It wasn't me: The role of source attribution on proprioceptive recalibration and updating predicted sensory consequences

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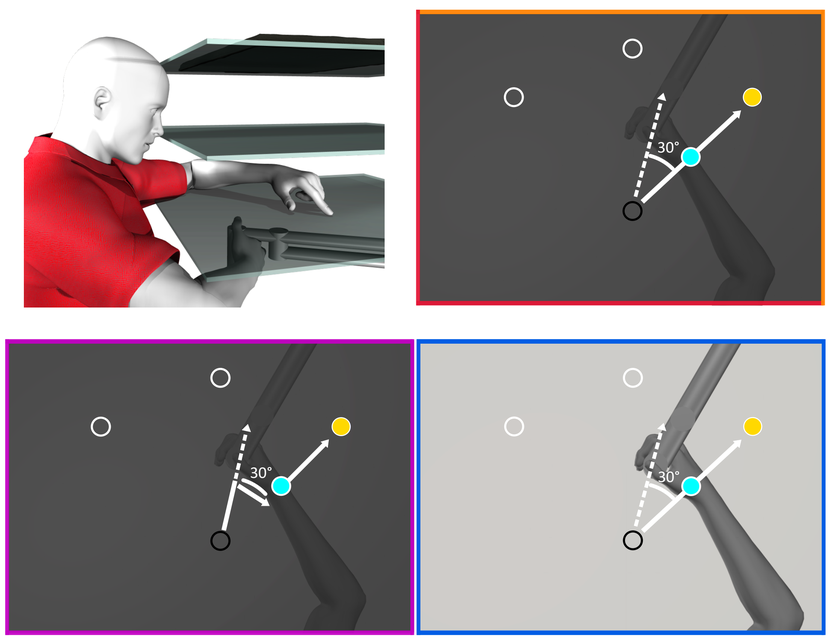
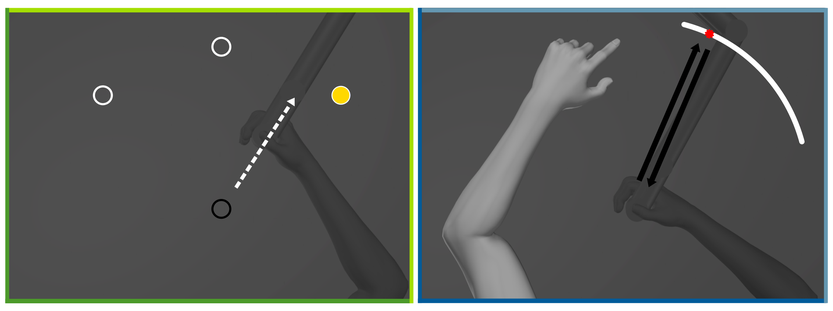
Source attribution and motor adaptation

People account for the source of motor errors during adaptation within dynamic conditions. When visual feedback of the hand is altered, adaptation involves updating hand position estimates based on both proprioception and efferent-based predicted sensory consequences. Updates in hand position estimates should not persist with explicit knowledge of the external nature of the visual perturbation. Here, participants trained to reach with a 30° rotated hand-cursor, and we manipulated the extent of external error attribution.

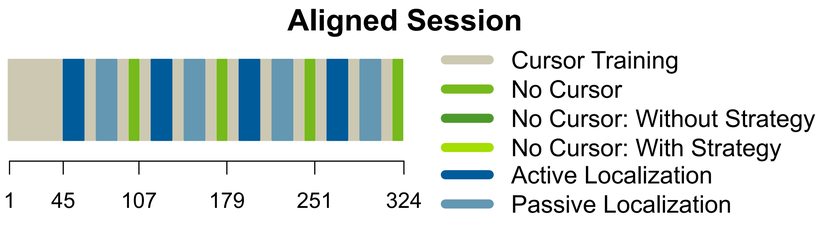


- non-instructed group (n=20): control, received neither instructions nor different visual stimuli
- instructed group (n=21): received a counter-strategy for the rotation
- cursor jump group (n=20): saw the rotated cursor mid-reach on every trial
- hand view group (n=29): saw their actual hand along with the rotated cursor on every trial

