support	TI	<0.05	Cohen's <i>d</i>	0.77	medium
left	upper	2	PPS	Second single support	MI	<0.05	<i>r</i>	0.69	large
left	upper	2	PPS	Second single support	TC	<0.01	<i>r</i>	0.85	large
left	upper	3	PPS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.9 4	large
right	upper	1	PPS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.97	large
right	upper	1	PPS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.86	large
right	upper	1	PPS	Second double support	TI	<0.05	Cohen's <i>d</i>	0.94	large
right	upper	2	PPS	Second double support	MC	<0.05	<i>r</i>	0.66	large
right	upper	3	PPS	First double support	MI	<0.05	Cohen's <i>d</i>	-0.7 9	medium
right	upper	3	PPS	First single support	MI	<0.05	Cohen's <i>d</i>	-0.8 8	large
right	upper	3	PPS	First single support	TI	<0.05	Cohen's <i>d</i>	-0.9 3	large
right	upper	3	PPS	Second single support	MI	<0.05	Cohen's <i>d</i>	-0.9 3	large
left	lower	1	2	First single support	TI	<0.05	Cohen's <i>d</i>	0.83	large
left	lower	1	2	Second single support	MI	<0.05	Cohen's <i>d</i>	0.76	medium
left	lower	1	2	Second single support	TC	<0.05	Cohen's <i>d</i>	0.77	medium
left	lower	2	2	First double support	TI	<0.01	Cohen's <i>d</i>	-1.2 1	large
left	lower	2	2	First single support	MI	<0.05	Cohen's <i>d</i>	-0.9 6	large
left	lower	2	2	First single support	TI	<0.00 1	Cohen's <i>d</i>	1.99	large
left	lower	2	2	Second double support	MI	<0.01	Cohen's <i>d</i>	-1.0 9	large

left	lower	3	2	First double support	MC	<0.05	Cohen's <i>d</i>	0.94	large
left	lower	3	2	Second single support	MI	<0.05	Cohen's <i>d</i>	0.73	medium
left	lower	3	2	Second single support	TC	<0.05	Cohen's <i>d</i>	0.97	large
right	lower	1	2	First double support	MI	<0.05	Cohen's <i>d</i>	0.80	medium
right	lower	1	2	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.76	medium
right	lower	2	2	Second double support	TI	<0.05	Cohen's <i>d</i>	1.02	large
right	lower	3	2	First single support	MC	<0.05	Cohen's <i>d</i>	-0.97	large
right	lower	3	2	Second double support	TC	<0.05	Cohen's <i>d</i>	-1.00	large
left	upper	1	PS	First single support	TC	<0.001	Cohen's <i>d</i>	1.55	large
left	upper	1	PS	First single support	TI	<0.05	Cohen's <i>d</i>	0.96	large
left	upper	1	PS	Second double support	MC	<0.01	Cohen's <i>d</i>	1.12	large
left	upper	2	PS	Second single support	TI	<0.05	Cohen's <i>d</i>	-0.89	large
left	upper	3	PS	Second double support	MI	<0.05	<i>r</i>	0.73	large
left	upper	3	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.94	large
left	upper	3	PS	Second double support	TI	<0.01	Cohen's <i>d</i>	-1.08	large
right	upper	1	PS	First double support	MC	<0.05	Cohen's <i>d</i>	0.81	large
right	upper	1	PS	First single support	MC	<0.05	Cohen's <i>d</i>	-0.99	large
right	upper	1	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.77	medium
right	upper	2	PS	Second double support	MI	<0.05	Cohen's <i>d</i>	-0.73	medium
right	upper	2	PS	Second double support	TC	<0.05	Cohen's <i>d</i>	-0.74	medium
right	upper	3	PS	First double support	TC	<0.05	Cohen's <i>d</i>	-1.02	large
right	upper	3	PS	First single support	TC	<0.05	Cohen's <i>d</i>	0.86	large
right	upper	3	PS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.94	large



right	upper	3	SS	First double support	MI	<0.05	Cohen's <i>d</i>	0.98	large
left	upper	1	SS	First double support	MC	<0.05	<i>r</i>	0.69	large
left	upper	1	SS	First double support	TC	<0.05	Cohen's <i>d</i>	0.75	medium
left	upper	1	SS	First single support	TC	<0.05	Cohen's <i>d</i>	0.76	medium
left	upper	1	SS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.99	large
left	upper	1	SS	Second double support	TC	<0.05	Cohen's <i>d</i>	0.86	large
left	upper	2	SS	First double support	TI	<0.05	<i>r</i>	0.69	large
left	upper	3	SS	First single support	MI	<0.01	Cohen's <i>d</i>	-1.1 6	large
left	lower	1	SS	First double support	MI	<0.05	<i>r</i>	0.66	large
left	lower	1	SS	Second single support	MC	<0.01	<i>r</i>	0.85	large
left	lower	1	SS	Second single support	TI	<0.00 1	Cohen's <i>d</i>	1.53	large
left	lower	2	SS	First single support	TI	<0.01	<i>r</i>	0.85	large
left	lower	3	SS	First single support	MC	<0.01	Cohen's <i>d</i>	-1.0 3	large
left	lower	3	SS	First single support	TI	<0.05	Cohen's <i>d</i>	-0.7 5	medium
left	lower	3	SS	Second single support	MC	<0.01	Cohen's <i>d</i>	1.03	large
right	lower	1	SS	First single support	MC	<0.01	Cohen's <i>d</i>	1.12	large
right	lower	1	SS	First single support	MI	<0.01	<i>r</i>	0.85	large
right	lower	1	SS	First single support	TC	<0.01	Cohen's <i>d</i>	1.09	large
right	lower	1	SS	First single support	TI	<0.05	Cohen's <i>d</i>	0.80 24	large
right	lower	1	SS	Second double support	MI	<0.00 1	Cohen's <i>d</i>	-1.8 5	large
right	lower	1	SS	Second double support	TC	<0.01	<i>r</i>	0.89	large
right	lower	1	SS	Second double support	TI	<0.05	Cohen's <i>d</i>	-0.8 1	large
right	lower	1	SS	Second single support	MC	<0.00 1	Cohen's <i>d</i>	-1.2 2	large

right	lower	1	SS	Second single support	MI	<0.05	Cohen's <i>d</i>	-0.85	large
right	lower	1	SS	Second single support	TC	0.01	Cohen's <i>d</i>	-1.43	large
right	lower	2	SS	Second double support	MI	<0.05	Cohen's <i>d</i>	0.78	medium
right	lower	3	SS	First single support	MC	<0.05	Cohen's <i>d</i>	-0.72	medium

