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Roll Tilt Self-Motion Direction Discrimination: First Evidence for Perceptual Learning

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Vestibular Oriented Research Meeting 2019

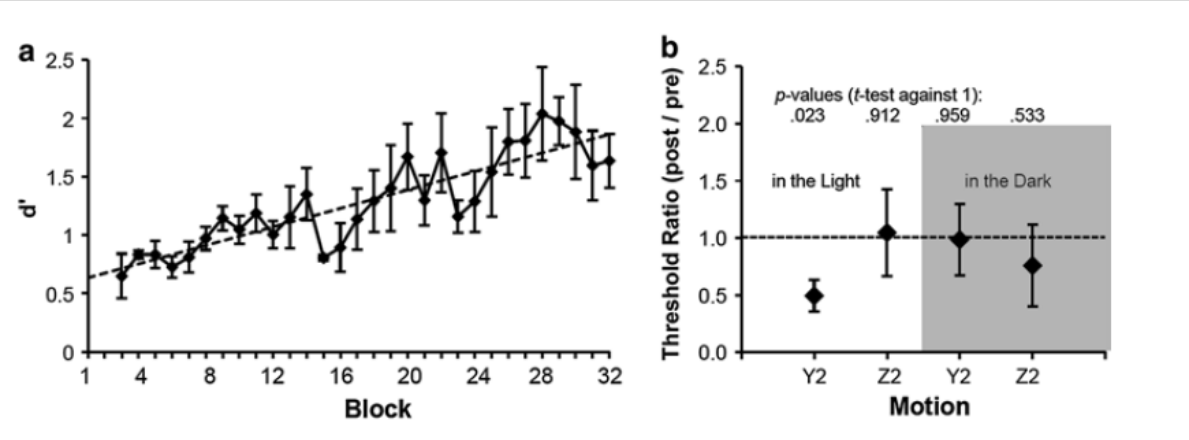
Research Question

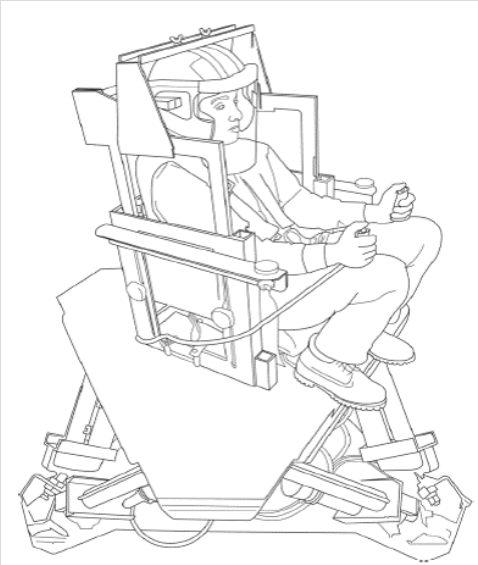
Can vestibular self-motion perception thresholds be improved through practice?

Perceptual Learning

Self-Motion Perception Training (Hartmann et al., 2013)

