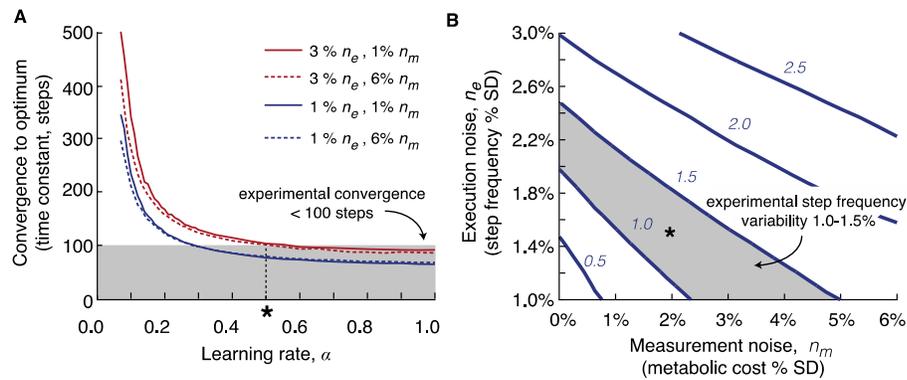
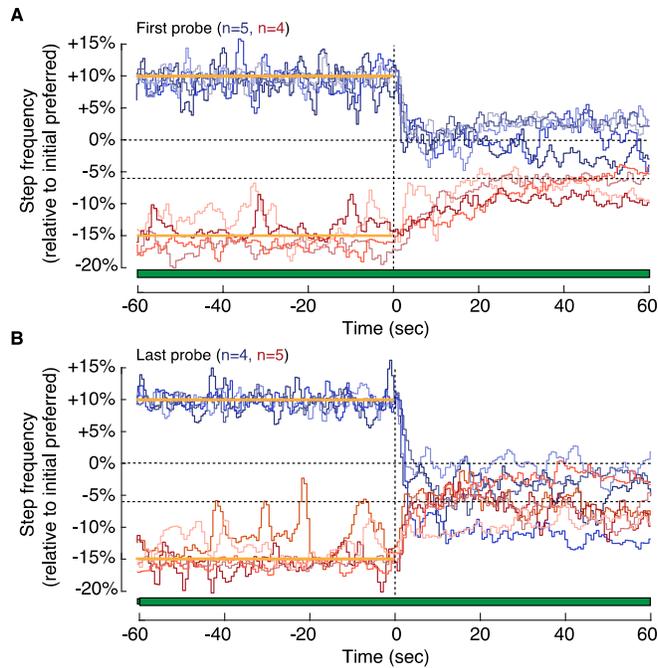


**Fig. S1. Discrimination plot of spontaneous and non-spontaneous initiators.** We defined spontaneous initiators as having a final step frequency during the First Experience Period consistent with the expected optima ( $-3SD$  from the initial preferred step frequency, or approximately  $-5\%$ , x-axis), as well as displaying a significant change in step frequency from that displayed immediately after the exoskeleton was turned on (significantly different from  $0\%$ , y label). Although the above statistics, and not simple thresholds, were used for each criteria, the dashed lines illustrate roughly how each criteria divided the data.



**Fig. S2. Sensitivity analysis of model parameters.** (A) Effect of varying the learning rate parameter on the rate of converge to the energetic optimum for different measurement and execution noise levels. The shaded region represents a reasonable convergence rate given that observed experimentally (maximum 100 steps), while the asterisk and dashed vertical line represents the chosen learning rate parameter value used in simulation (0.5). (B) Effect of varying measurement and execution noise on variability in steady state step frequency. Learning rate was kept constant at 0.5. Each line and the associated italic number represents a constant value of steady state step frequency. The shaded region represents reasonable steady state step frequencies given that observed experimentally (1.0% to 1.5%). The asterisk represents the chosen measurement and execution noise parameter values used in simulation (2.0% and 1.5%, respectively).



**Fig. S3. Individual participant effect of experience direction during first and last step frequency probe.** Step frequency time-series data for the first (A) and last (B) probes following experience either high (blue) or low (red) step frequencies for individual participants. The horizontal bars indicate when the controller is turned on (green fill) and off (white fill), and the yellow lines indicate the prescribed metronome frequencies.

**Table S1. Participant numbers per protocol.** We initially tested nine participants in each of the three Second Experience Periods. To account for a high number of spontaneous initiators in the Self Guided Broad Experience Period we added an additional two participants to this group to rebalance our conditions. To achieve the statistical power necessary to investigate the interaction between high and low cost experience, as well as the order of the experience, we added an additional seven participants to the Metronome Guided Discrete Experience group, one of which we found to be a non-spontaneous initiator. In total, we tested 36 participants, six of which were classified as spontaneous initiators and 30 which were non-spontaneous initiators.

Second Experience Period	Initial participants		Added to rebalance		Added to explore high low		Total participants		
	Spont.	Non-Spont.	Spont.	Non-Spont.	Spont.	Non-Spont.	Spont.	Non-Spont.	All
Metronome Guided Discreet	1	8	0	0	1	6	2	14	16
Metronome Guided Broad	1	8	0	0	0	0	1	8	9
Self Guided Broad	3	6	0	2	0	0	3	8	11
Total	5	22	0	2	1	6	6	30	36