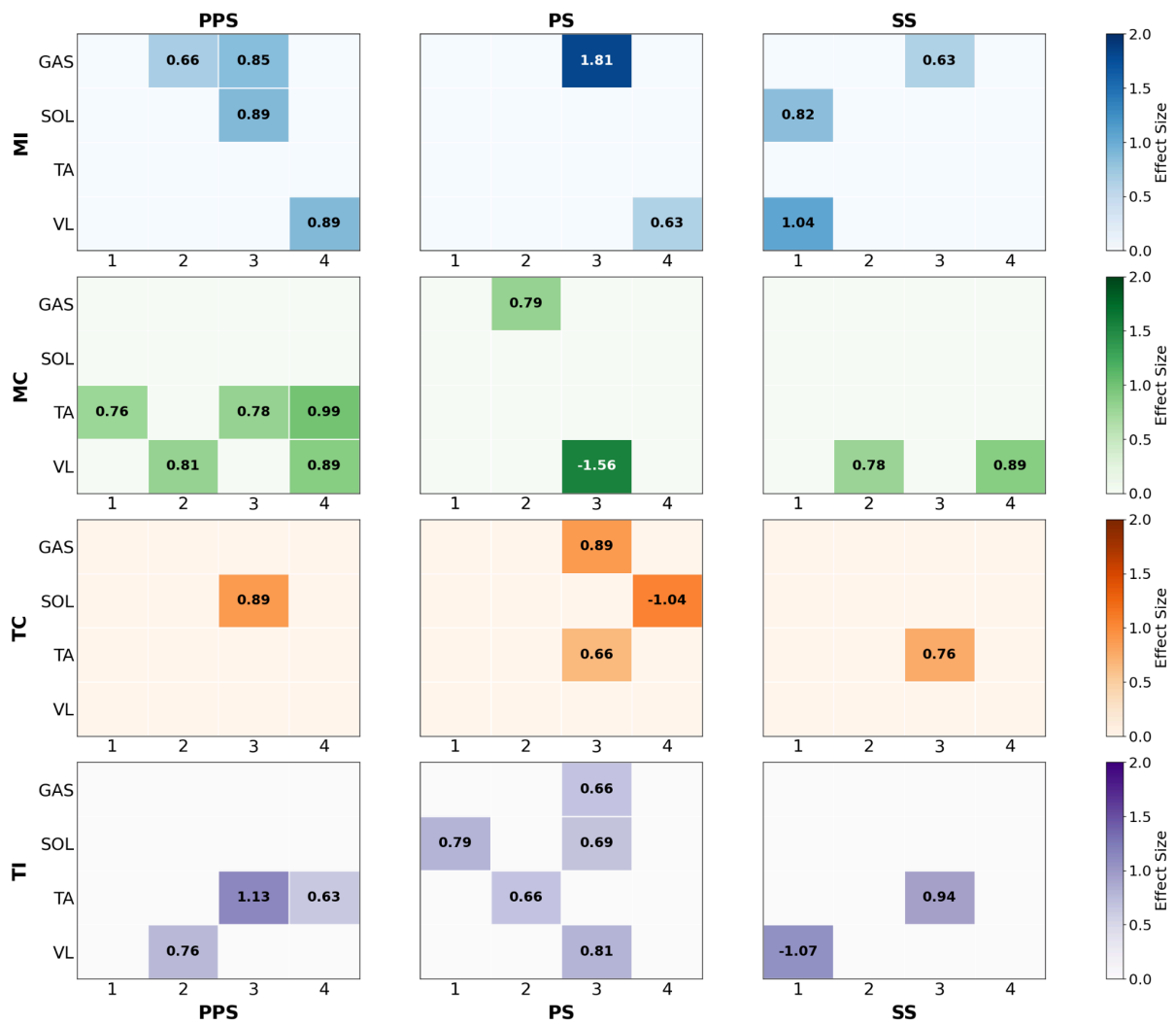


Figure A1. The figure presents heatmaps of the effect size of the co-contraction peak location for the left distal limb muscles (TA, SOL, GAS, VL) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

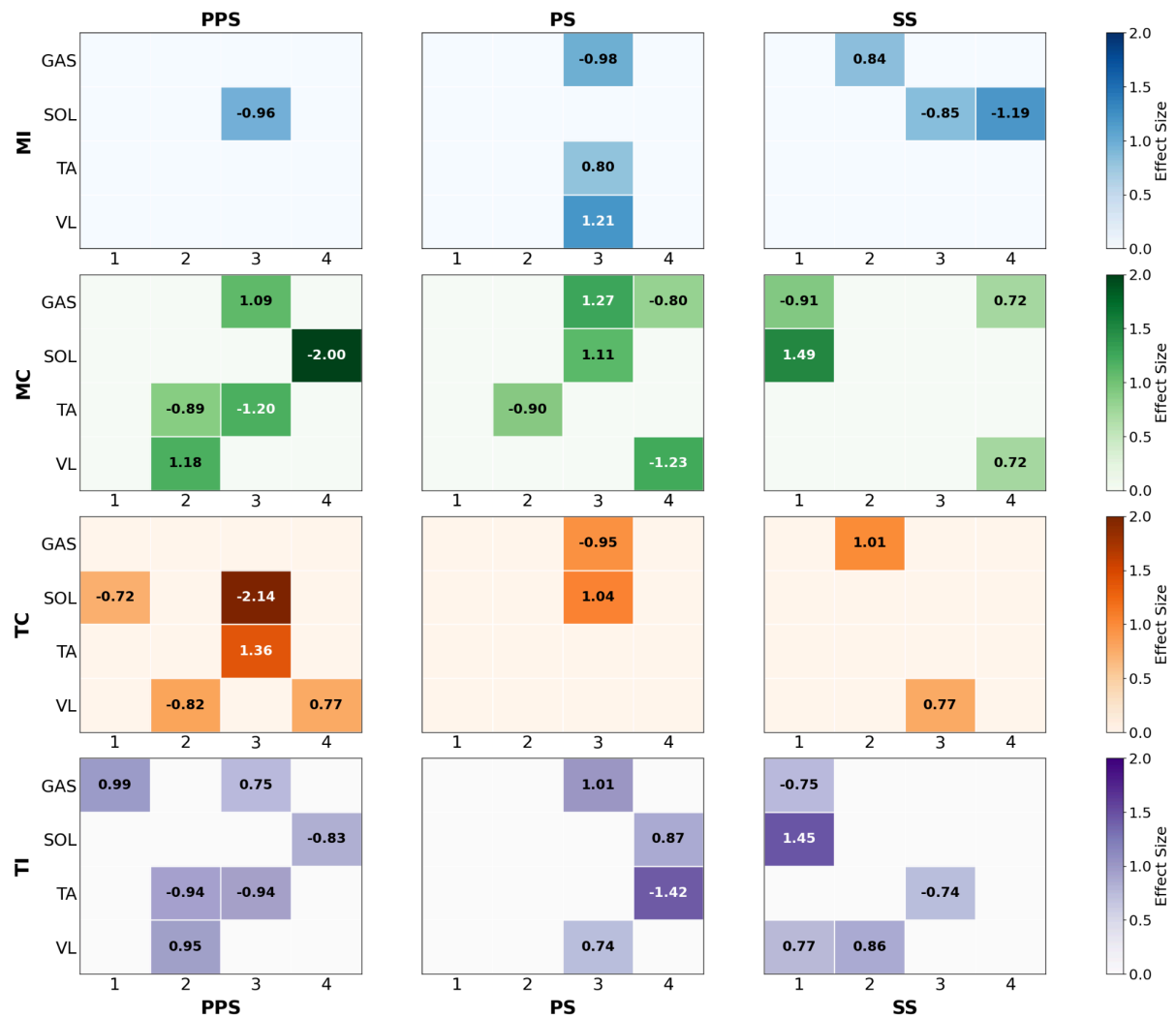


Figure A2. The figure presents heatmaps of the effect size of the co-contraction peak value for the left distal limb muscles (TA, SOL, GAS, VL) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

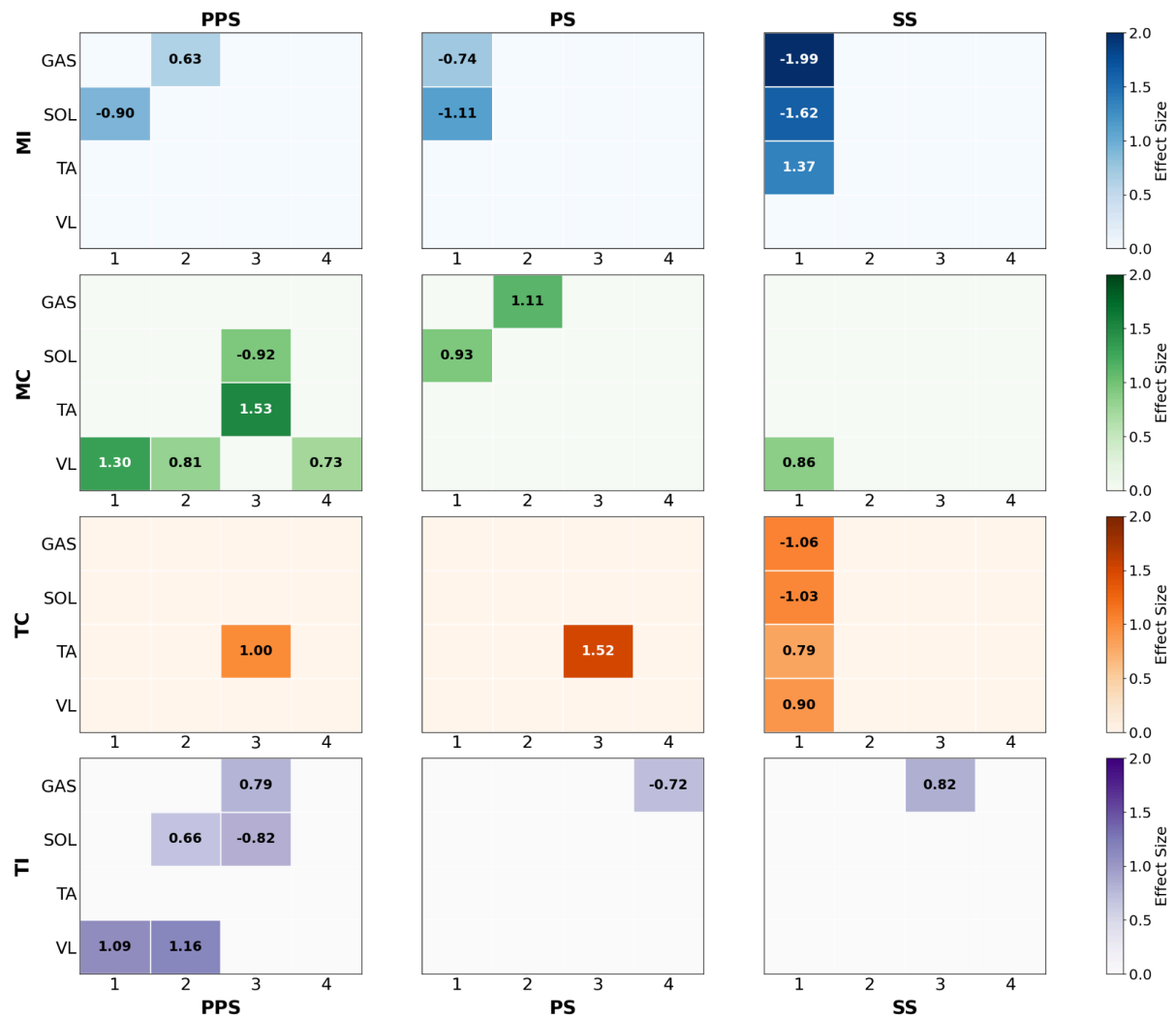


Figure A3. The figure presents heatmaps of the effect size of the co-contraction sum for the right distal limb muscles (TA, SOL, GAS, VL) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

