Using tools as cues for dual adaptation to opposing visuomotor rotations in virtual reality

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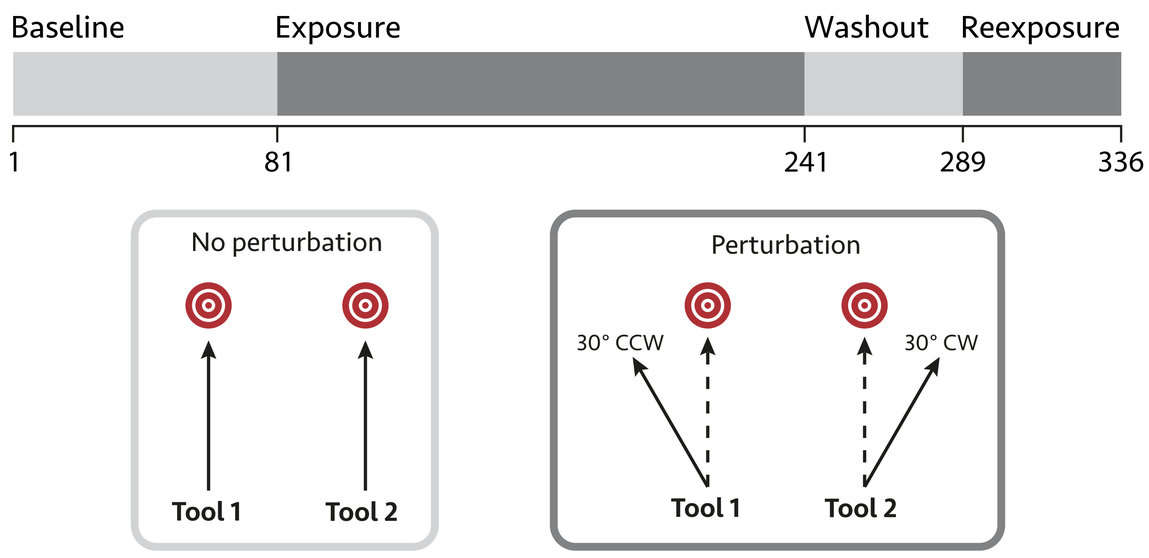
Contextual cues are important for dual adaptation

- Successful dual adaptation (concurrently adapt to two opposing perturbations) requires the use of contextual cues to form and retrieve separate motor memories.
- These cues can be extrinsic (e.g., change in background color) or intrinsic (motor-related).
- **Can we use different tools to cue opposing rotations during dual adaptation in virtual reality?**

Adaptation paradigm in virtual reality

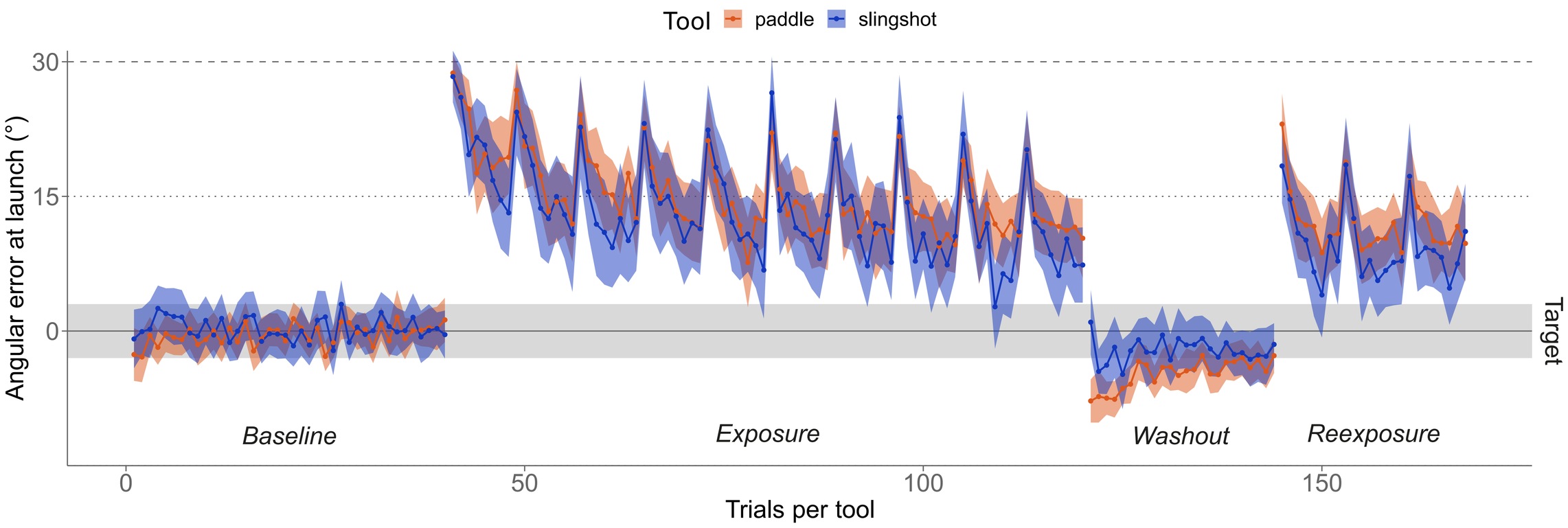
- In virtual reality, participants (N = 40) used two tools to move a ball towards a target:
  - **air hockey paddle** (forward movement)
  - **slingshot** (backward movement)

- Each tool was associated with one rotation (30° CW or CCW) applied to the moving ball.
- Dual adaptation: the tools **switched every 8 trials**.
- Single adaptation: **no switch** between the tools.