Y-Translation: In the light

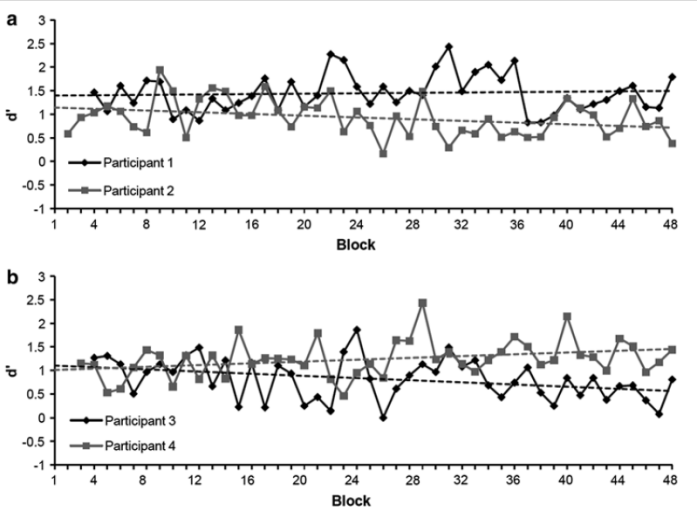




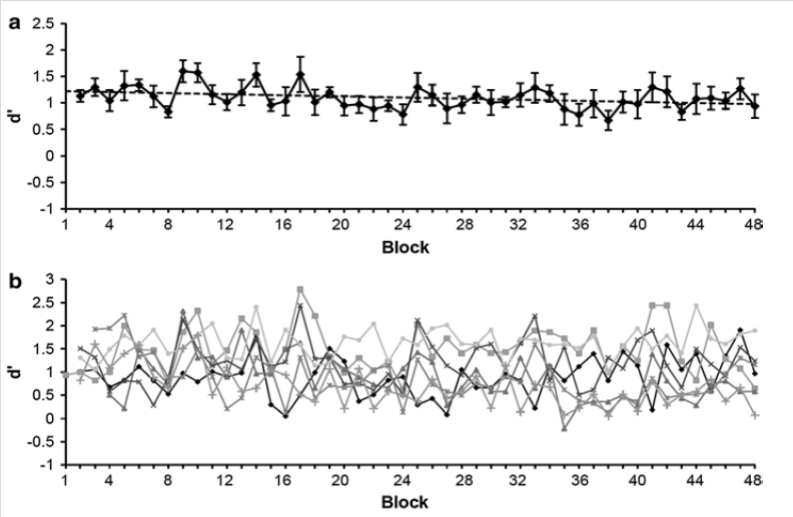
Perceptual Learning

Self-Motion Perception Training (Hartmann et al., 2013)

Yaw Rotation: In the dark



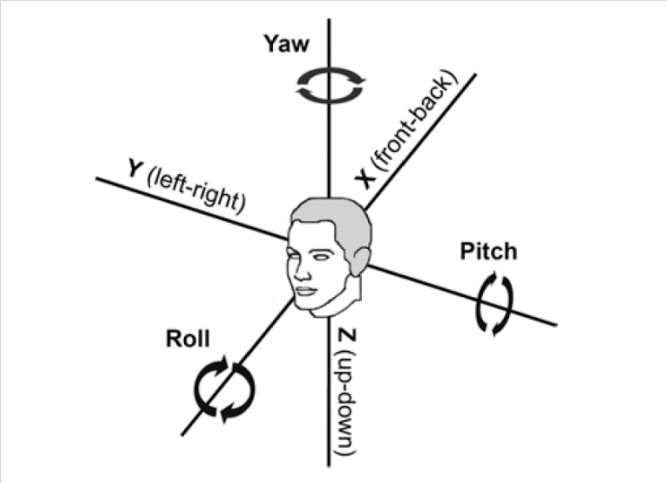
Y-Translation: In the dark



Perceptual Learning

0.2 Hz Roll Tilt Self-Motion Stimuli

- Combined semicircular canal and otolith input
- 0.2 Hz Roll self-motion perception thresholds predict performance in balance tests (Karmali et al., 2017)

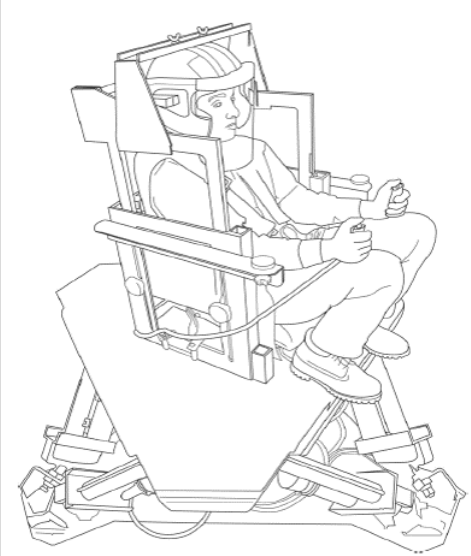


Methods

Subjects and Stimuli

- Self-motion perception training
- MOOG 6DOF motion platform
- single-cycles of sinusoidal acceleration motion profiles in the dark

