Effect of Error Feedback on Implicit Adaptation

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How is Implicit Learning Influenced by Feedback?
People constantly adapt their movements to their changing circumstances, which is mostly handled by our automatic, unaware, or implicit motor adaptation systems. While the time course of these implicit processes is thought to be slow, this is actually largely unknown. Motor adaptation is usually induced by having people reach to targets with a cursor whose motion is misaligned with respect to their unseen hand. Here, I have tested the effects of various kinds of feedback of the unseen hand motion on the speed of implicit learning.

Experimental Procedure
All groups completed the same rotation schedule with different visual feedback (see below) and all trained with a cursor rotated 45°. After every training trial participants completed a no-cursor trial to probe implicit adaptation. By alternating between training and testing trials, we could measure the rate of implicit learning at a fine temporal resolution.

Aiming Direction - Explicit [°]  
Feedback Group  
Continuous  Terminal  Cursor Jump  
C  45°  
B  
Continuous  Terminal  Cursor Jump  
D  No Cursor  

Terminal Training Saturates Fastest

Aiming Direction - Explicit [°]  
Feedback Group  
Continuous  Terminal  Cursor Jump  

Continuous reaches  Terminal reaches  CursorJump reaches

Aftereffect Saturation Rate

Continuous reaches  Terminal reaches  CursorJump reaches

Error feedback affects the level but not the rate of implicit adaptation