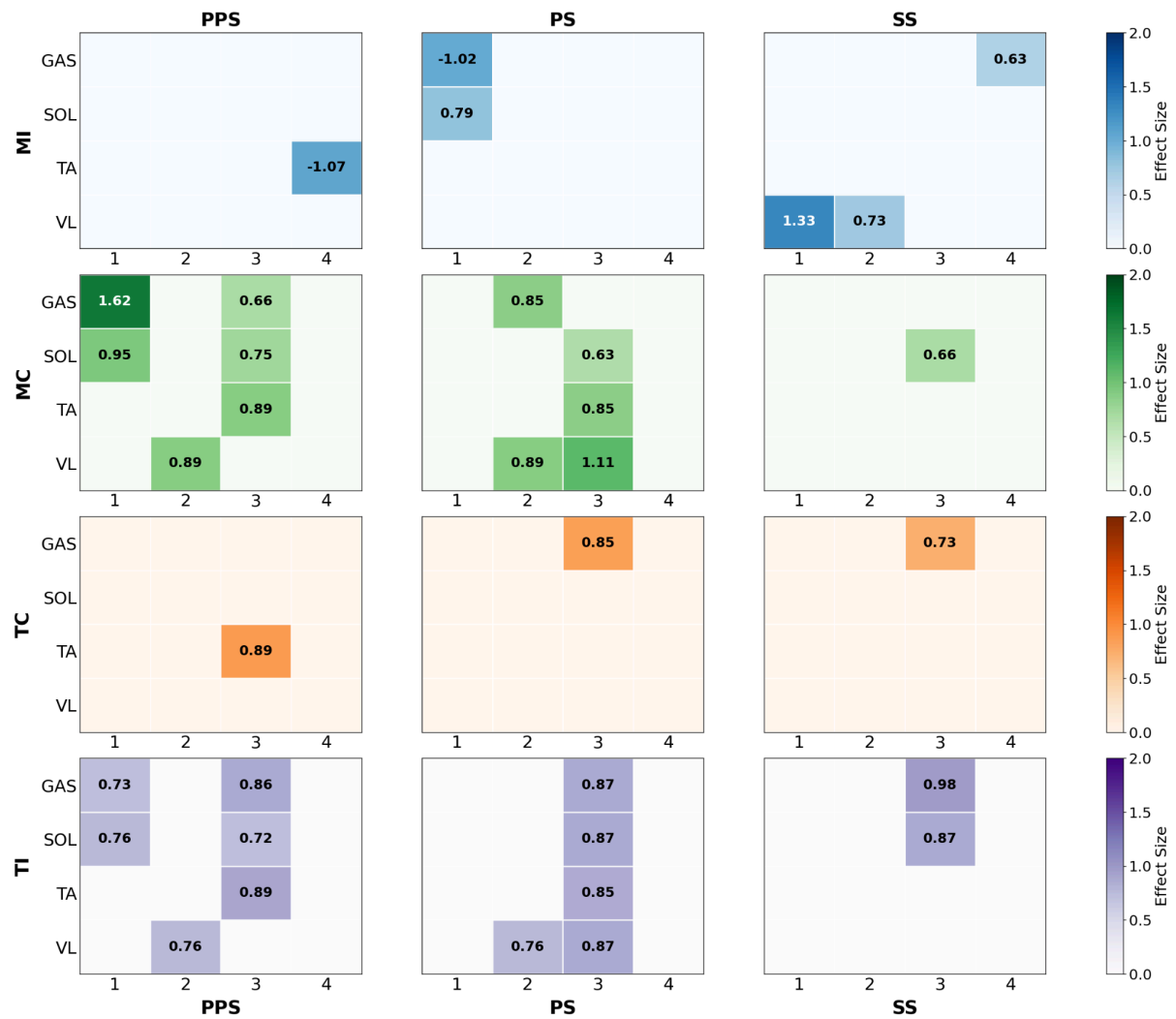


Figure A4. The figure presents heatmaps of the effect size of the co-contraction peak location for the right distal limb muscles (TA, SOL, GAS, VL) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

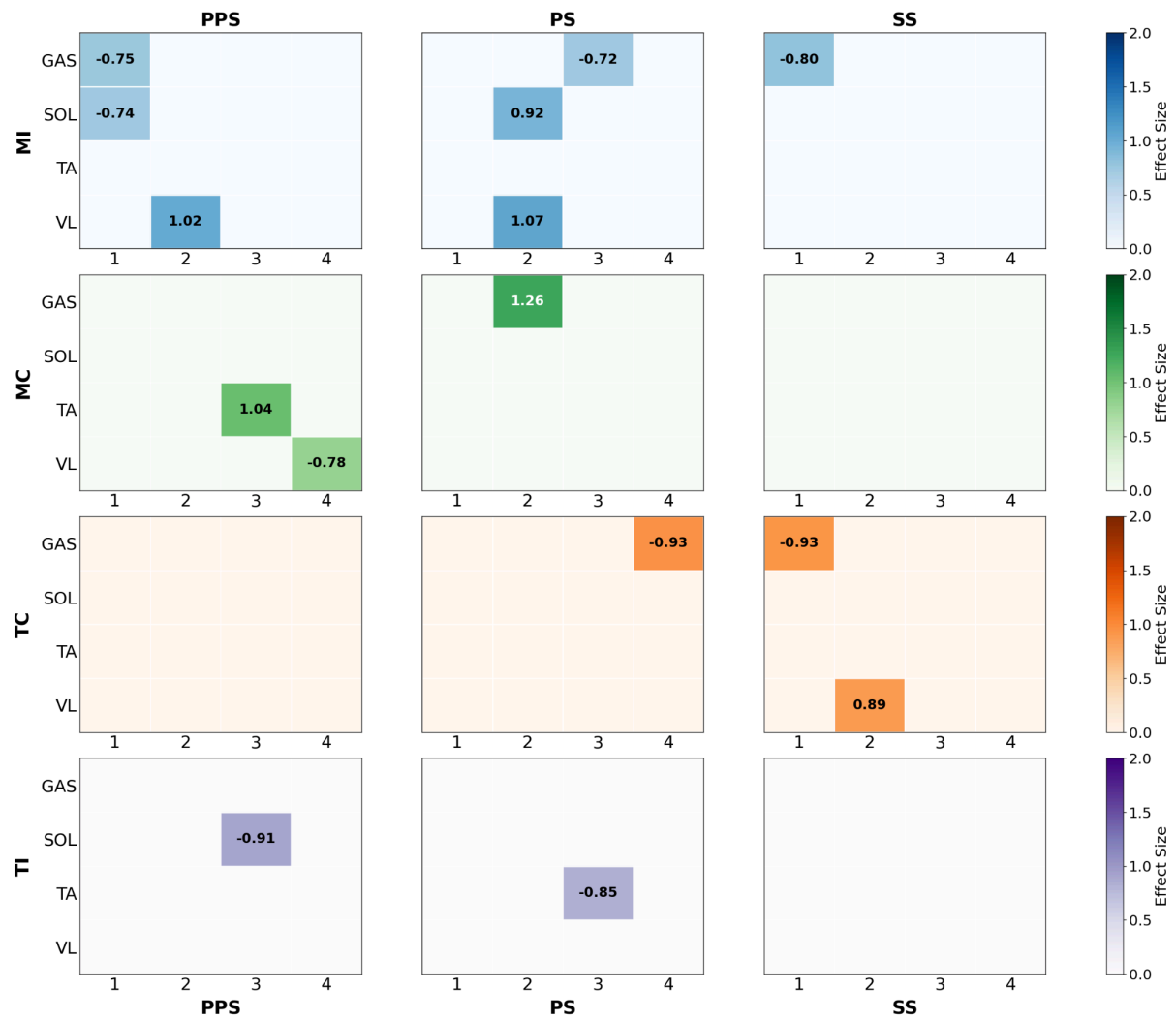


Figure A5. The figure presents heatmaps of the effect size of the co-contraction peak value for the right distal limb muscles (TA, SOL, GAS, VL) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

