Task Dependent Modulation of Adaptation

Darius E. Parvin1, J. Ryan Morehead2, Alissa R. Stover4, Kristy V. Dang4, Richard B. Ivry1
University of California, Berkeley1, Harvard University2

darius@berkeley.edu
ivrylab.berkeley.edu

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 to SPEs occurs even when detrimental to task performance. These results suggest that adaptation is only sensitive to SPEs and is not influenced by instructions, or task performance (1,2,3).

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. Responses were well modeled as the average of the two cursors. In this experiment, the multiple cursors were combined equally with task 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 the each cursor. If adaptation is sensitive to task relevance, our findings should mirror those in Kasuga et al. (2013).

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

Adaptation is sensitive to cursor relevance

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.