

An action system analysis of visuomotor learning

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Rationale

Visuomotor learning is a powerful tool to discover invariant aspects of action initiated events. We study such learning by investigating the generalization of a new relationship between throwing direction and projectile trajectory.

Research Question

Consider the adjustment in the direction of underhanded throws when throwing on a rotating carousel (I). We showed that stable adjustment is based on the visual event of launched projectiles [1].

The current study tests for generalization of such adjustment to different forms of throwing and to pointing. We hypothesized a generalization to functionally related forms of throwing as these might reflect the adjustment based on the visual event of launched projectiles.

Method

Studies had a pretest, experimental manipulation and posttest phase (II). During the experimental manipulation participants learned underhand throwing on the rotating carousel. In the pre- and posttests participants threw underhanded at stationary targets from a stationary position, and in addition either threw using a different form (overhanded or underhanded by the left arm) or pointed at the targets.

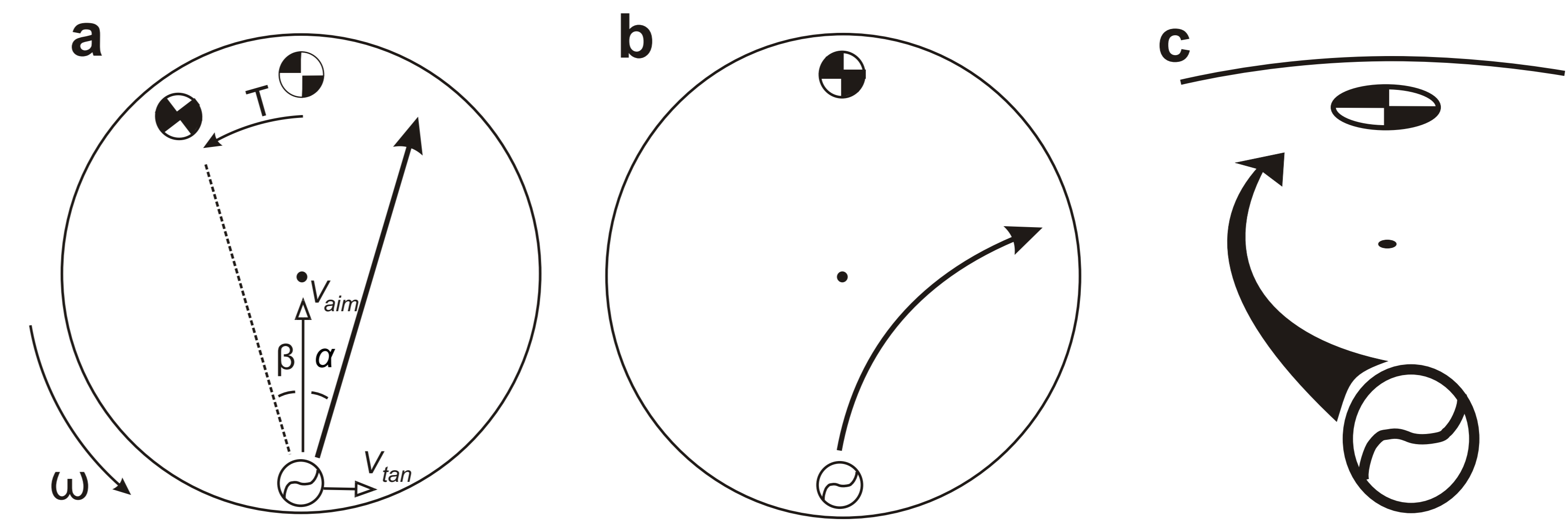
Results

Pretest/posttest comparisons revealed that adjustment in underhand throwing on a counterclockwise rotating carousel transferred to significant shifts in the direction of overhand throws (III-a) and throws by the left arm (III-b). No such transfer was found in the direction of pointing (III-c).

Conclusion

Adjustment in underhand throwing on the rotating carousel recalibrates the visual motor coordination of a system of throwing actions.