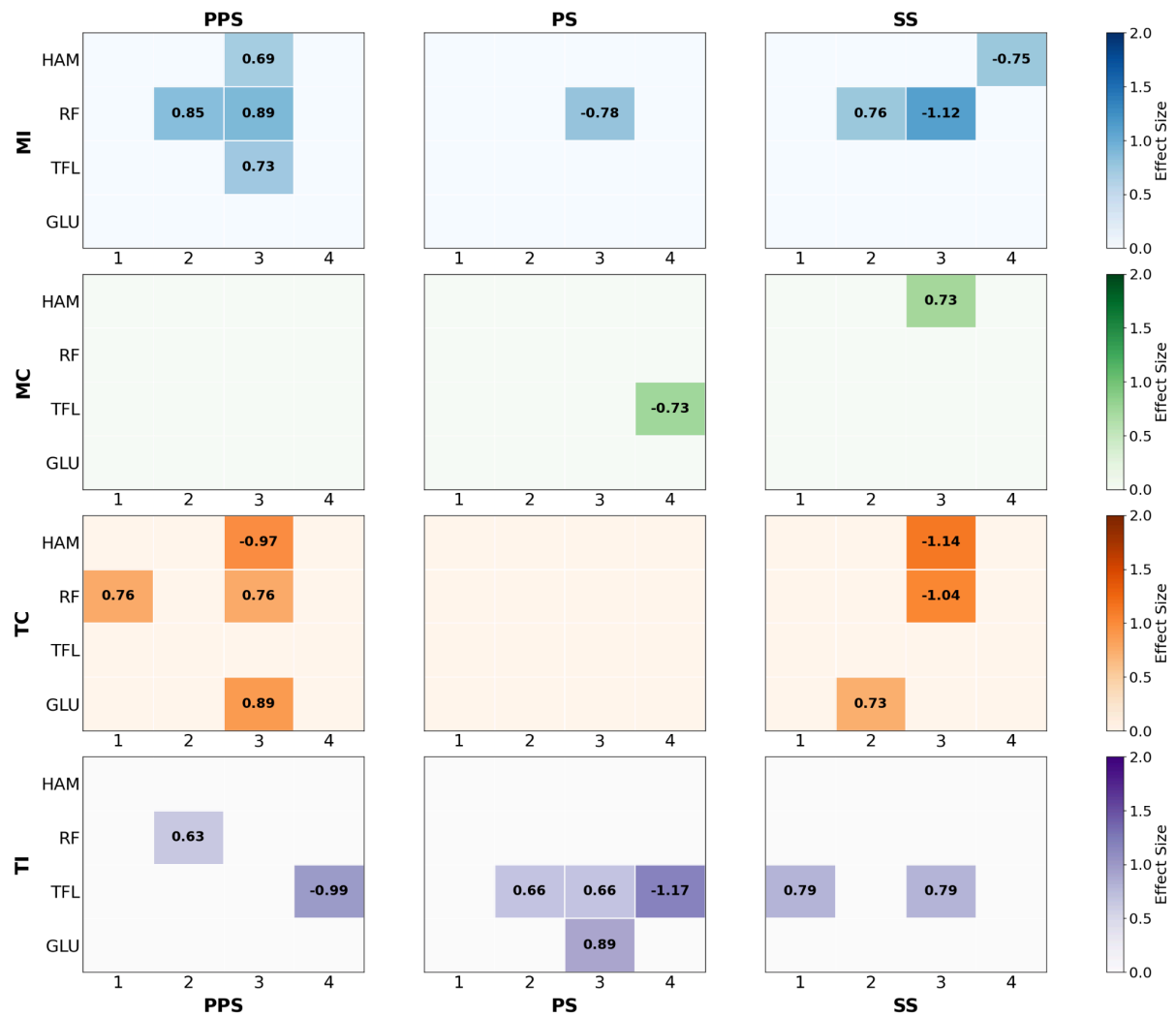


Figure A6. The figure presents heatmaps of the effect size of the co-contraction peak location for the left proximal limb muscles (HAM, RF, TFL, GLU) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.

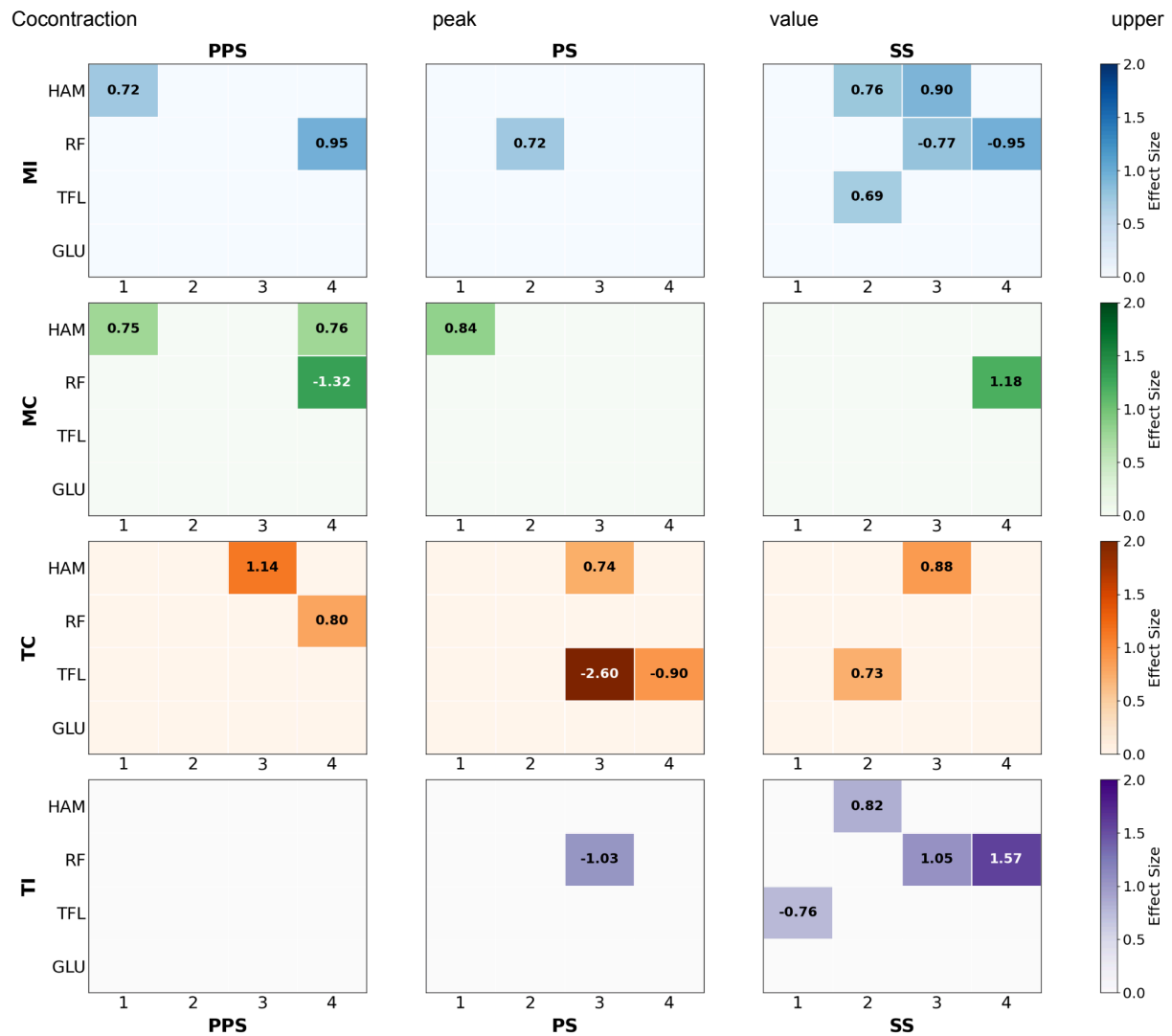


Figure A7. The figure presents heatmaps of the effect size of the co-contraction peak value for the left proximal limb muscles (HAM, RF, TFL, GLU) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty. Cells that remained significant after False Discovery Rate (FDR) correction are additionally highlighted with borders.