- Subjects:
  - Training group: n = 10
  - Control group: n = 20



Methods

Design

Pretest:
Psychometric functions for pre/post comparison

Roll 0.2 Hz
Roll 1 Hz
Pitch 0.2 Hz
Y-Axis 0.2 Hz

Training Group:
0.2 Hz Roll self-motion perception training for 6 days

Control Group:
Wait for 6 days

Posttest:
Psychometric functions for pre/post comparison

Roll 0.2 Hz
Roll 1 Hz
Pitch 0.2 Hz
Y-Axis 0.2 Hz

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Methods

0.2 Hz Roll Tilt Self-Motion Training

- Training of self-motion direction discrimination task
- One intensity per subject with target accuracy 65%
- 3 blocks per day for 6 days, 100 trials per block
- Feedback was given on error trials

Methods

Data Analysis

Hierarchical generalized linear model with probit link function

- **Pre/Post comparison:** response ~ velocity * group * condition
- **Training effect:** response ~ direction * block

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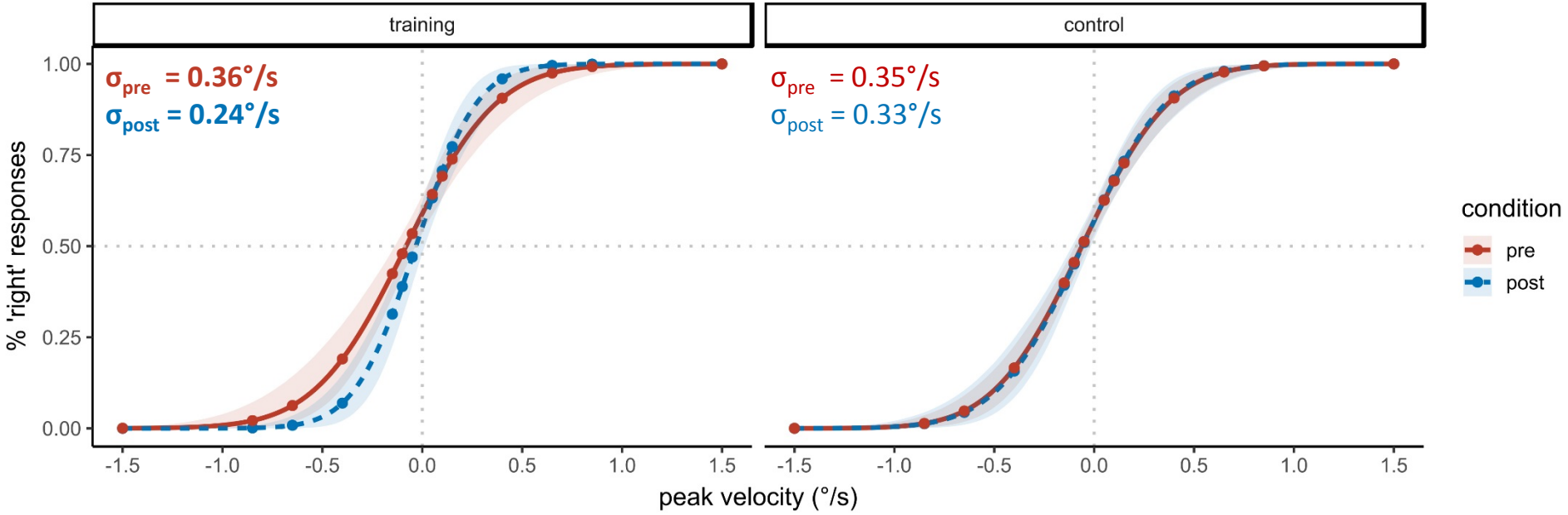
Results