I: Adjustment of underhanded throws based in the visual event



Calibration based on the kinematics of the visual event for a carousel rotating counterclockwise. Throws miss the target when aimed directly towards the target. In 'a', a top view perspective -attached to earth- demonstrates the effects of the tangential velocity of the thrower (11°) and target (11°). In 'b', a top view perspective -rotating with the carousel- displays the curved path of a beanbag due to a fictitious force. Finally, in 'c', an illustration of a participant perspective which demonstrates the path of a beanbag for a throw that is adjusted for these factors.

II: Design of Studies

Pretest

Throwing/pointing while stationary
no visual & auditory feedback
2 x 16 trials

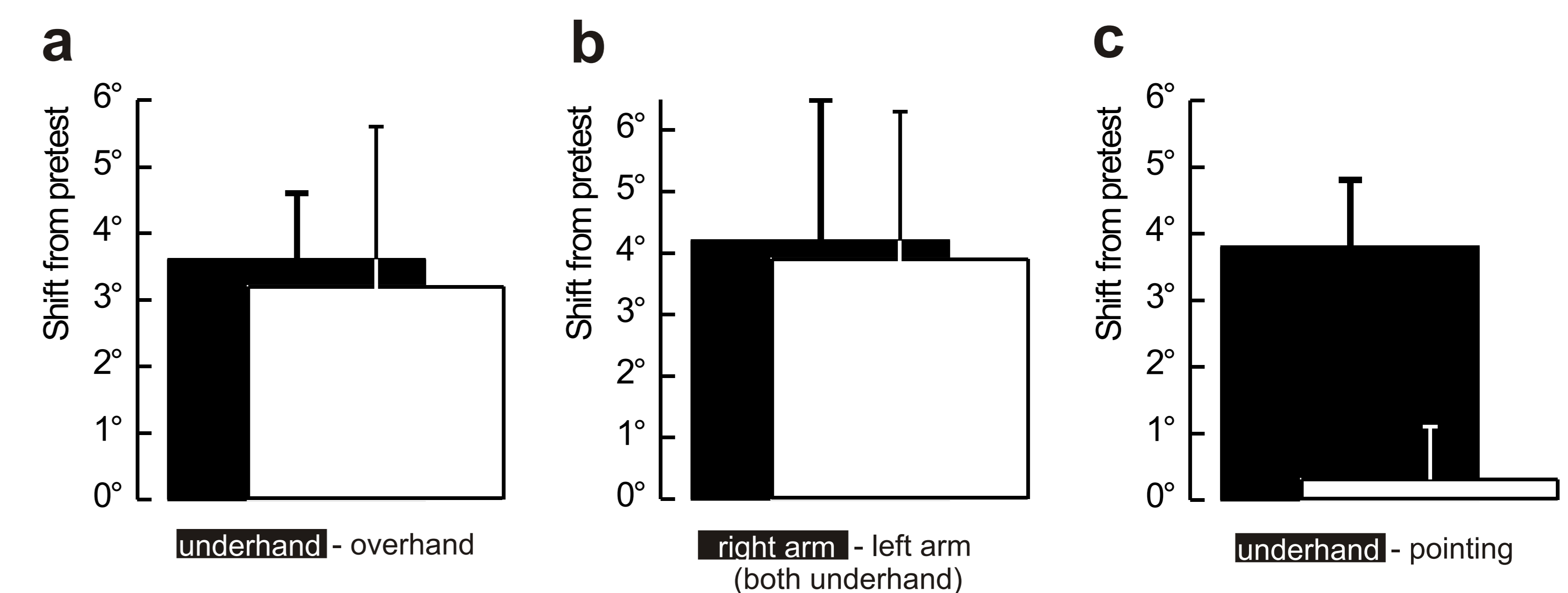
Experimental Manipulation

Throwing on rotating carousel
60 underhanded throws

Posttest

Throwing/pointing while stationary
no visual & auditory feedback
2 x 16 trials

III: Adjustment generalizes to functionally related forms of throwing, not to pointing



[1] Bruggeman, H., Eid, C. L., Rieser, J. J., & Pick, H. L. (2003). Alteration of the direction of throwing; multiple levels of adaptation. *Journal of Vision*, 3(9), 678a

This research was partially supported by a grant from the National Science Foundation to the University of Minnesota, NSF IIS-0121044, ITR/SY.