

# Reach aftereffects as a measure of implicit learning after abrupt and gradual visuomotor rotations

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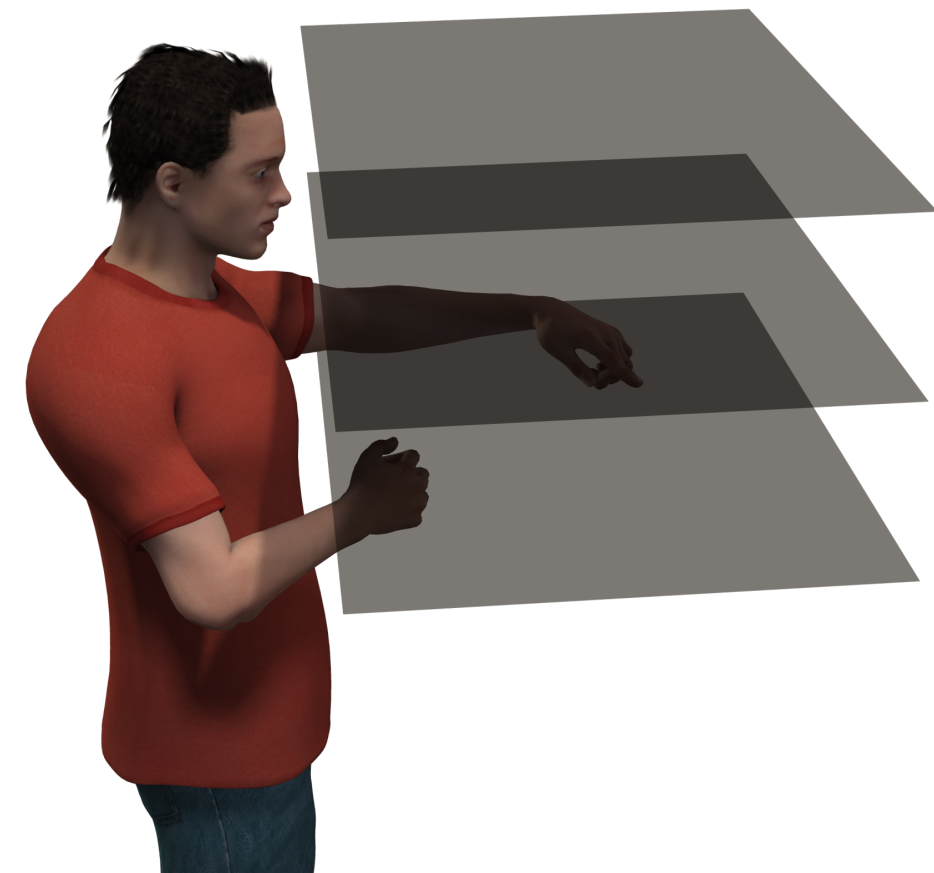
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## Visuomotor Adaptation And Implicit Learning