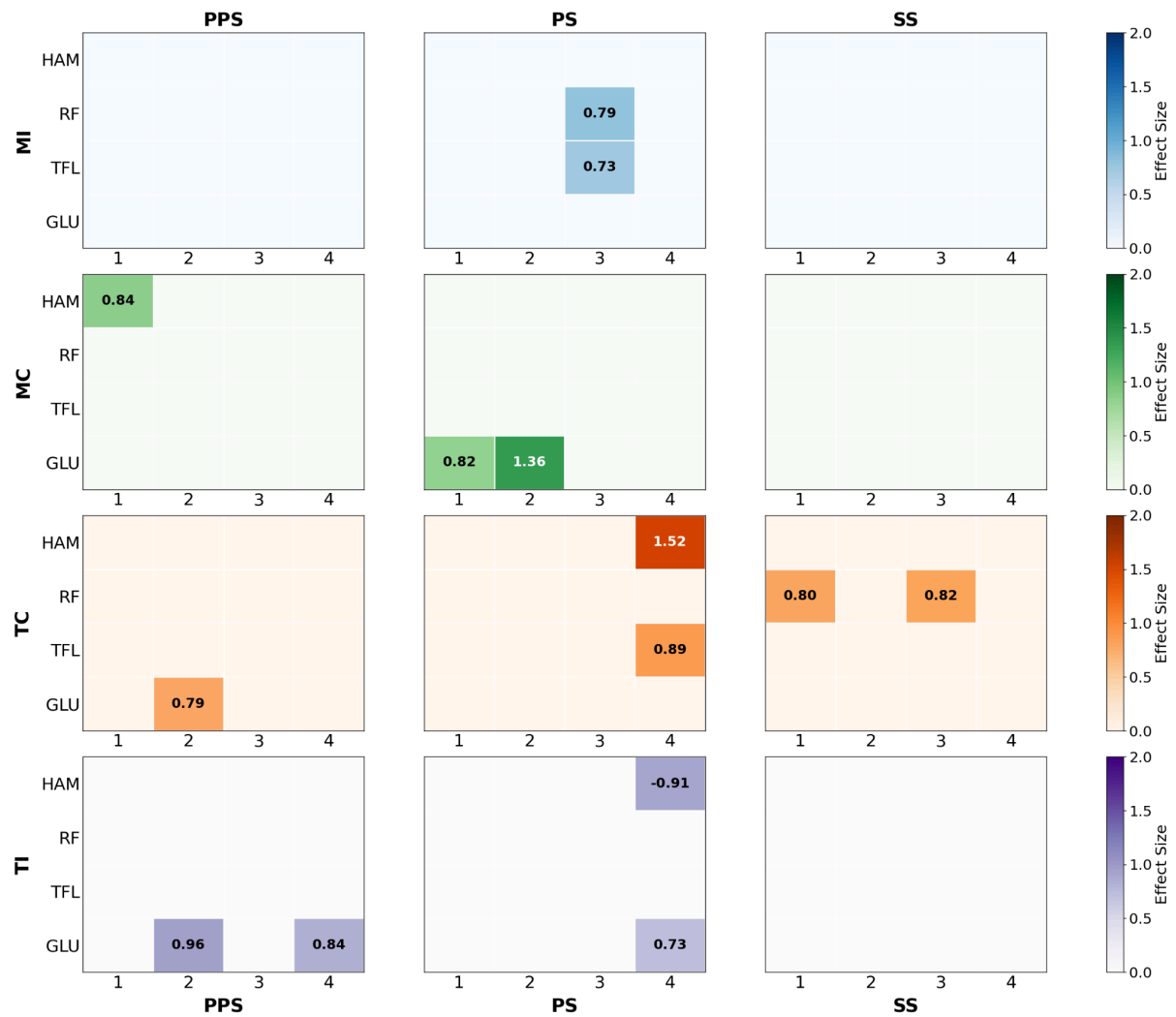


Figure A8. The figure presents heatmaps of the effect size of the co-contraction sum for the right proximal limb muscles (HAM, RF, TFL, GLU) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty.

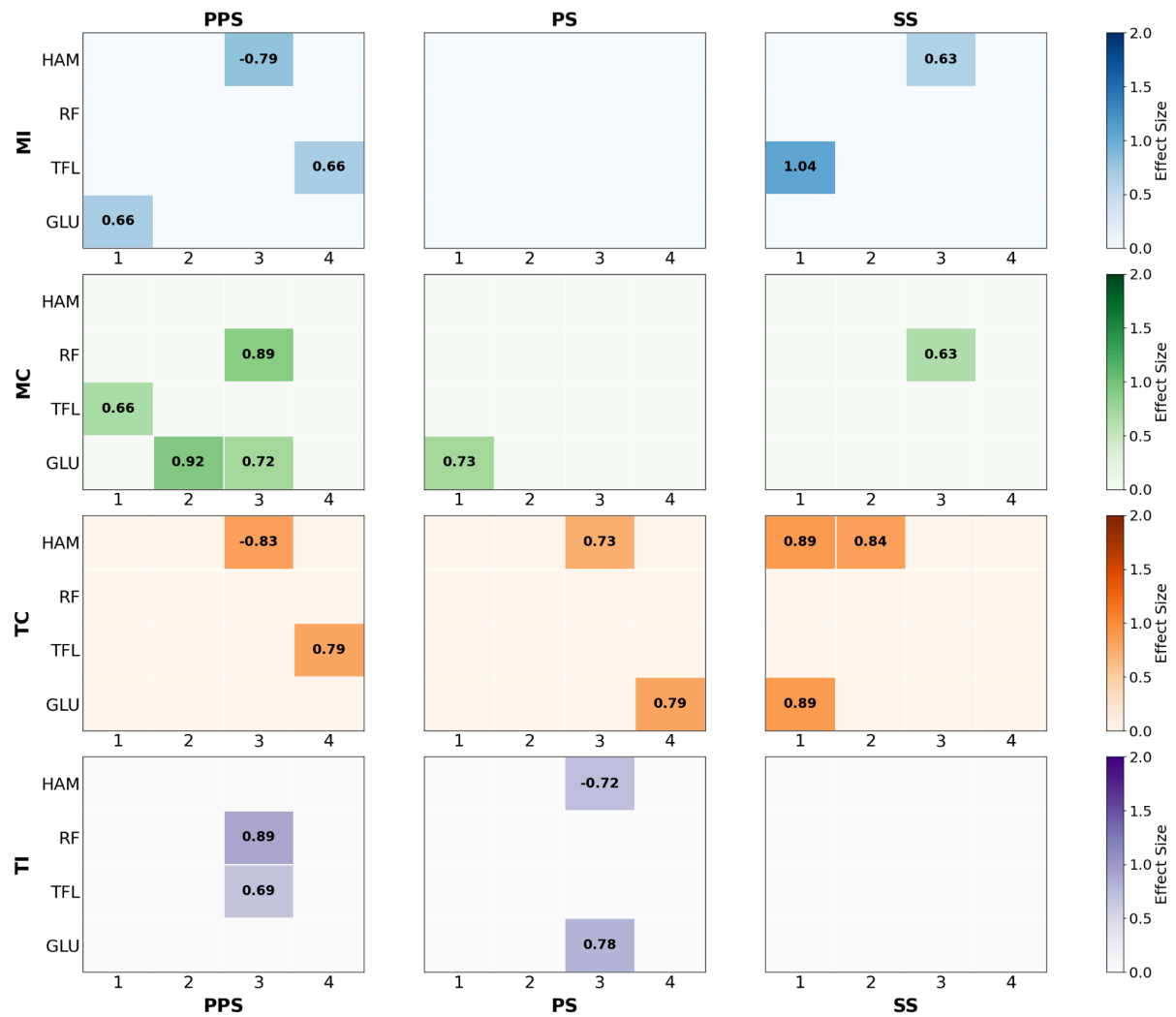


Figure A9. The figure presents heatmaps of the effect size of the co-contraction peak location for the right proximal limb muscles (HAM, RF, TFL, GLU) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty.