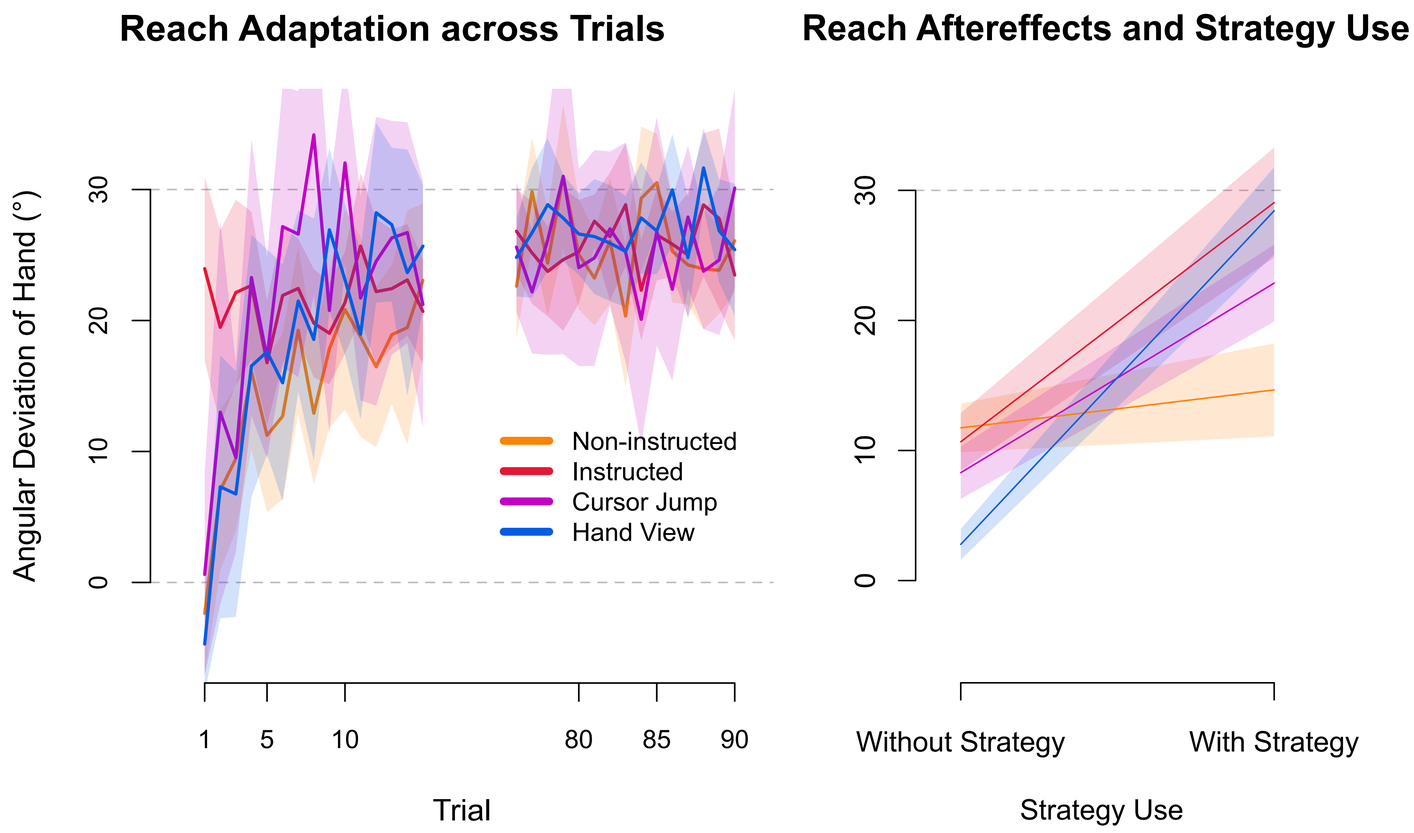


No Cursor reaches
- With Strategy
- Without Strategy

Hand localization
- Active Localization: Participants generated their own movement, allowing hand localization with both proprioception and efferent-based predictions.
- Passive Localization: Robot moved the hand of the participant, allowing hand localization with only proprioception.