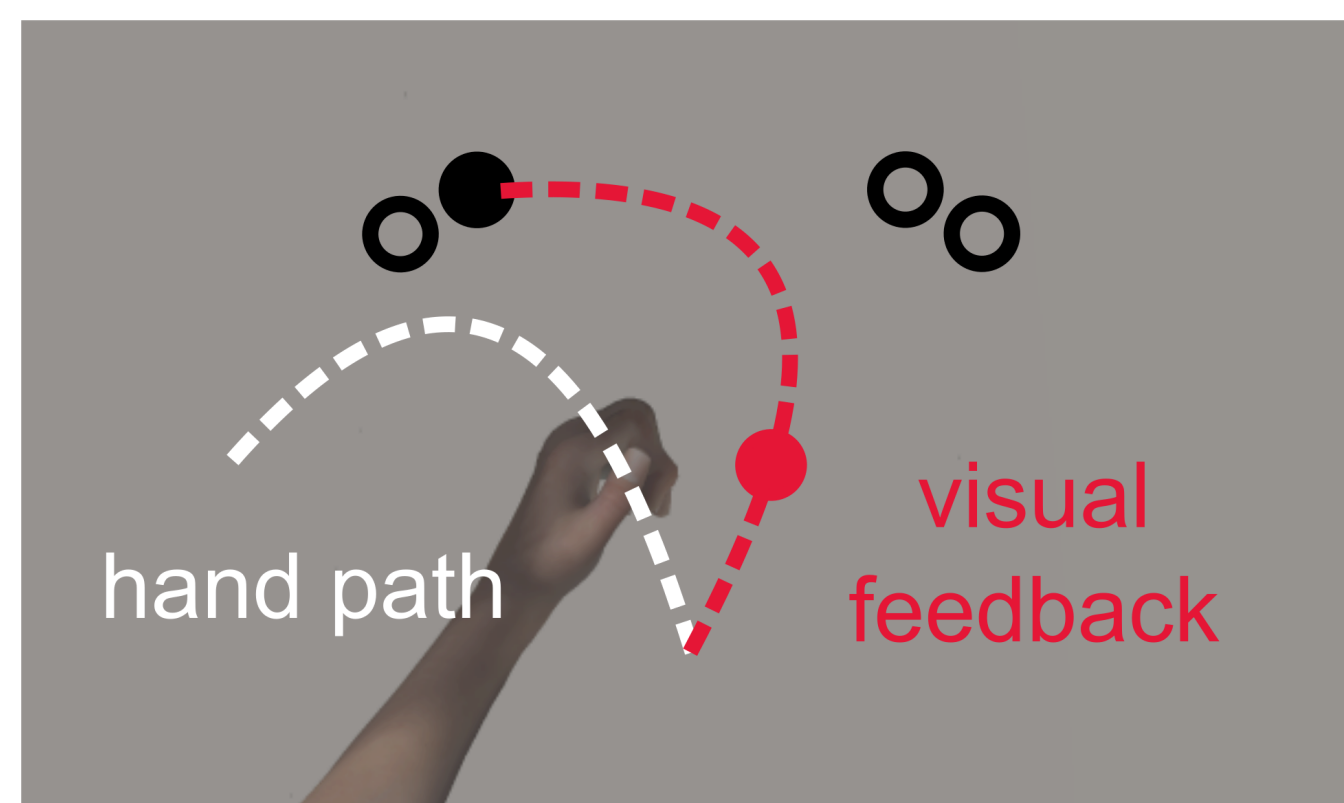
People have an incredible ability to learn new movements and adapt their movements to changing circumstances. Visuomotor adaptation involves adjustment of movements in response to repeated changed visual feedback. Motor adaptation engages both implicit and explicit learning processes. Implicit learning is automatic and harder to be suppressed, whereas explicit learning requires more effort but can be activated or deactivated at will. In this study, we look at how a higher contribution of implicit learning influences visuomotor adaptation, as measured in reach aftereffects and retention.