Roll 0.2 Hz



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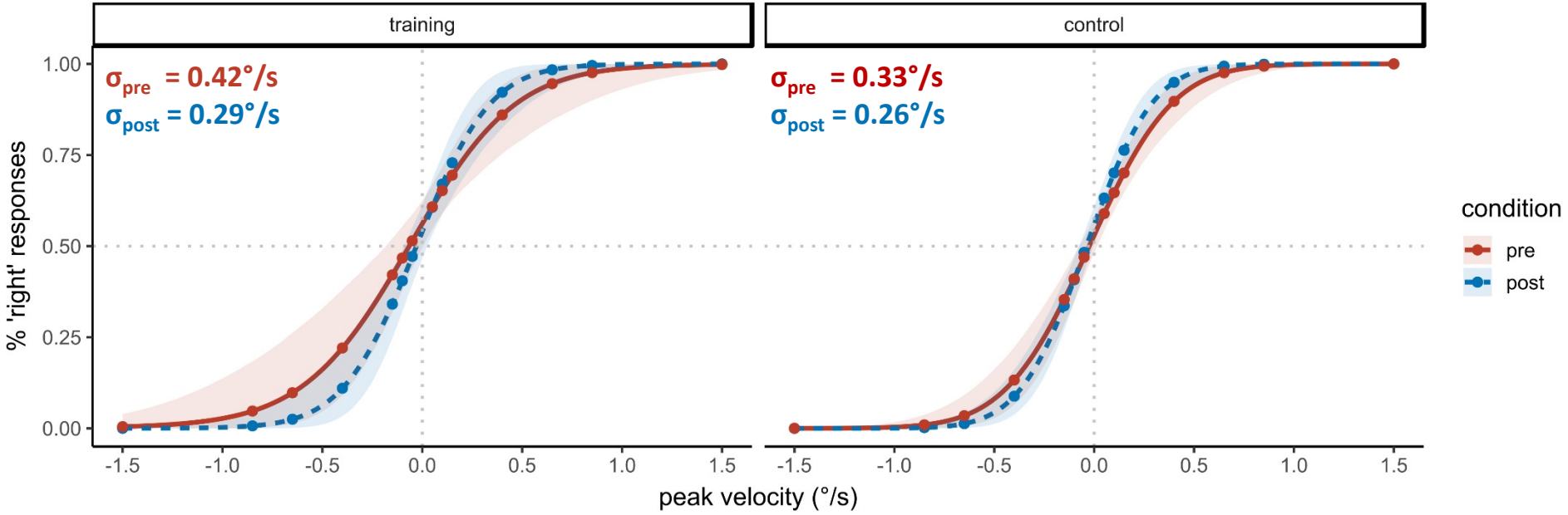
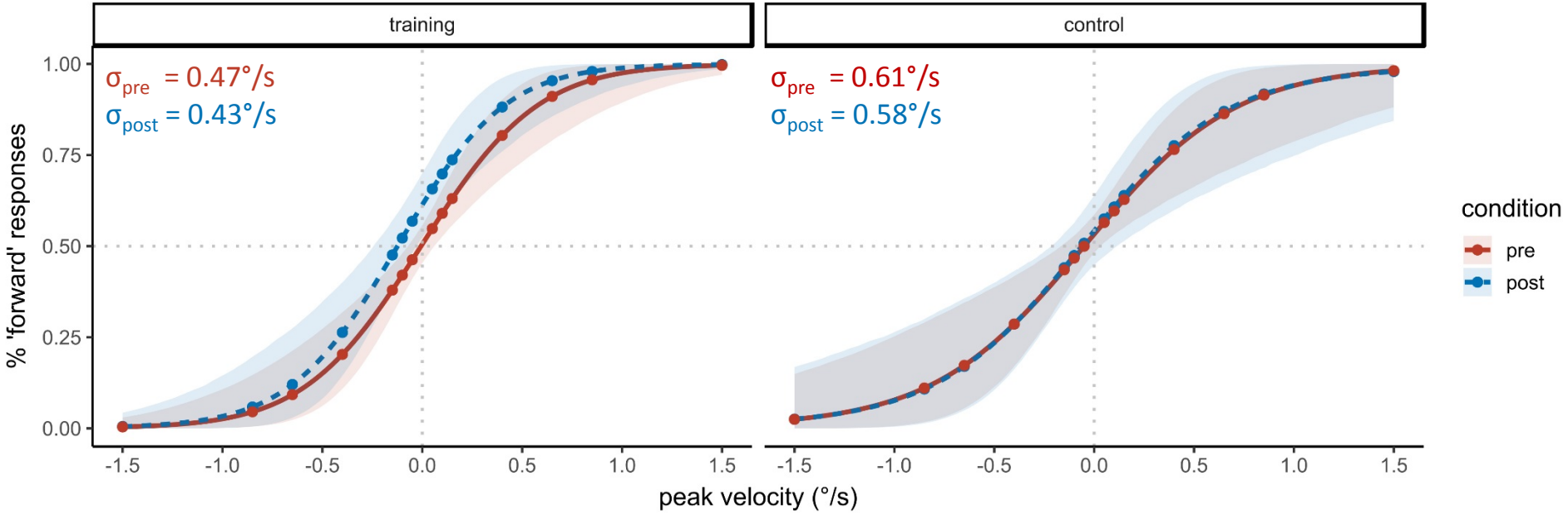
Results

