Compensating for a visuomotor rotation in the absence of sensory prediction errors

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Overview

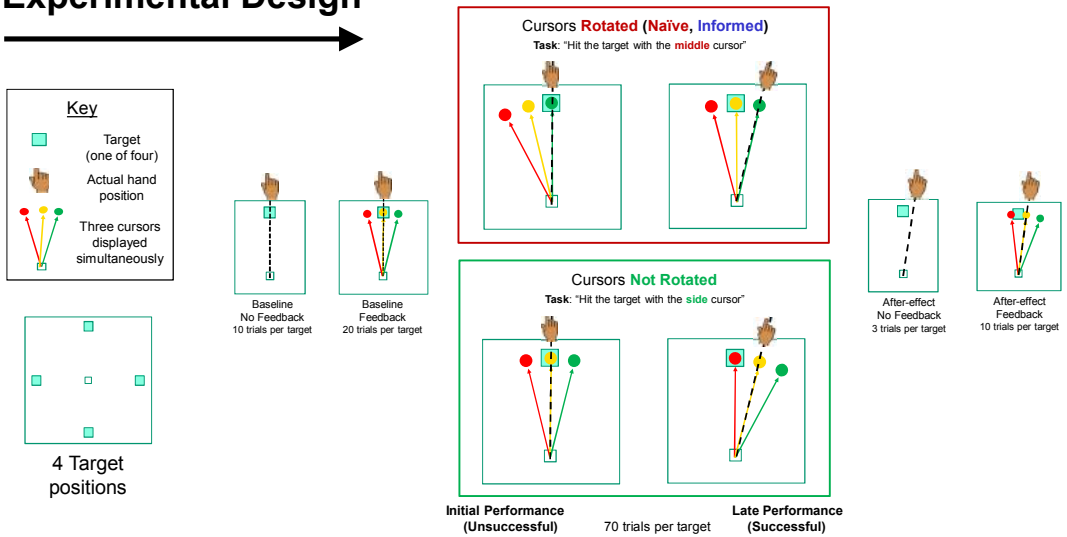
- Sensorimotor learning of a visuomotor rotation is considered to be driven by error-based learning.
- However, recent work has highlighted how performance on such tasks may reflect the operation of multiple learning processes.
- To distinguish between these processes, we devised a variation of a visuomotor rotation task in which error-based learning should be minimized.

Background

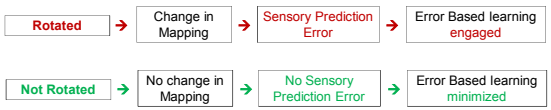
Examples of multiple learning phenomena involved in visuomotor rotation tasks:

- Savings
- Strategic aiming
- Generalization
- Influence of prior reaches

Experimental Design



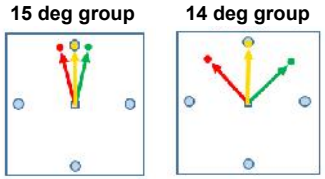
Minimization of Error Based Learning



Two rotation groups: In the first, participants were **naïve** about the rotation, in the second they were **informed** about the rotation.

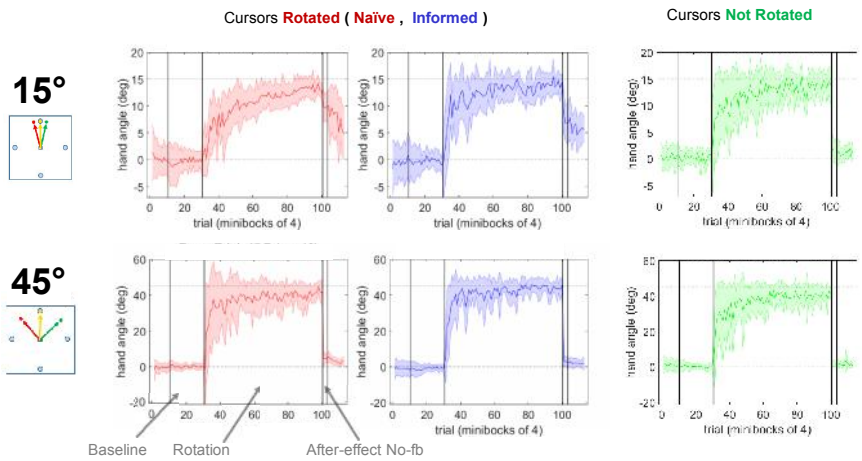
Small vs Large Rotation sizes

- Two versions of each task condition (left) were run. One where the angle between each of the three cursors was 15°, and one with 45°.
- For the rotation condition, the cursors were rotated by the same amount as the spacing between the cursors.

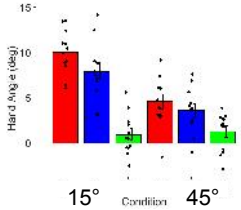


Results

Performance



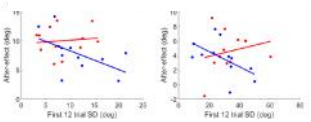
Aftereffects



- No significant after-effect for the Not Rotated condition
- Less after-effect in 45° than 15°
- Reduced after-effect for Informed participants

Trial by trial Variation vs Aftereffects

- Did strategic aiming attenuate aftereffect for the rotation groups?
- We correlated variance during initial learning against aftereffect. Similar analysis also done with variance at asymptote of learning.
- Negative correlations were trending for informed groups, but not significant (p = 0.06, p = 0.06)



Conclusions and Questions

- Participants in the Not Rotated condition learned an equivalent rotation behavior but not via error based learning.
- Smaller aftereffects in the 45° group compared to 15° group could be due to increased visual blurring/feedback uncertainty (Kasuga et al. 2013, Wei & Kording 2010)
- Informing participants about the rotation could increase explicit awareness and encourage the use of a strategy, shifting the peak of adaptation.
- **Future**: Characterizing non-adaptive learning mechanisms for different target distributions? (Verstynen & Sabes 2011)