## Procedure and Apparatus

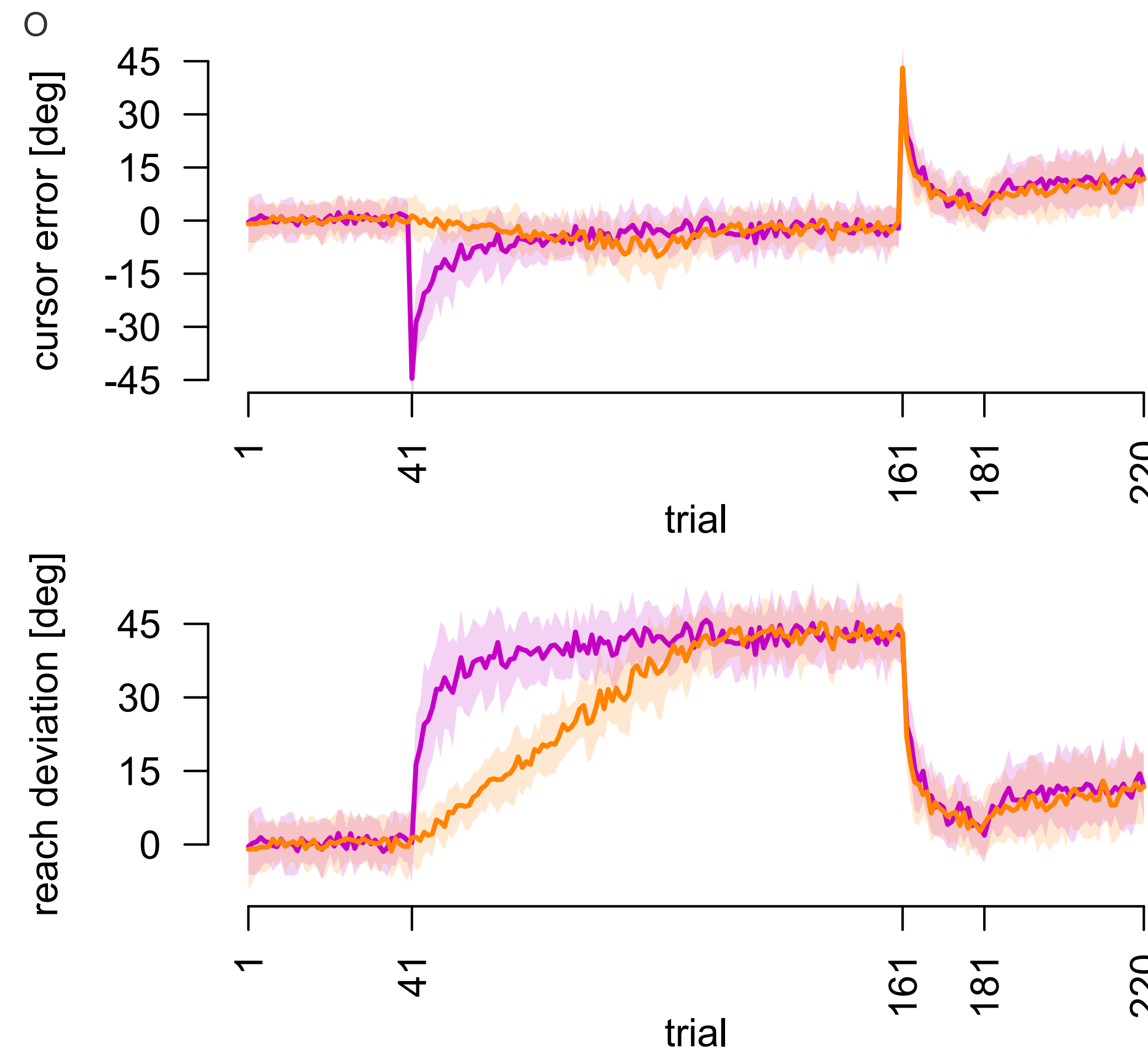
Participants reach to a target by moving the cursor with their unseen left hand on the tablet. We changed the contribution of implicit learning by introducing the visual feedback of cursor's rotation either abruptly or gradually.



gradually. After completion of training trials for both abrupt and gradual rotations, participants complete washout trials for which rotation is removed, followed by error clamp trials for which the rotation and visual feedback is removed.