Roll 1 Hz



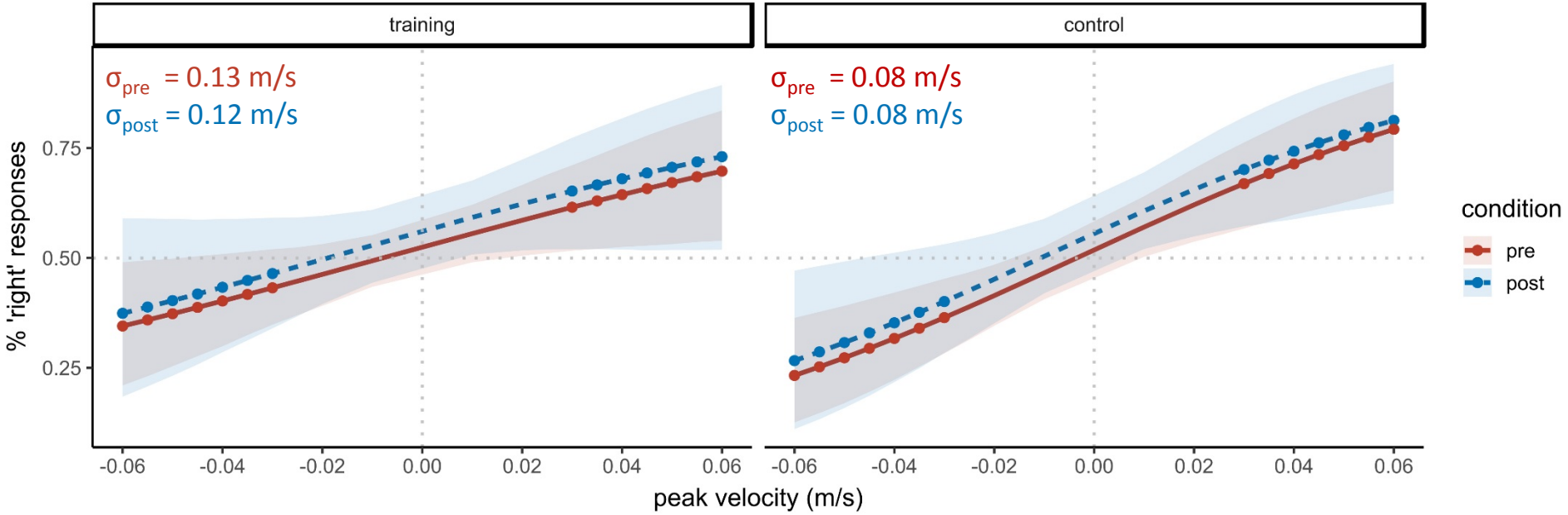
Results

Pitch 0.2 Hz



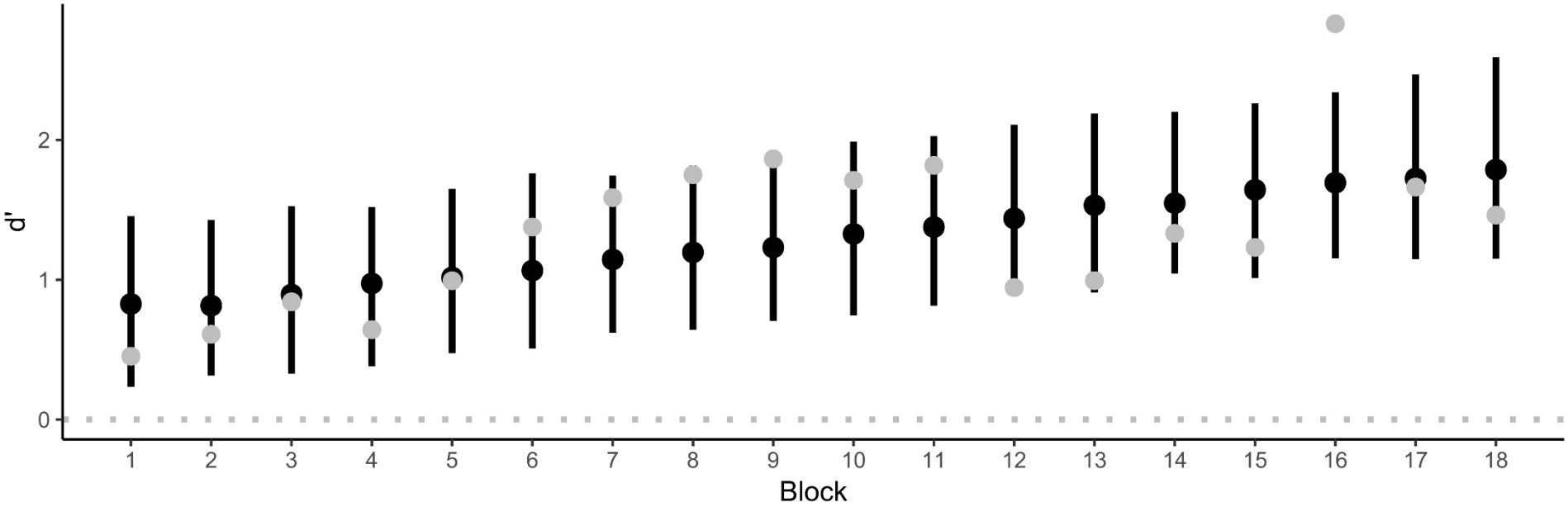
Results

Y-Translation 0.2 Hz



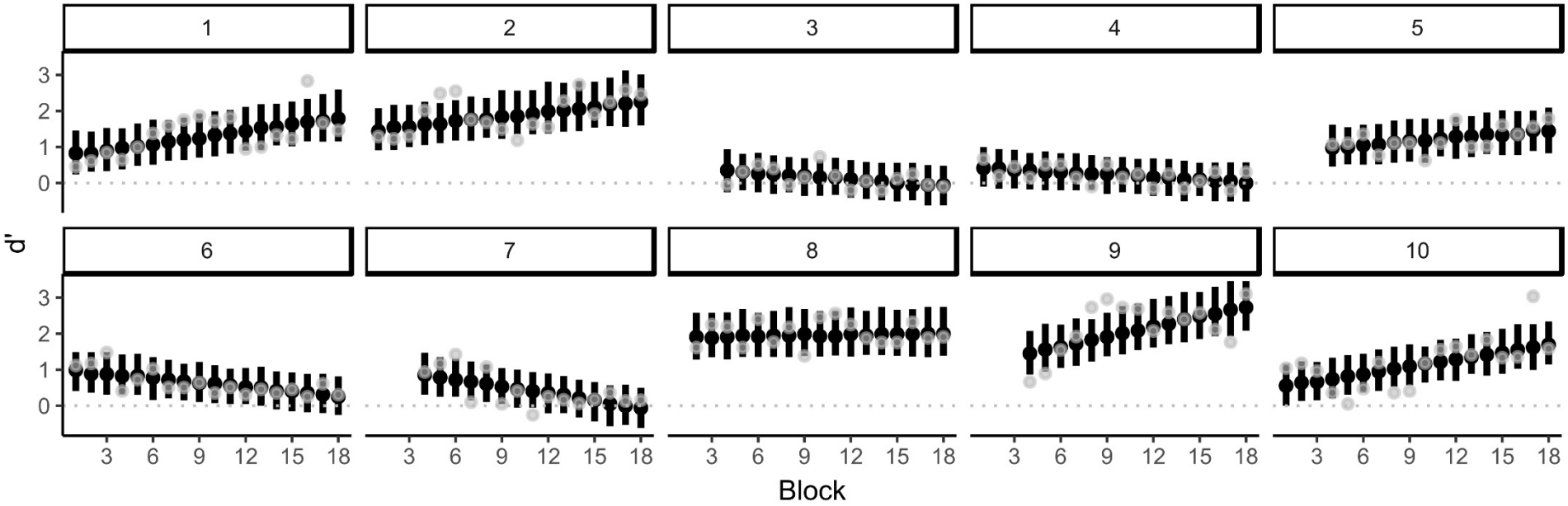
Results

Training Effect: Subject 1