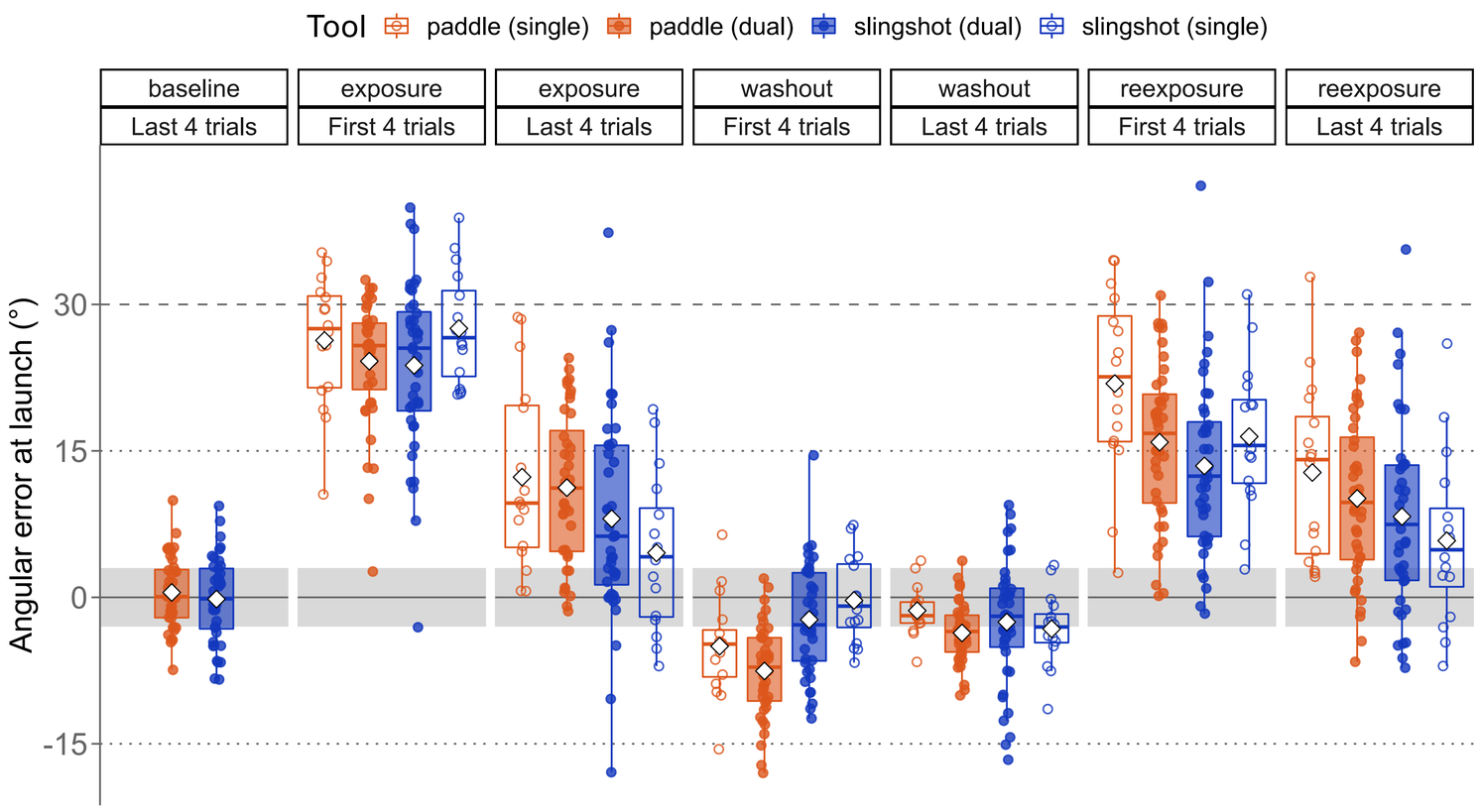


Trial-by-trial dual adaptation

N = 40



Individual errors in dual and single adaptation



For both tools, we observe:

- Large switching errors when changing tool
- Decreased errors at the end of exposure
- Small after-effects during washout
- Reduced initial errors upon reexposure

There was no significant difference between errors in dual and single adaptation.

Despite high switching costs, participants show complete dual adaptation compared to single adaptation.
Tools can be used as cues to form and recall separate motor memories during dual adaptation.

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