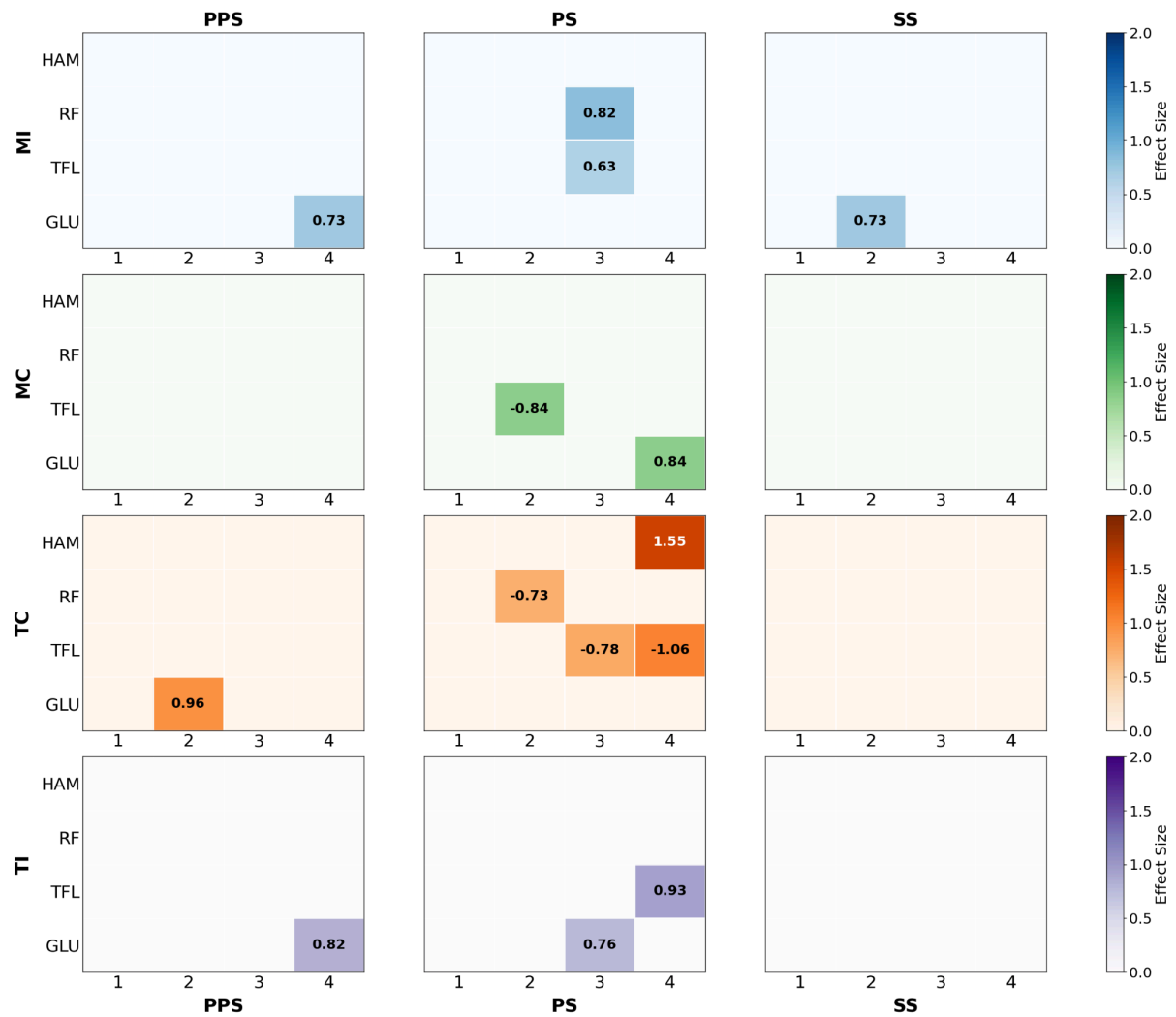


Figure A10. The figure presents heatmaps of the effect size of the co-contraction peak value for the right proximal limb muscles (HAM, RF, TFL, GLU) across four gait phases presented in the abscissa (the first double, the first single, the second double, and the second single support phases, respectively) and three strides (PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride). Each row corresponds to one perturbation condition compared to Control (MI - Midstance Ipsilateral, MC - Midstance Contralateral, TC - Touchdown Contralateral, TI - Touchdown Ipsilateral), and each column corresponds to one stride. Non-significant cells are left empty.

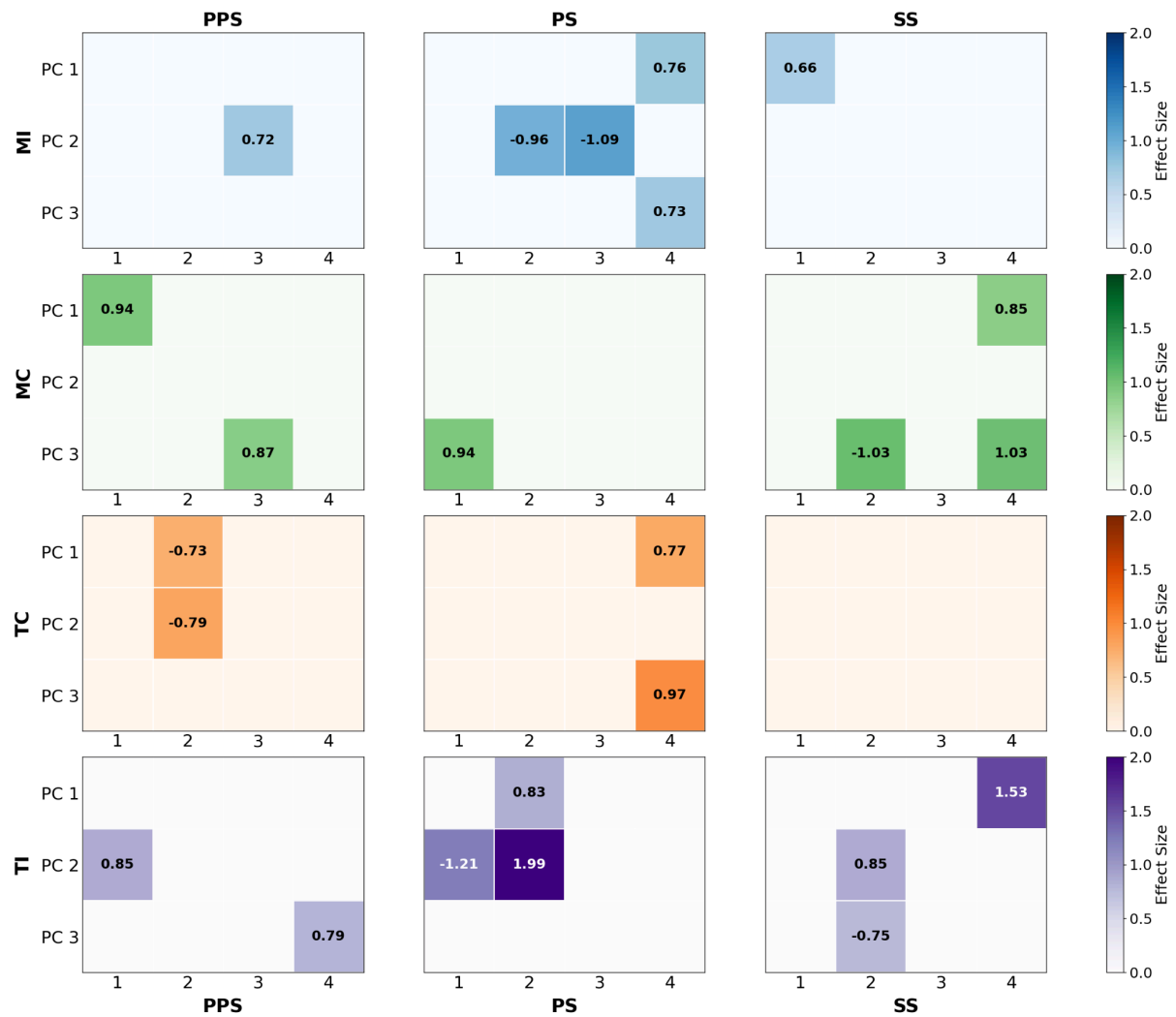


Figure A11. Peak value effect size - PCA distal limb, left side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.

