Supplementary Information: Imagery of movements immediately following performance allows learning of motor skills that interfere

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To encourage uniformity of movement kinematics, we placed constraints on the timing of participants' reaches (see Methods). If unperturbed movements to the central target were substantially different for the two possible secondary targets, this could have facilitated learning [4, 5]. Therefore, we examined whether the kinematics of pre-exposure movements to the central target within each group depended on which secondary target (±45°) was displayed.

We extracted position data from when the hand left the starting location until 50 ms after it entered the central target. We tested for baseline differences in peak speed, movement duration (which covaries with peak speed), maximum signed lateral deviation and path length. Preparatory neural activity has been shown to differ as a function of peak speed [1], hand path curvature [3], and movement extent [2, 6, 7], and such differential activity during planning might affect learning.

For each group and kinematic measure we performed a repeated-measures ANOVA on the pre-exposure null trials as a function of follow-through direction (±45°). Of the 20 tests (Table 1), we found one marginally significant difference (motor imagery path length, p=0.046), however the mean difference in path length between left and right secondary target positions was only 0.13cm, which other studies have shown is insufficient to drive learning [5].

Table S1. Movement kinematics on pre-exposure (null field) trials do not depend on secondary target position. Data are for the movement to the central target, and from a single start position ($0°$). δ is the difference between mean measures for each target ($+45°$ target minus $-45°$ target).

	Follow-through			Planning only			No motor imagery			Motor imagery			Motor imagery no fixation		
Measure	δ	$F_{1,7}$	p	δ	$F_{1,7}$	p	δ	$F_{1,15}$	p	δ	$F_{1,15}$	p	δ	$F_{1,7}$	p
Lateral deviation (cm)	-0.26	0.49	0.507	-0.37	0.85	0.387	-0.12	0.93	0.350	-0.27	2.96	0.106	-0.52	3.54	0.102
Path length (cm)	-0.01	0.00	0.953	-0.45	4.76	0.065	-0.01	0.02	0.901	-0.13	4.72	0.046	0.11	0.96	0.361
Duration (s)	-0.01	0.06	0.807	-0.03	0.56	0.478	-0.00	0.55	0.472	-0.01	1.06	0.319	0.01	0.14	0.724
Peak Speed (cm/s)	-0.8	0.69	0.434	-0.6	0.15	0.711	-1.0	2.16	0.163	-0.8	2.12	0.166	0.1	0.02	0.890

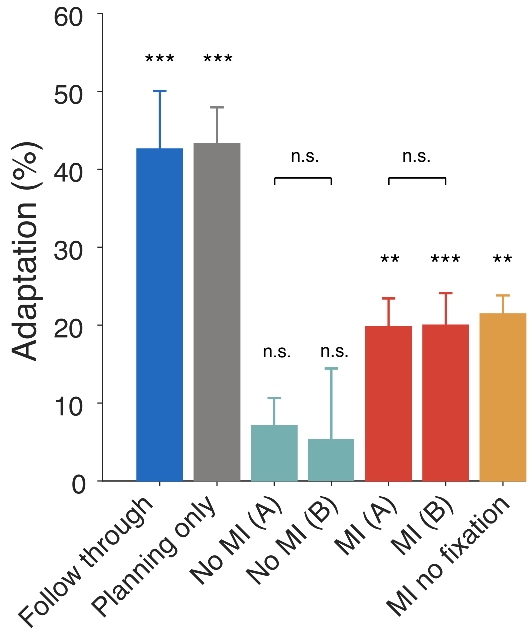

Figure S1. Final adaptation for all subgroups Final adaptation measured on follow through channel trials for all participants across the subgroups of the motor imagery group (MI (A) and MI (B)) and the no motor imagery group (No MI (A) and No MI (B)) (mean ± s.e. of final six blocks of exposure). The subgroups denoted by (A) performed the post-exposure phase immediately after the exposure phase, and the subgroups denoted by (B) performed an additional phase in which we included channels on the non-follow through trials. Asterisks show statistical significance of final adaptation level compared to pre-exposure. MI = motor imagery; n.s. = not significant.

References

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