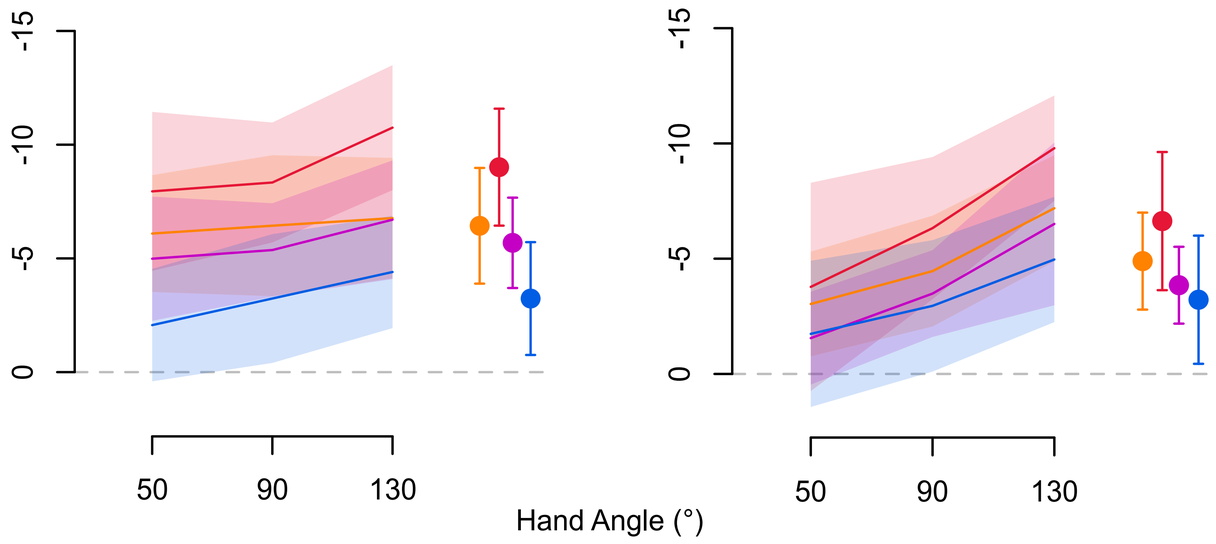


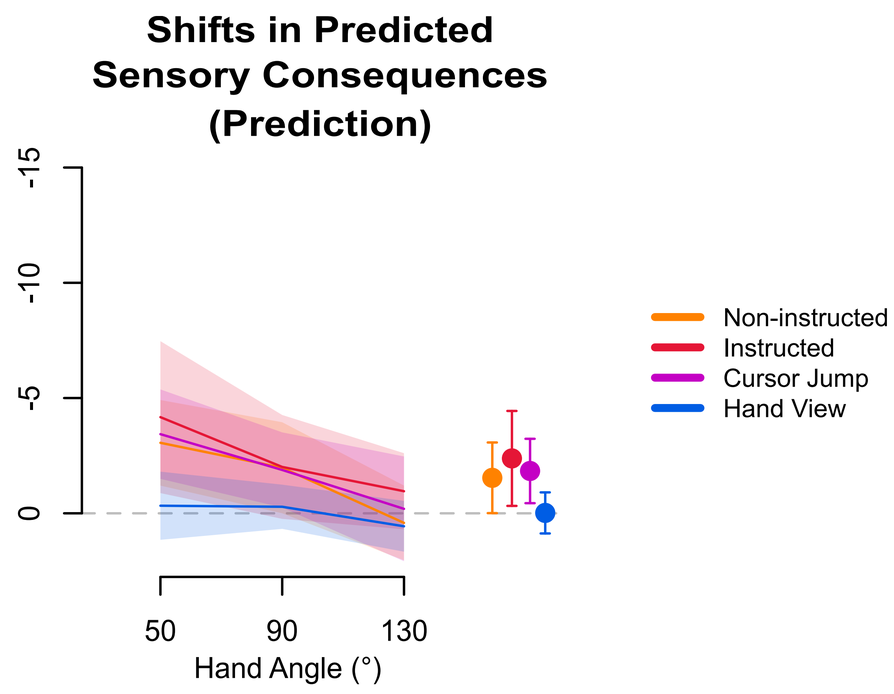
External error attribution increases explicit learning



During training, the instructed group immediately countered for the rotation while other groups showed typical rates of learning. When asked to either use or not use any strategy developed to counter the rotation, only the non-instructed group could not do so at will. Moreover, reach aftereffects were present in all groups but were lower for the hand view group.

Effects of external error attribution on proprioception and predictions





Although the perturbation for the hand view group was clearly external in nature, implicit learning was still present and updates in proprioceptive estimates persisted. However, updates in predictions were dampened.

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