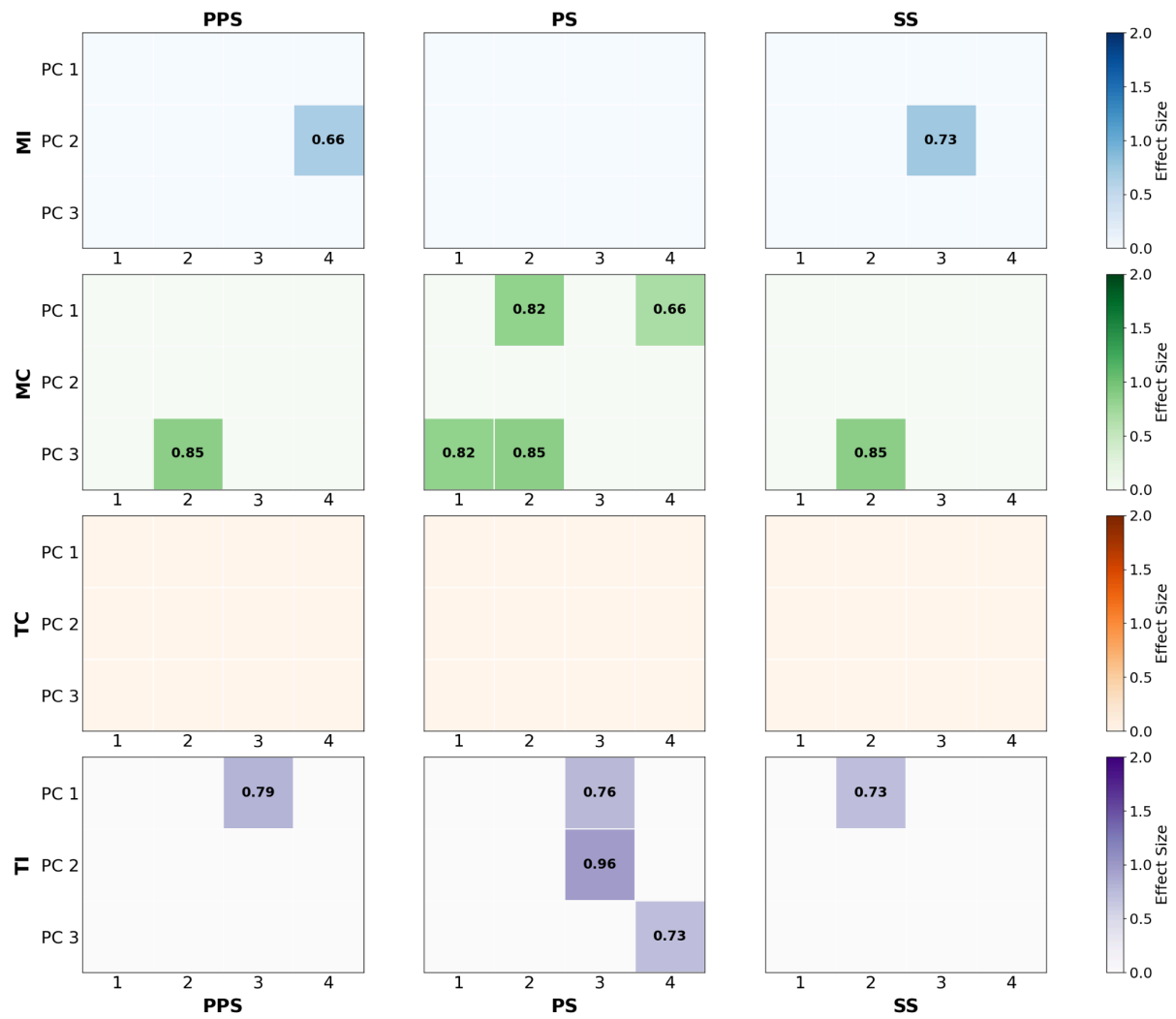


Figure A12. Peak location effect size - PCA distal limb, right side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.

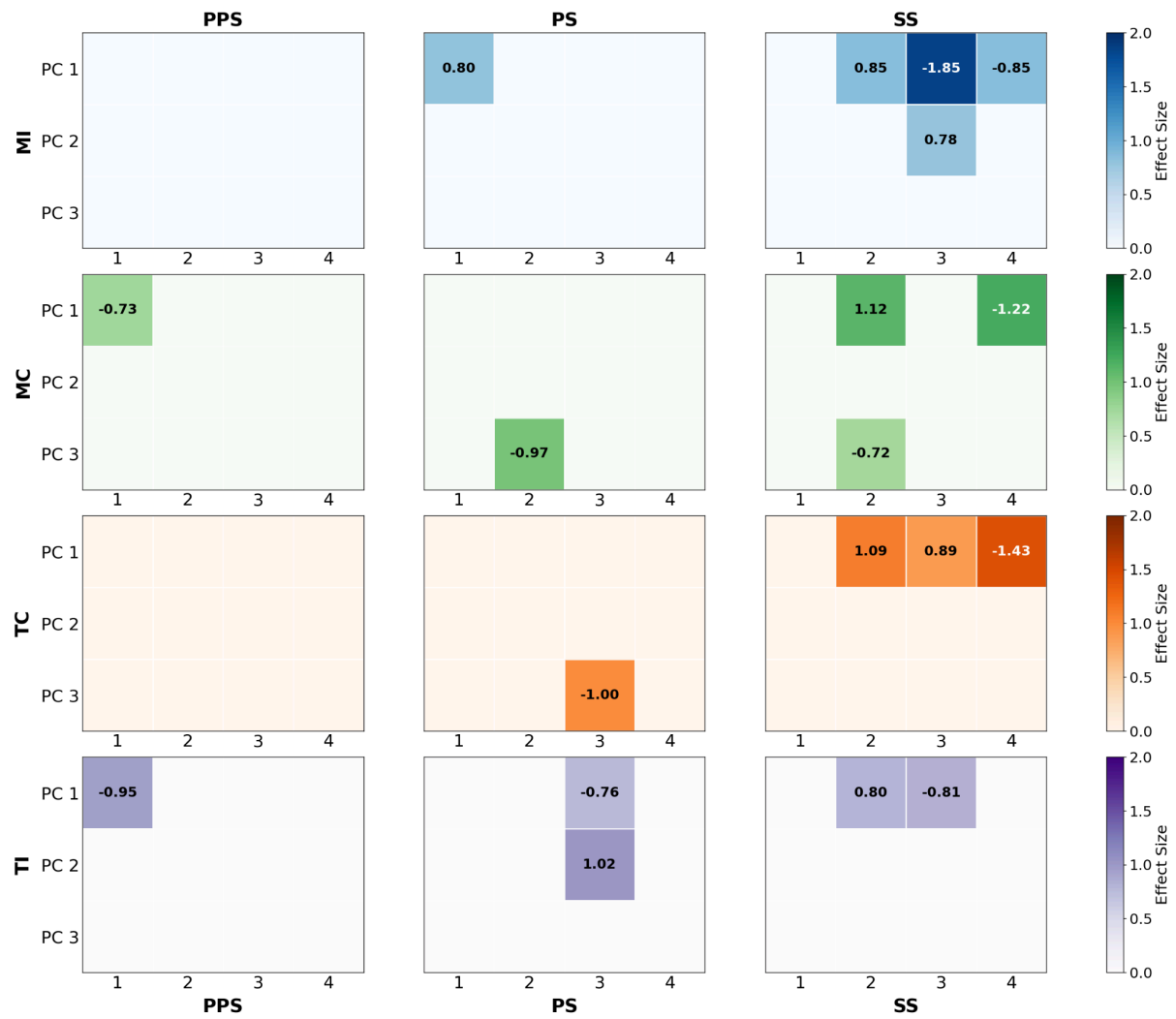


Figure A13. Peak value effect size - PCA distal limb, right side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.

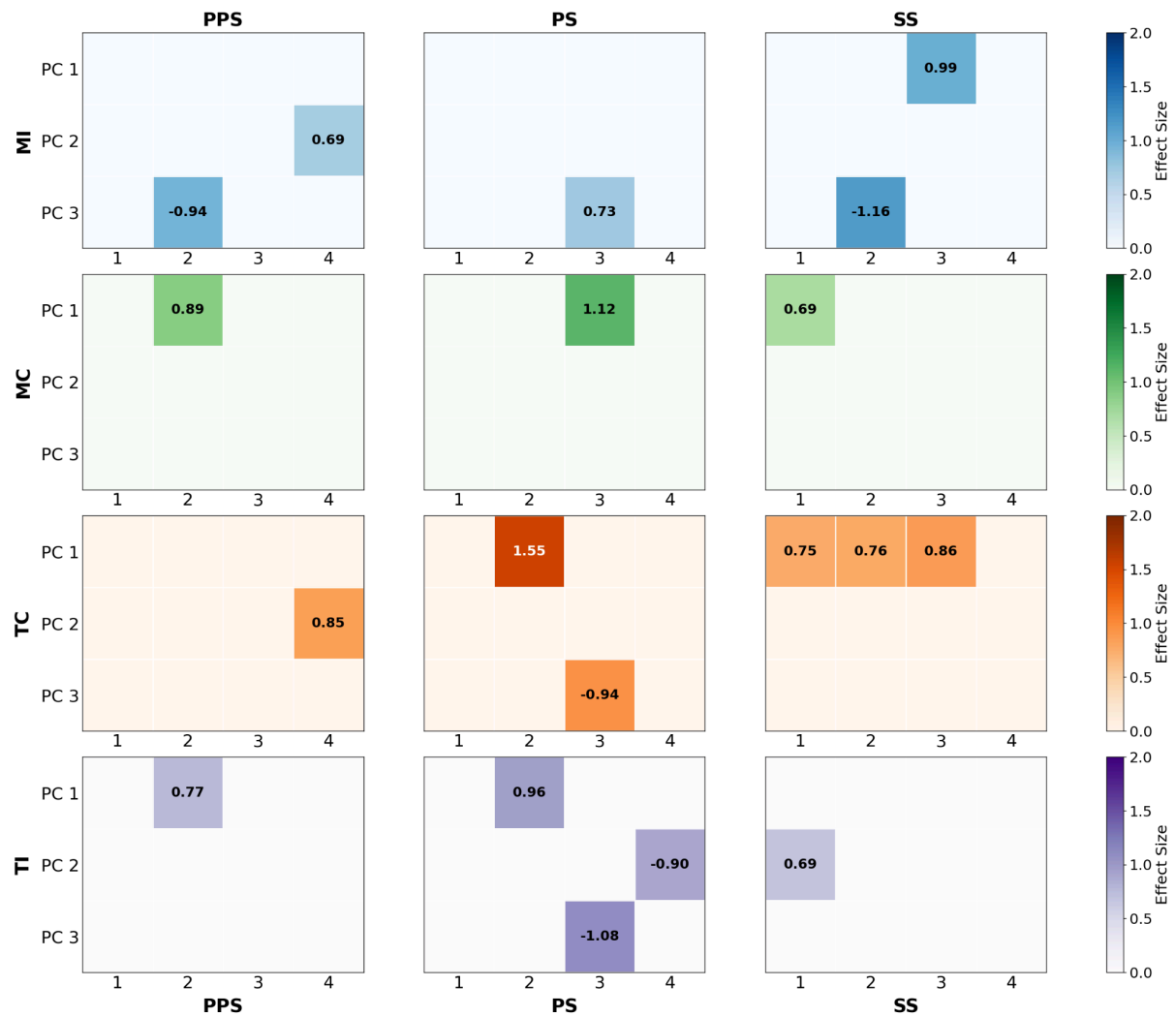


Figure A14. Peak value effect size - PCA proximal limb, left side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.