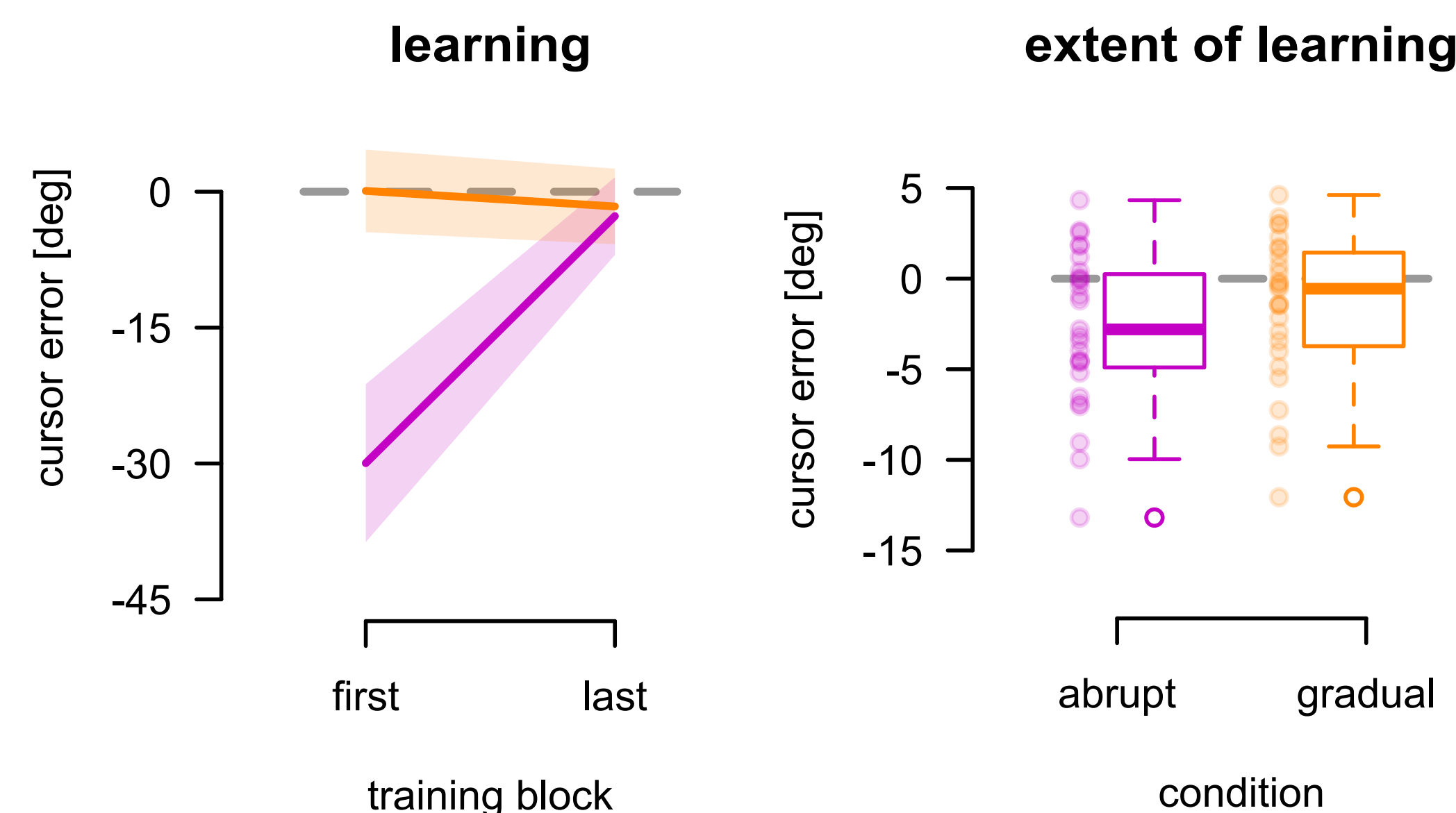


## Cursor Rotation and Error Measurements



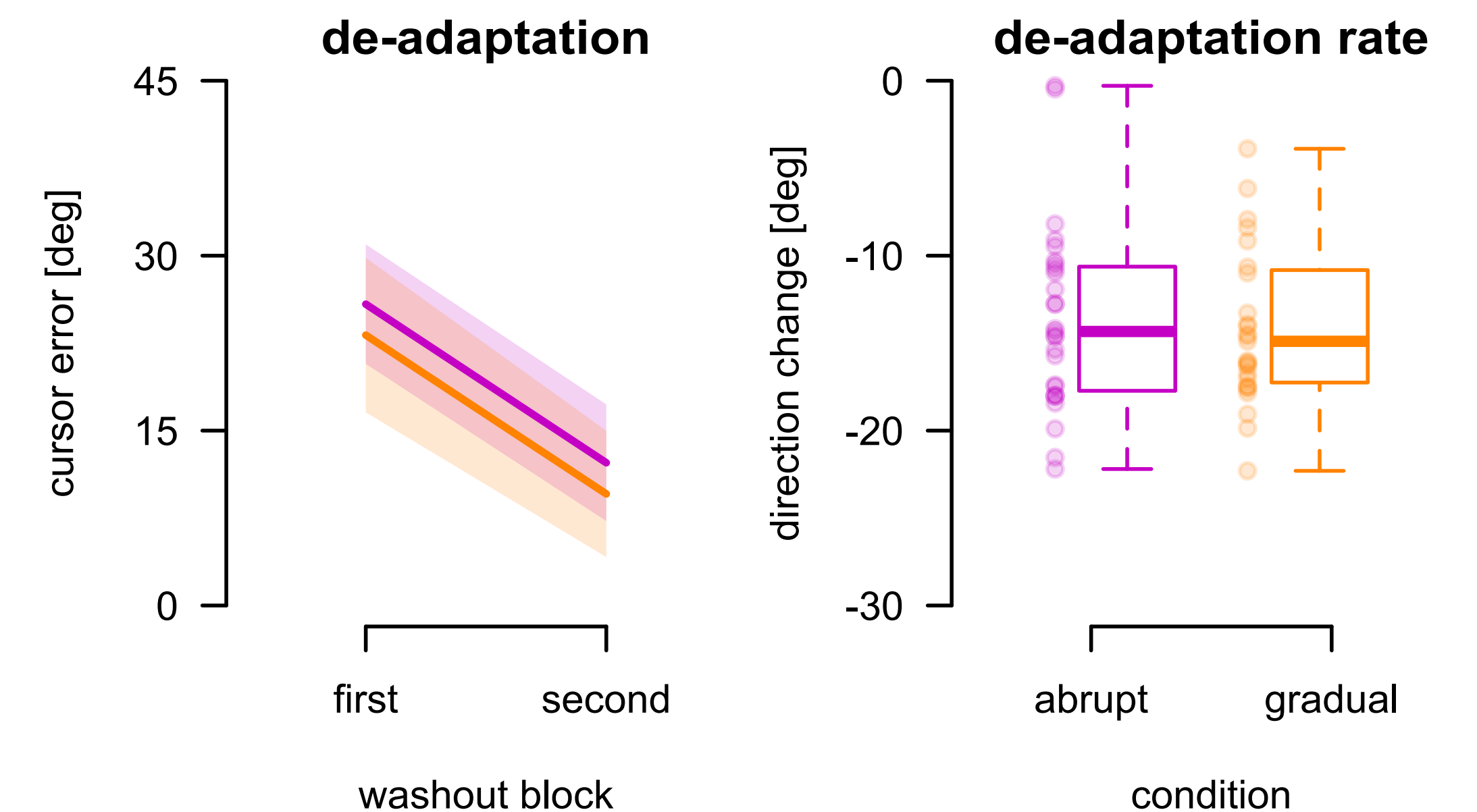
## Learning And Extent Of Learning

Training under gradual and abrupt rotation conditions, resulted in the same extent of learning.



