

Direction matters: Training in a 2-D racing skill acquisition task improves speed, accuracy, and path efficiency but depends on movement direction

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Skilled practice improves motor performance

People excel at acquiring new motor skills through the formation of sensorimotor mappings. However, most daily tasks benefit from refining movement execution, an understudied aspect of motor learning. Here, we test whether continued practice utilizes similar mechanisms as other motor learning types, using established measures from skill acquisition tasks.

Speed and accuracy improvements in a 2-D racing task

Participants used a stylus on a digitizing tablet to control a race car through a track as quickly and accurately as possible. They received lap-time and accuracy feedback, with the car turning red if it left the track, and could rest at a pit stop (yellow car).



Offline gains and performance generalization

Performance typically improves upon re-experiencing a task (offline gains). To test this, participants returned the next day and we assessed for further speed and accuracy improvements. We also tested how changes in the task may interfere with previous learning, by altering track orientation or reversing the movement direction.

Example experiment schedule

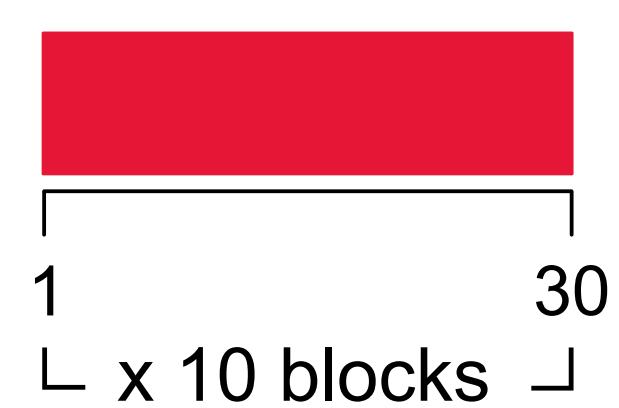
Study 1

Day 1: N = 45
Day 2: N = 43

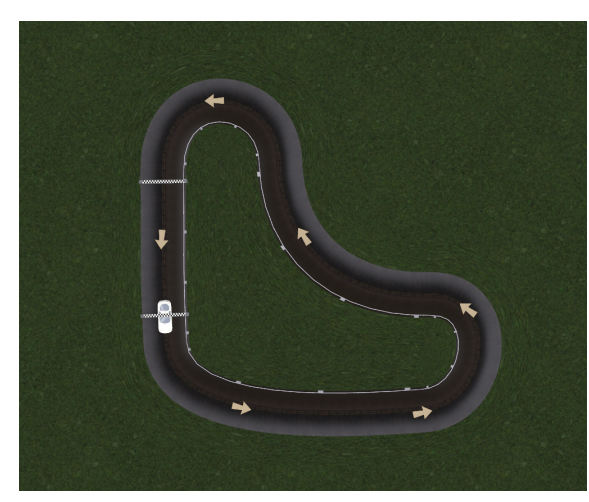
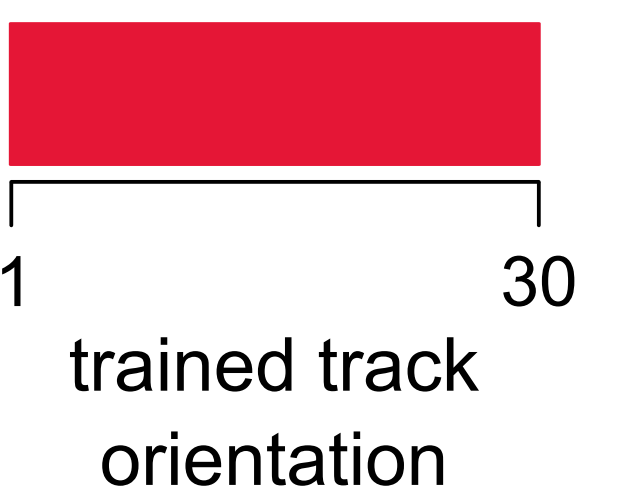
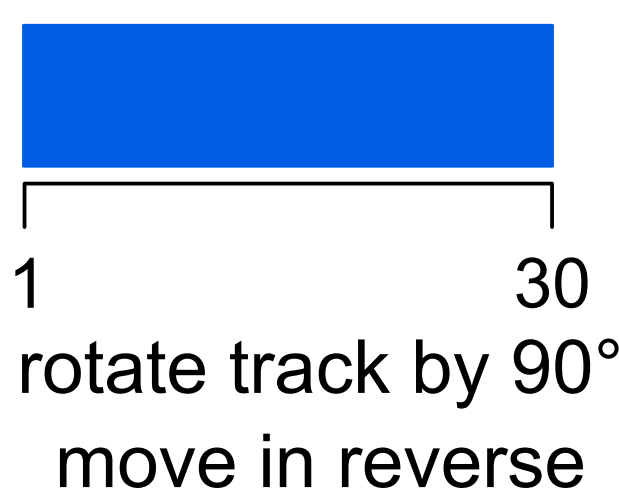
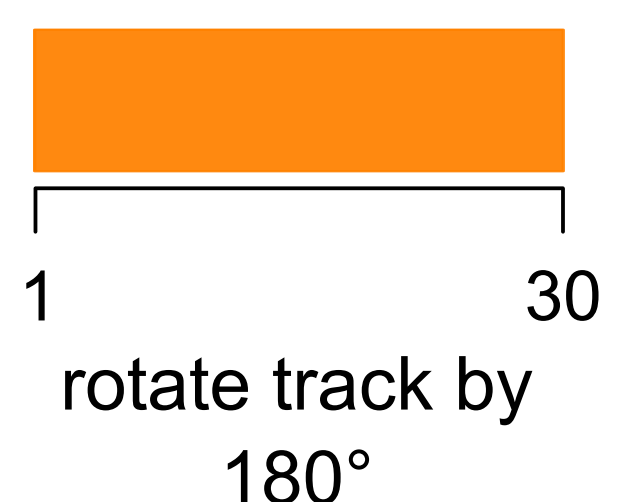
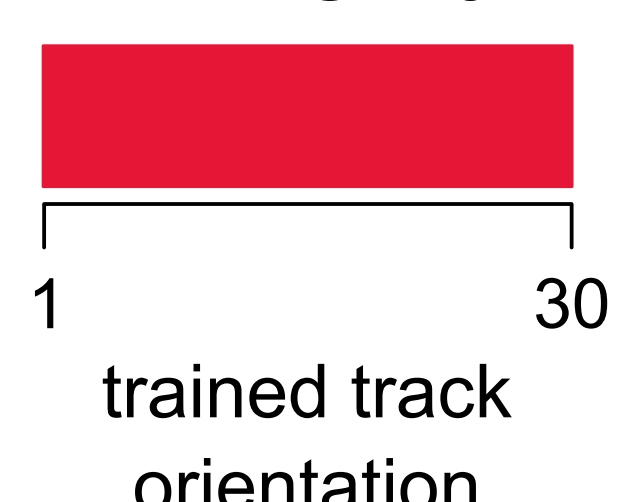
Study 2

