

Online changes in movement representations could be preserved in memory for at least 500ms

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Summary

Humans adapt to mechanical perturbations within tens of trials, but how quickly this process influences motor behavior has only been recently investigated. Recent findings suggest that adaptive feedback control happens within trial, ie, corrective movements can be tuned to the specific perturbation of each individual trial. This was highlighted in our previous work with a reaching experiment in which participants had to stop at a via-point located between the start and the goal. On catch trials, we applied a force field during the first part and then unexpectedly switched it off at the via-point. Our results highlighted an after effect when participants exited the via-point in less than 500ms, which is consistent with standard adaptation scenarios. These previous observations raised the question of whether the after-effect evoked within the sequence was similar to standard sustained and long-lasting after-effects, or whether it would be rapidly forgotten because of the fact that it resulted from transient disturbances. In such case, as we are studying reaching adaptation in a very rapid time scale, one could expect that the movement corrections would be lasting for a short time. The aim of the study was to investigate how long changes in movement representations lasted within the trial. For this, we have studied the same reaching task through a via-point on the pathway in two situations: one without any strict instruction about the residing time in the via-point (NoDwell) and the second with an imposed 500ms dwell time in the via-point (Dwell). When there is no instruction about the dwell time, the presence of an after effect to the movement correction became evident as the hand path deviation after the via-point that was opposed to the perturbation that was present before the via-point. However, comparable after effect is observed when there is a 500ms dwell time at the via-point. This supports the view that online corrections to force field perturbations within the movements could be preserved in the memory for at least 500ms of resting time. As such, the within sequence adjustments of reach representation highlighted without dwell time, which produced an after effect in less than 500ms, almost certainly shares most features with after effects observed from trial to trial in standard adaptation experiments. In conclusion, our data further support that the fast time scales of motor adaptation are sufficiently fast to complement feedback and adapt an on-going movement.