



Fig. S1. Frontal and sagittal iWBAM and step width and length changes across perturbation conditions. Results from all participants are shown in the figure. **(A-C)** Deviations in frontal balance, measured by changes in integrated whole-body angular momentum (iWBAM) relative to steady state, across perturbation conditions for the perturbed and recovery steps. Severity of deviation is classified as no response as well as small, medium, and large changes in stability. **(D-F)** Deviations in step width across perturbation conditions for the perturbed and recovery steps. Severity of deviation is classified as no response as well as small, medium, and large changes in step placement. **(G-I)** Deviations in sagittal balance, measured by changes in iWBAM relative to steady state, across perturbation conditions for the perturbed and recovery steps. Severity of deviation is classified as no response as well as small, medium, and large changes in stability. **(J-L)** Deviations in step length across perturbation conditions for the perturbed and recovery steps. Severity of deviation is classified as no response as well as small, medium, and large changes in step placement. **(ALL)** An additional class, jump, is shown for trials in which the participant lost ground contact. If a jump occurred following the perturbation, the jump classification was shown for both the perturbed and recovery step.

Table S1. iWBAM and step placement across perturbation magnitudes. Results from all participants are shown in the table. The results reported here are the numerical values associate with Fig. 4A,D in the main text, rounded to the nearest tenth decimal place.

Effect of Perturbation Magnitude on Euclidean iWBAM						
Step	Magnitude (cm)	Jump (%)	Large (%)	Medium (%)	Small (%)	No Response (%)
Perturbed	5	0	0.8	1.3	23.4	74.5
	10	0.4	3.1	8.1	34.1	54.3
	15	2.2	8.7	13.0	31.9	44.1
Recovery	5	0	3.2	5.1	29.9	61.7
	10	0.4	13.9	15.3	35.1	35.3
	15	2.2	24.3	22.5	29.3	21.7
Effect of Perturbation Magnitude on Step Placement						
Perturbed	5	0	2.3	5.9	27.8	64.1
	10	0.4	13.5	10.9	29.2	46.0
	15	2.2	22.4	11.1	28.2	36.2
Recovery	5	0	4.0	8.9	35.9	51.1
	10	0.4	21.3	18.2	31.9	28.3
	15	2.2	38.1	17.1	23.4	19.2

Table S2. iWBAM and step placement across perturbation directions. Results from all participants are shown in the table. The results reported here are the numerical values associated with Fig. 4C,F in the main text, rounded to the nearest tenth decimal place.

Effect of Perturbation Direction on Euclidean iWBAM						
Step	Direction	Jump (%)	Large (%)	Medium (%)	Small (%)	No Response (%)
Perturbed	lateral	3.8	6.3	8.8	31.3	49.7
	lateral/anterior	2.5	3.8	7.3	32.0	54.4
	anterior	0	0.5	5.1	26.5	67.9
	medial/anterior	0.3	8.4	8.9	30.7	51.8
	medial	0.3	8.1	9.8	30.3	51.5
	medial/posterior	0	4.3	8.0	31.2	56.5
	posterior	0	0	2.8	26.1	71.1
	lateral/posterior	0	2.3	9.3	30.3	58.3
Recovery	lateral	3.8	28.0	16.2	29.8	22.2
	lateral/anterior	2.5	26.2	20.9	29.2	21.2
	anterior	0	9.7	13.0	33.9	43.4
	medial/anterior	0.3	8.4	11.9	29.9	49.5
	medial	0.3	15.7	17.2	33.3	33.6
	medial/posterior	0	6.3	16.8	31.7	45.2
	posterior	0	0.3	5.3	32.0	62.4
	lateral/posterior	0	16.0	13.3	31.8	39.0
Effect of Perturbation Direction on Step Placement						
Perturbed	lateral	3.8	23.5	10.9	22.0	39.9
	lateral/anterior	2.5	28.2	10.1	23.2	36.0
	anterior	0	9.2	13.3	31.6	45.9
	medial/anterior	0.3	9.1	8.4	36.3	45.9
	medial	0.3	15.2	5.8	27.3	51.5
	medial/posterior	0	8.0	10.8	28.6	52.5
	posterior	0	0.3	5.1	28.9	65.7
	lateral/posterior	0	8.5	10.0	29.3	52.3
Recovery	lateral	3.8	37.6	15.2	28.5	14.9
	lateral/anterior	2.5	28.7	18.9	30.7	19.1
	anterior	0	3.6	6.6	34.2	55.6
	medial/anterior	0.3	15.2	15.7	30.5	38.3
	medial	0.3	36.1	19.2	23.5	21.0
	medial/posterior	0	26.4	17.8	28.4	27.4
	posterior	0	2.5	7.6	27.7	62.2
	lateral/posterior	0	18.8	16.8	39.8	24.8

Table S3. iWBAM and step placement across perturbation timings. Results from all participants are shown in the table. The results reported here are the numerical values associate with Fig. 4B,E in the main text, rounded to the nearest tenth decimal place.

Effect of Perturbation Timing on Euclidean iWBAM						
Step	Timing	Jump (%)	Large (%)	Medium (%)	Small (%)	No Response (%)
Perturbed	DS	0.1	16.4	22.3	40.6	20.7
	early SS	0	0.4	6.0	40.9	52.7
	mid SS	1.0	0	1.7	24.6	72.7
	late SS	2.2	0	0.2	14.3	83.3
Recovery	DS	0.1	10.8	13.7	31.5	43.8
	early SS	0	11.3	13.5	31.7	43.4
	mid SS	1.0	18.0	14.1	32.8	34.1
	late SS	2.2	15.0	15.8	29.9	37.1
Effect of Perturbation Timing on Step Placement						
Perturbed	DS	0.1	40.7	19.3	24.2	15.7
	early SS	0	10.2	15.3	40.1	34.4
	mid SS	1.0	0.4	2.9	32.3	63.5
	late SS	2.2	0.1	0.4	17.8	79.5
Recovery	DS	0.1	19.0	16.2	35.5	29.1
	early SS	0	10.5	12.7	34.8	42.0
	mid SS	1.0	20.3	13.0	29.9	35.7
	late SS	2.2	33.9	16.8	21.9	25.2

Table S4. All conditions that elicited a jump response and the number of jump occurrences. Results from all participants are shown in the table.

Magnitude (cm)	Direction	Timing	Jump Occurrences
15	lateral (pink)	late single stance	8
15	antero-lateral (red)	late single stance	5
15	antero-lateral (red)	mid single stance	4
15	lateral (pink)	mid single stance	4
10	lateral (pink)	late single stance	3
10	antero-lateral (red)	late single stance	1
15	antero-medial (yellow)	late single stance	1
15	medial (green)	double stance	1