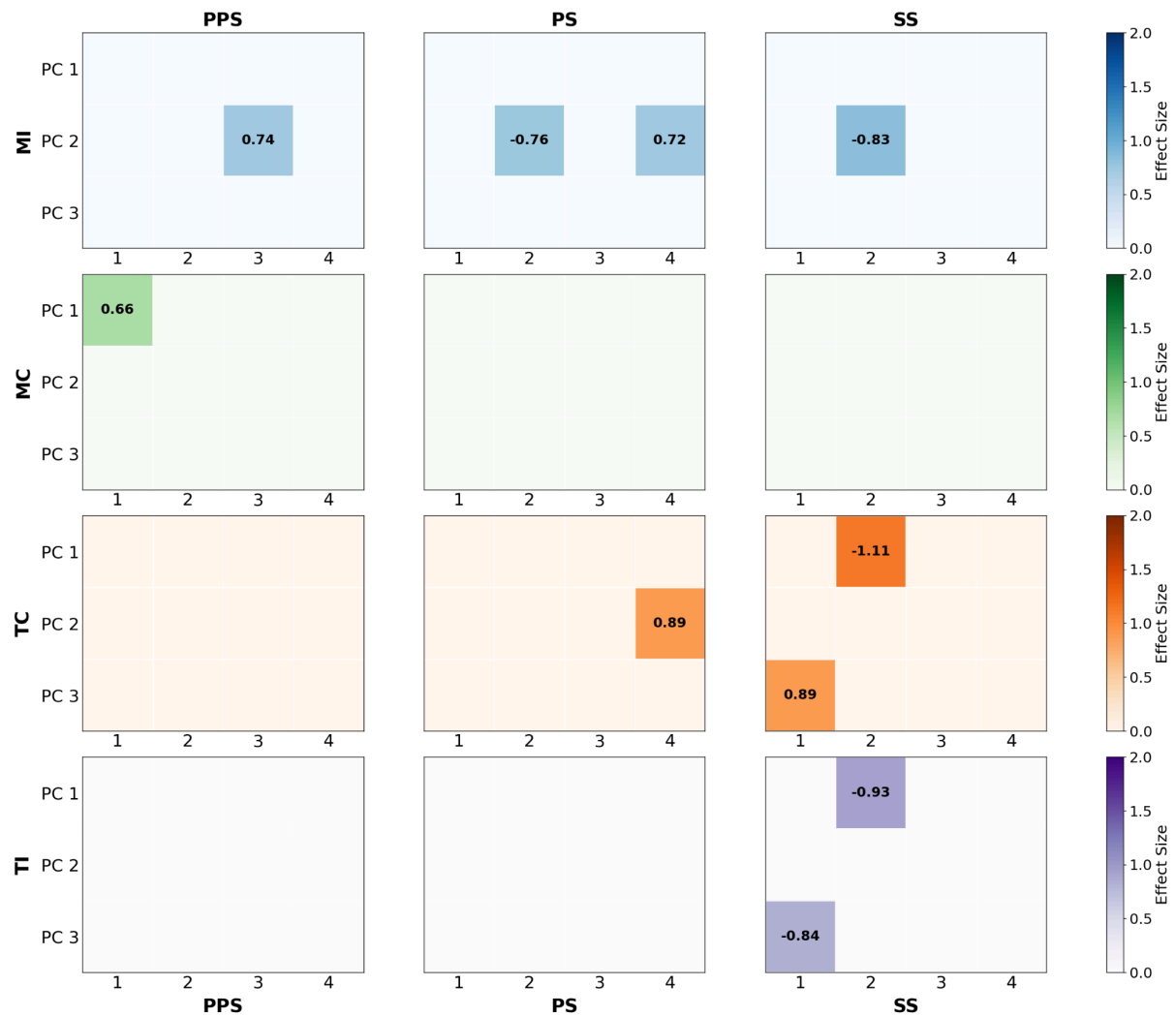


Figure A15. Peak location effect size - PCA proximal limb, right side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.



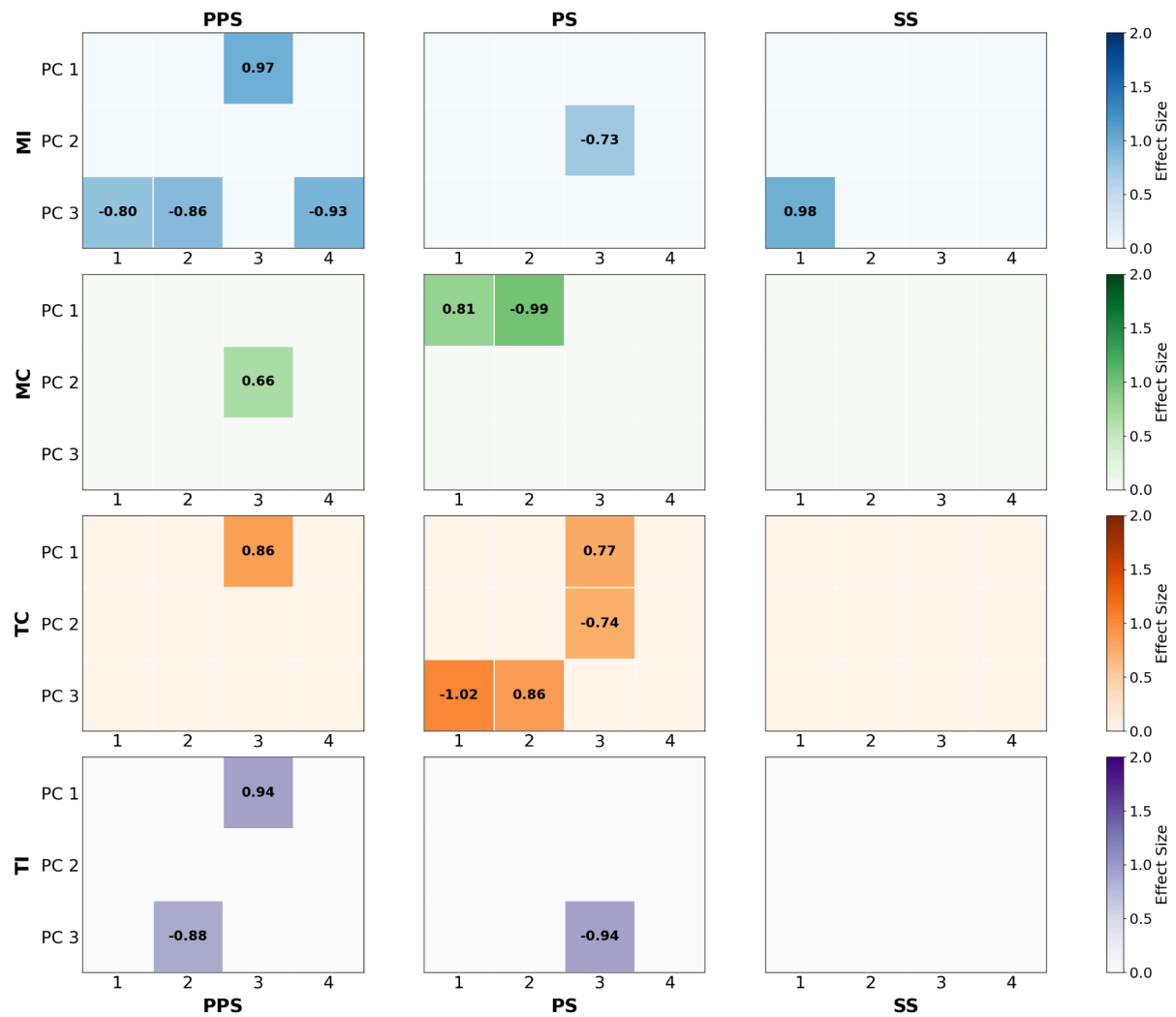


Figure A16. Peak value effect size - PCA proximal limb, right side, per perturbation and stride. The figure presents heatmaps of the effect size for peak score location (normalised timing of the peak within each phase, range 0–1) across three synergies (PC1, PC2, PC3), four gait phases presented in abscissa (the first double, the first single, the second double, and the second single support phases, respectively), and three strides PPS - Pre-perturbation Stride, PS - Perturbation Stride, SS - Subsequent Stride for the left distal limb. Rows represent perturbation conditions (MI, MC, TC, TI), while columns represent strides. Non-significant cells are left empty.