Day 1: N = 38
Day 2: N = 36

training day 1



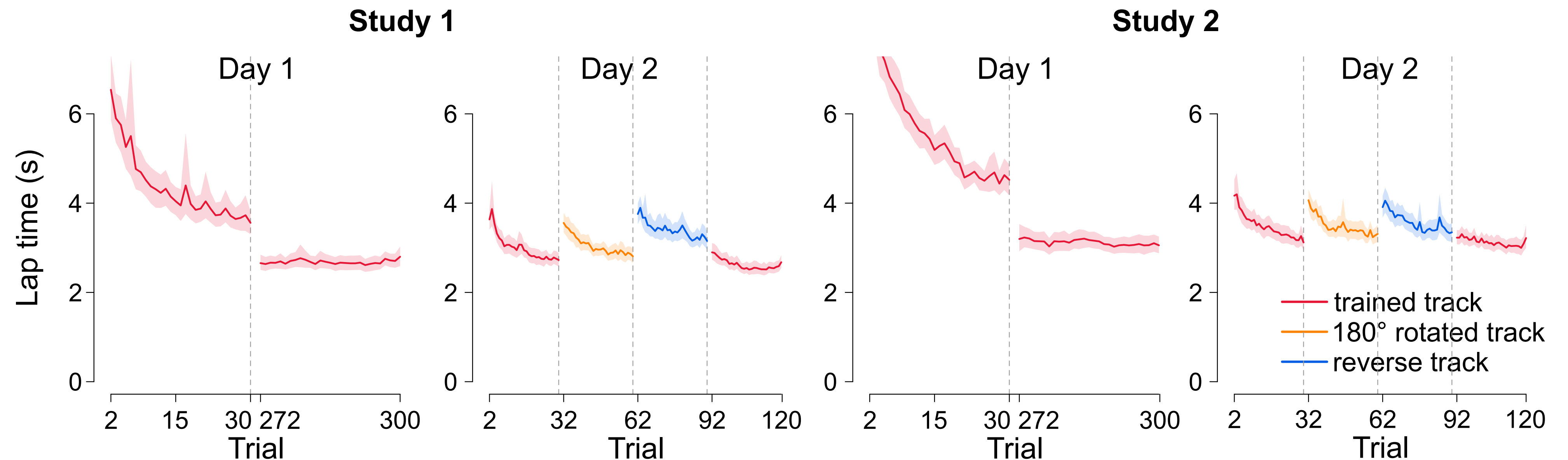
training day 2



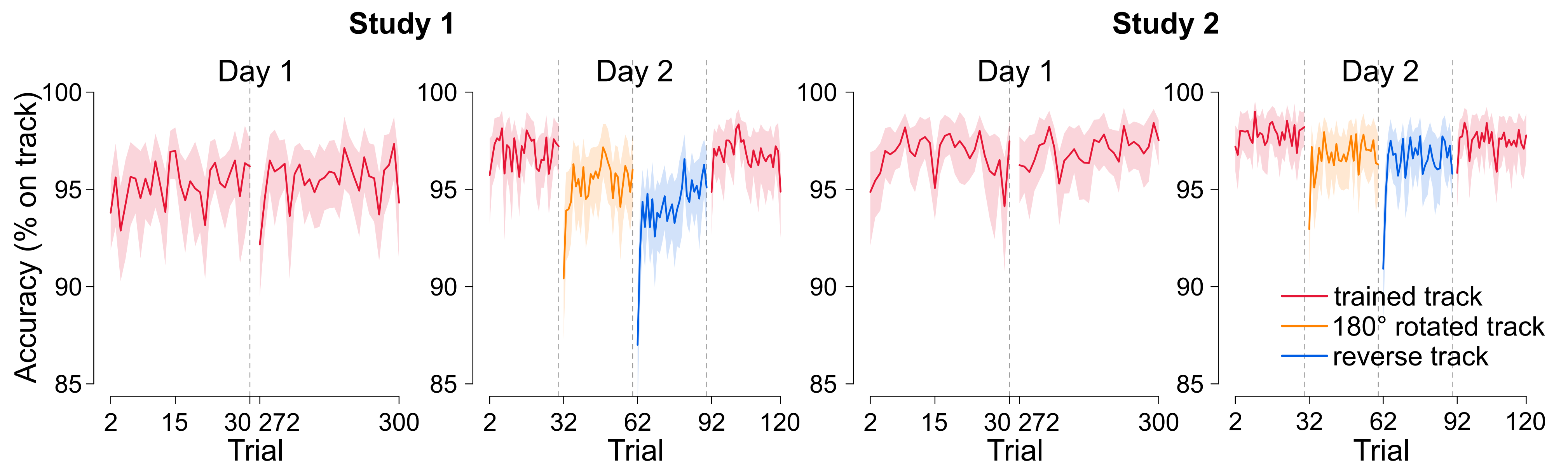
Movement precision is direction-dependent

Moving through the track in reverse reveals a movement direction effect (Study 1). Hence, in study 2, participants experienced the same experiment but trained on the reverse track instead.

