

Task Dependent Modulation of Adaptation



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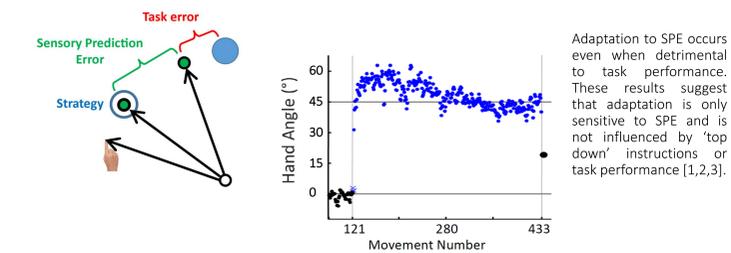
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Overview

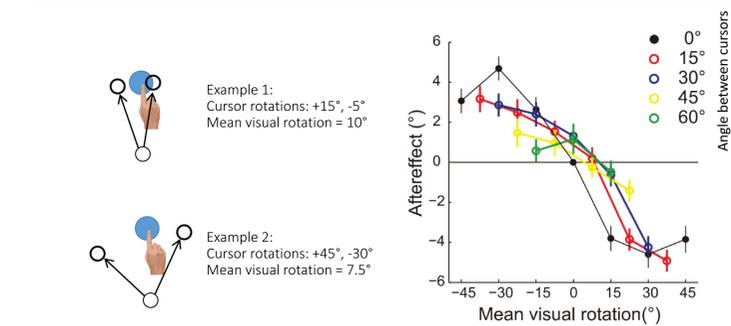
We ask if implicit adaptation is sensitive to task instructions by varying the relevance of different feedback signals. We examine this issue by manipulating the relevance of the cursors (experiment 1) or the relevance of the targets (experiment 2).

Background

Adapting to sensory prediction errors (SPEs) is obligatory



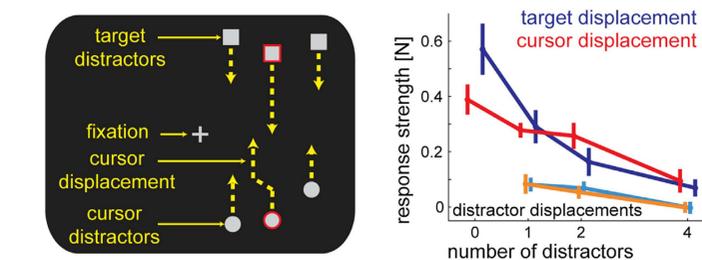
Adaptation responds to the mean of multiple (equally relevant) cursors



Using single-trial probes, Kasuga et al (2013) examined adaptation in response to multiple simultaneous cursors [4]. Responses were well modelled as the average of the two cursors. In this experiment, the multiple cursors were interleaved unexpectedly with single cursor trials. As such, both cursors were equally relevant to the task.

We present multiple cursors on every trial throughout a training block, and manipulate the task relevance of each cursor. If adaptation is insensitive to task relevance, our findings should mirror those in Kasuga et al (2013).

Online feedback control is sensitive to cursor relevance



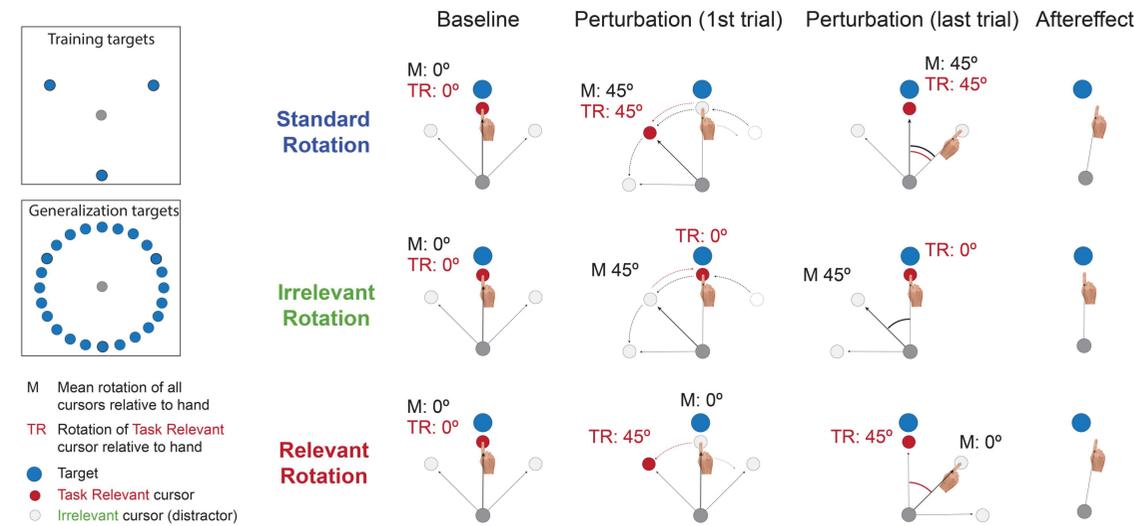
Reichenbach et al (2014) measured online corrective movements in response to cursor and target displacements in the presence of multiple cursor and target distractors [5]. Responses to the relevant cursor and target displacements were significantly greater than responses to displacements of the distractors.

Whether a similar effect occurs for trial by trial adaptation is the focus of this study. If adaptation is sensitive to the task relevant cursor, the aftereffect should be determined by the task relevant cursor, relative to task irrelevant cursors.