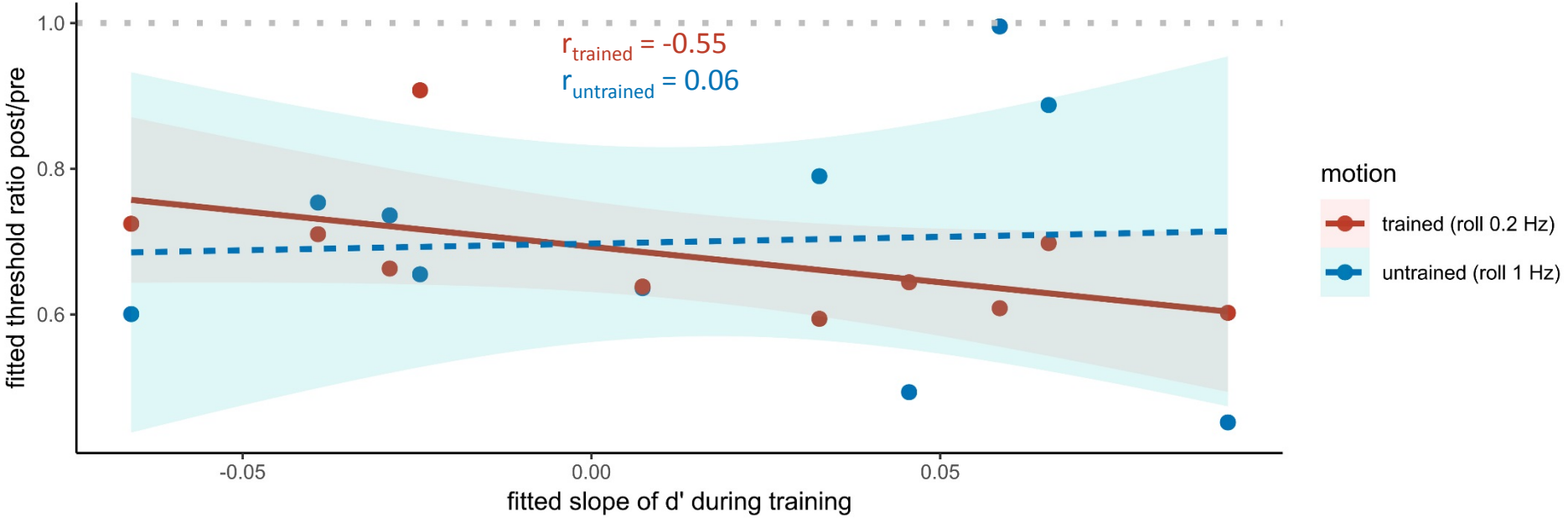
Results

Training Effect



Results

Correlation: Training – Pre/Post Comparison



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Discussion

Main Finding

- Perceptual learning of roll tilt self-motion in the dark
- Self-motion threshold was reduced by 33% after 6 days of training
- Training was specific to the trained motion

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Thank you for your attention!