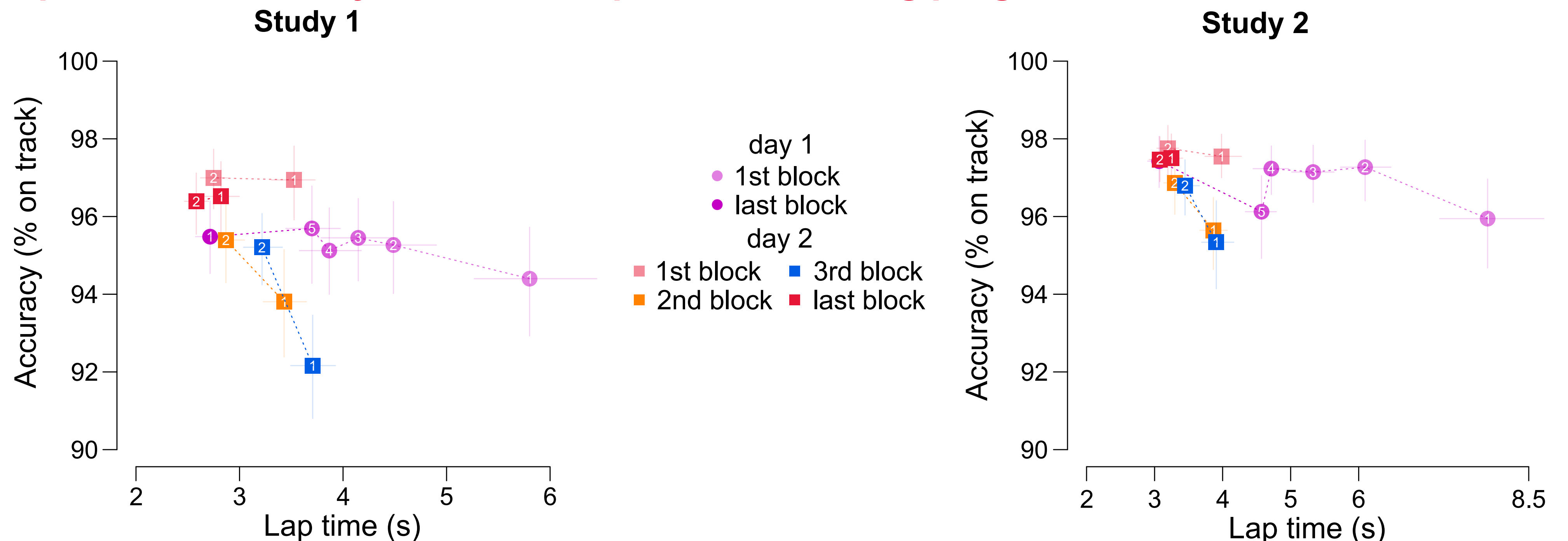
Lap times improve with training and show substantial retention, but moving through the track in the reverse (counterclockwise) direction slows down lap times