References

- Mazzoni & Krakauer 2006
- Taylor & Ivry 2011
- Morehead, Taylor, Parvin, Ivry 2017
- Kasuga, Hirashima, Nozaki 2013
- Reichenbach, Franklin, Zatzka-Haas, Diedrichsen 2014

Adaptation is sensitive to cursor relevance

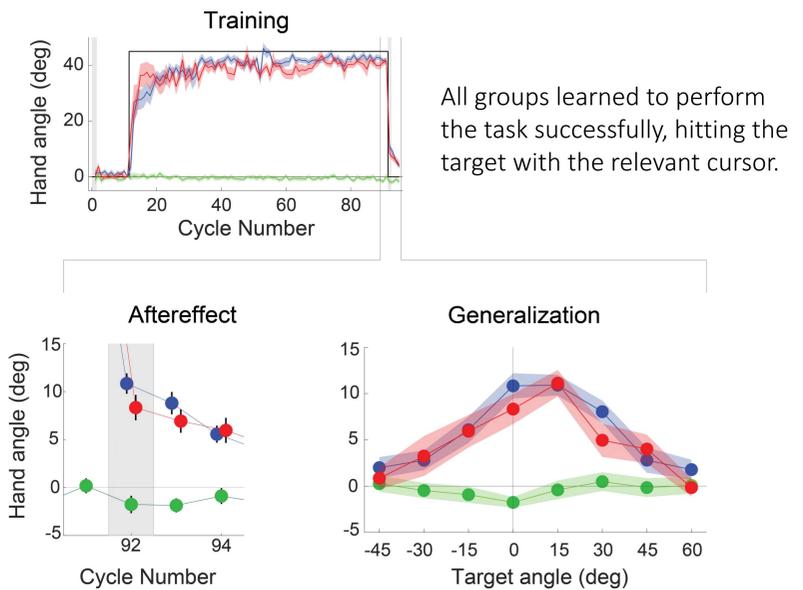


Task: Hit the target with the RED cursor. Ignore the white cursors

Predictions

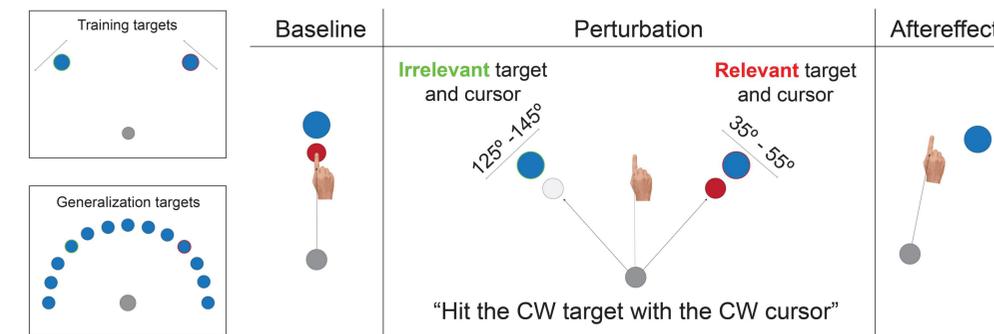
If adaptation is sensitive to task relevance → Aftereffects for Relevant Rotation group

If adaptation is not sensitive to task relevance → Aftereffects for Irrelevant Rotation group



Aftereffects were similar for the Standard Rotation and Relevant Rotation groups, and negligible in the Irrelevant Rotation group, consistent with adaptation being sensitive to the task relevance of the cursor.

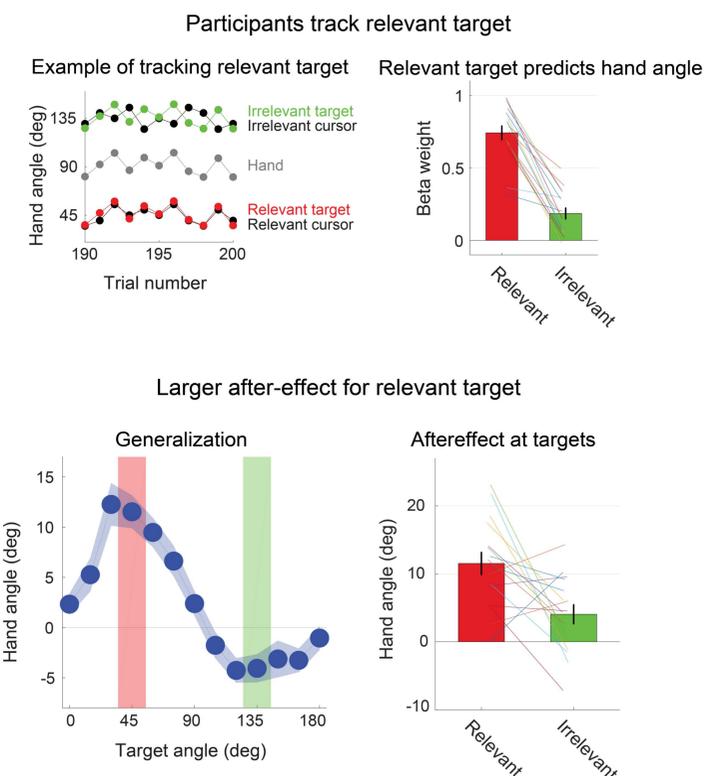
Adaptation is sensitive to target relevance



In perturbation trials, two targets are presented, on average at 45° and 135°. Exact target locations were independently jittered by +/- 10°.

Task goal was to hit the task-relevant target with the red cursor. Other target/cursor was irrelevant.

Participants were successful at tracking the relevant target over the irrelevant target (top right). Aftereffects were significantly larger for the relevant target than for the irrelevant target, consistent to adaptation being sensitive to task relevance (right).



Conclusion

- In the context of multiple feedback signals, adaptation was sensitive to the relevance of the feedback.

- Similar to biased competition models of visual attention, the task-relevant target and cursor may provide the main input for the adaptation system.
- Interestingly, with two targets and two cursors, adaptation appeared to occur at the irrelevant target as well.