Precision and performance in skill acquisition:
Improved speed, accuracy, and path efficiency following training in a 2-D racing task

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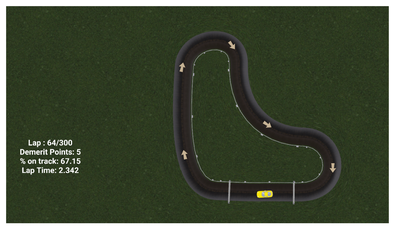
Improving motor performance with skilled practice

People excel at acquiring new motor skills, through the establishment of new sensorimotor mappings. However, most daily tasks rely on refining precision towards ideal movements, which is an aspect of motor learning that is understudied. It remains unclear whether continued practice shares similar mechanisms as in other motor learning processes. Here, we investigate continued practice using known measures from other skill acquisition tasks.

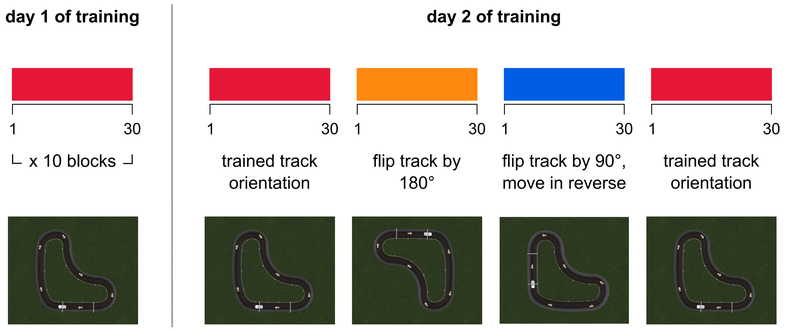
Speed and accuracy improvements in a 2-D racing task



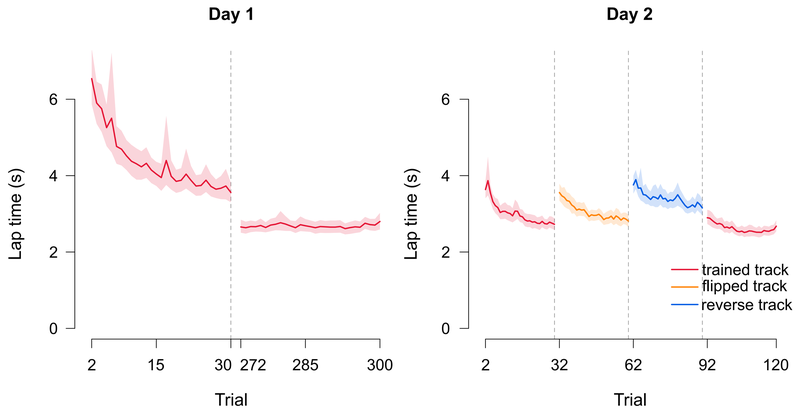
Participants (N = 45) used a stylus on a digitizing tablet to control a race car through a track as quickly and accurately as possible. They received feedback on lap time and accuracy, with the car turning red if it left the track. To prevent fatigue, they could rest in a pit stop (yellow car) between laps.

Offline gains and performance generalization

Performance typically improves upon re-experiencing a task (offline gains). To test this, participants (N = 43) 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.



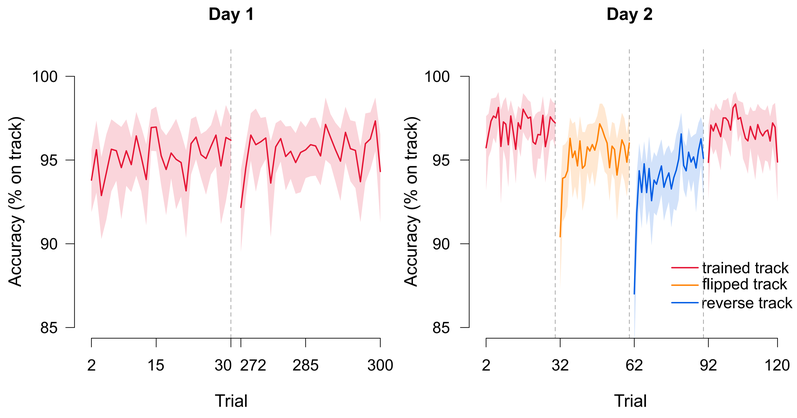
Lap times improve with training and show substantial retention, but movement direction slows down lap times



During day 1, lap times continuously improved before tapering off at around 2.5 seconds.

On day 2, participants quickly regained day 1 performance on the trained track, suggesting retention. Flipping the track produced similar learning patterns, while reversing movement direction increased lap times until the end of the block, suggesting interference. This interference did not affect performance on the trained orientation.

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



On day 1, participants immediately performed with high accuracy. On day 2, accuracy improved further, indicating offline gains. However, accuracy dropped with the flipped or reversed tracks, before quickly approaching trained levels.

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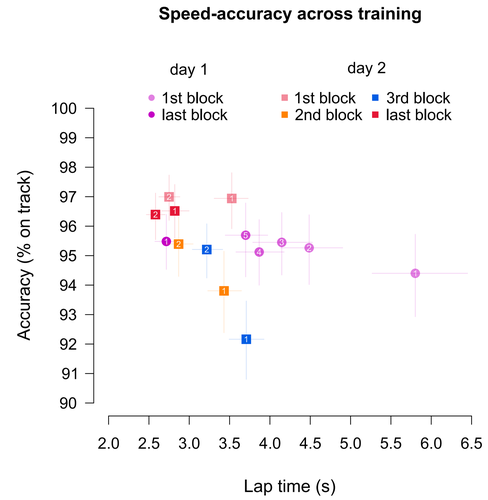
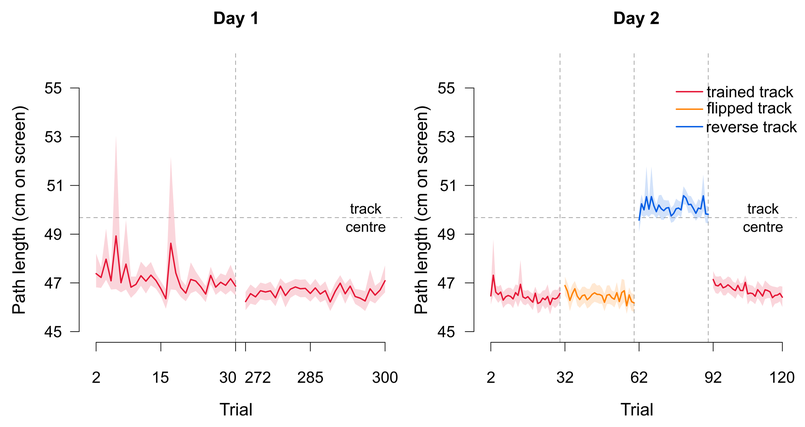
Speed and accuracy measures improve as learning progresses



Generally, participants were more accurate if they moved slower (i.e., speed-accuracy tradeoff). With practice, both speed and accuracy improved, but these improvements for the flipped and reversed tracks remained below trained track levels.

Path lengths are longer when moving through the track in reverse



Path length measures movement trajectory per lap. While participants moved more optimally compared to the track centre (49.7 cm), longer paths in the reverse direction suggest interference from the trained movement.

Skill acquisition in a continuous movement task shows substantial retention and generalization.

We are currently investigating whether the direction effect stems from interference or right-handed movement biases.