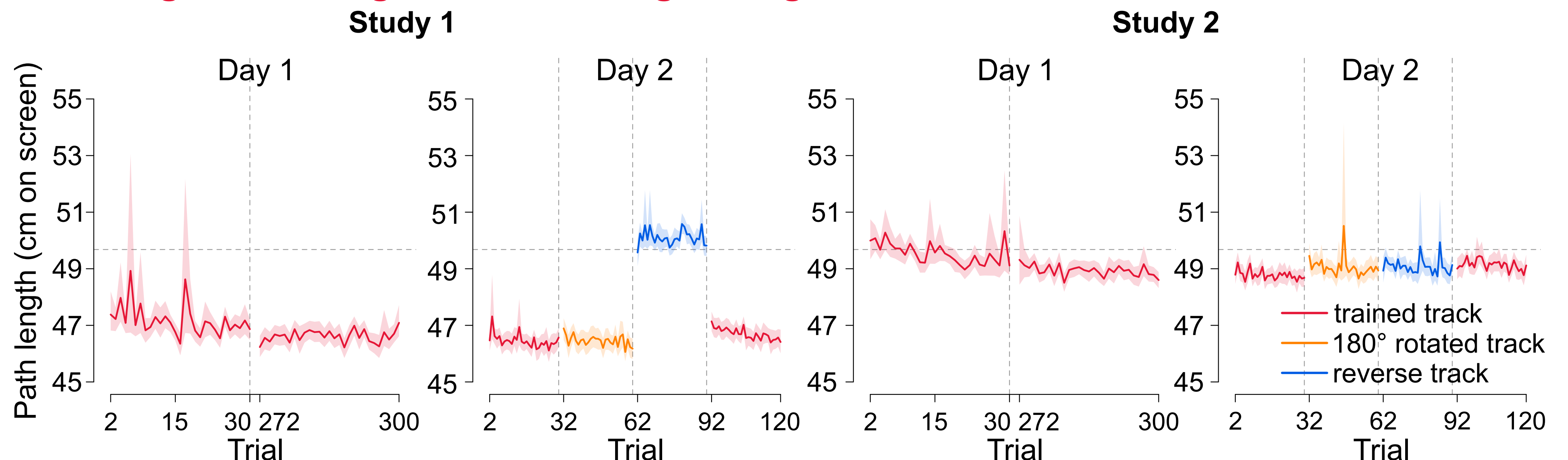
Accuracy levels indicate immediate task success, but show continued improvement across training sessions



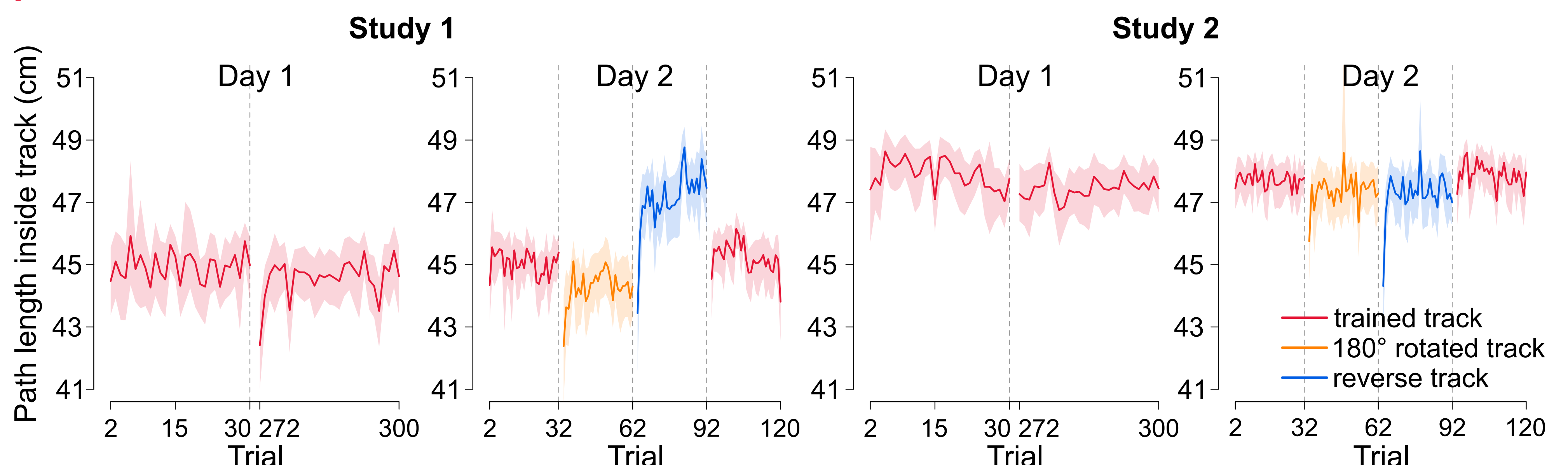
Speed and accuracy measures improve as learning progresses



Path lengths are longer when moving through the track in the reverse direction



Increased path lengths for the reverse direction are due to less efficient movement paths within the track



Skill acquisition in a continuous movement task can progress quickly. Performance improvements through continued practice are substantially retained and generalize to different contexts.

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