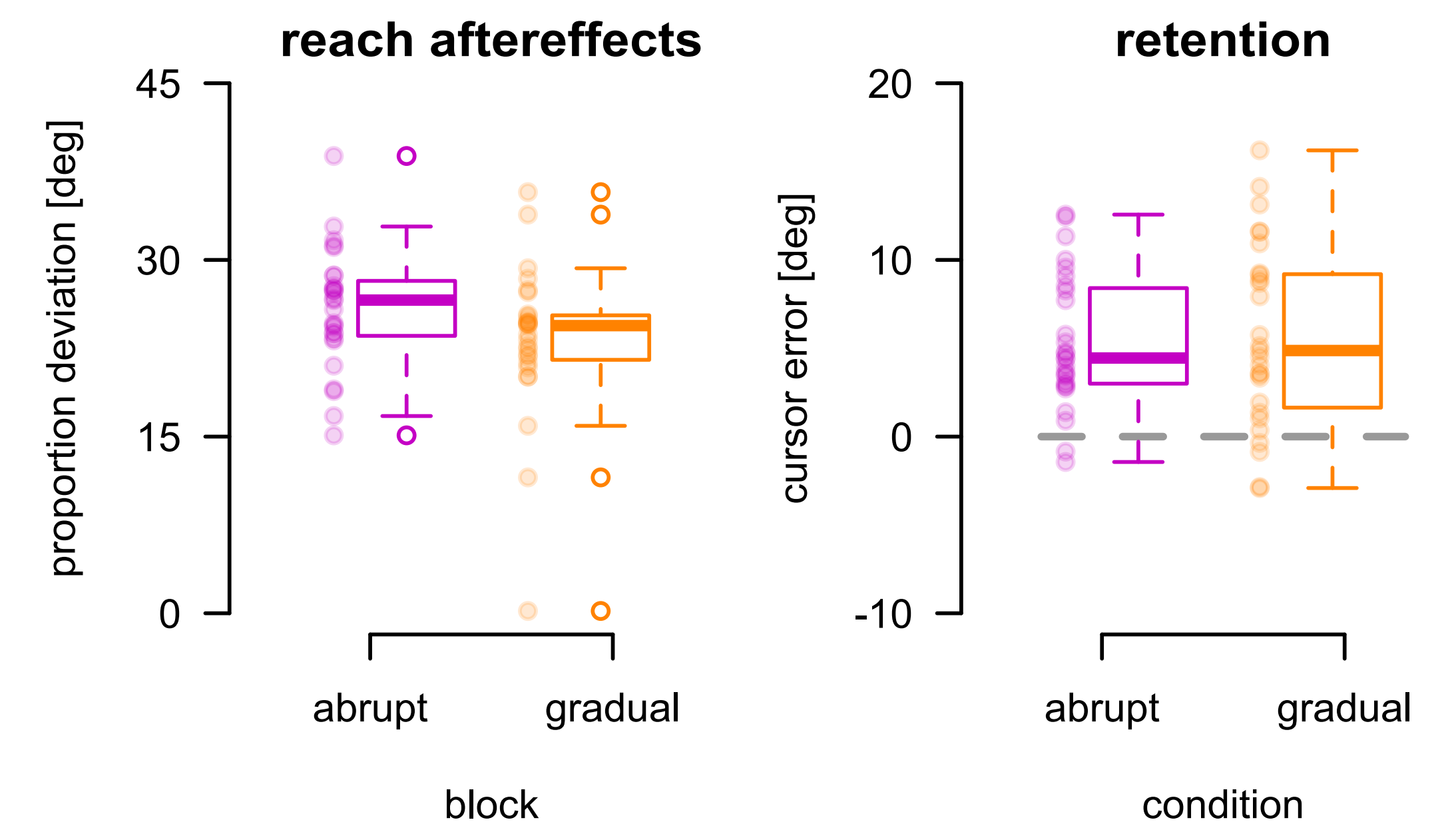
## De-adaptation and De-adaptation Rate

Cursor error measurements during washout trials show same rate of de-adaptation following training under gradual and abrupt rotation conditions.



## Reach-Aftereffects And Error Clamp measurements

Cursor error measurements show same level of reach-aftereffects and retention following abrupt and gradual rotation training.



**Gradual and abrupt learning result in equal adaptation, retention and reach aftereffects.**