Tricking your cerebellum with a reaching task

Exercise 2 – Savings, generalization & interference

General remarks HW1

- Teams of 2 (or 3)! I will not accept single submission anymore.
- Why the hint?→ Try to familiarize yourself with given coordinate system!

  no trial & error of trigonometric functions + shifts
- Capture **unbiased** subjects, not just yourself as the designer of experiment!
- Exclusion of slow attempts: different markers in plots
- Improve plots: label axes! Use colors & line-types wisely, optimize info/ink ratio, clear definition of segments in experiment, highlight after-effect etc. etc. etc.
- Short description of results **in captions of each plot!** Not in the discussion! Use the 200 words wisely: try to answer each given question very briefly.
- Task 4: Try something new in a slighty adapted version of the basic experiment.

General remarks HW1

Often missed details in discussion:

- ‚After Effect‘ as a key word
- Comparison of gradual and sudden perturbation
- Calculation of motor variability (‘MV‘) in blocks without perturbation (-> ~3°)

  → compare this to our gradual perturbation

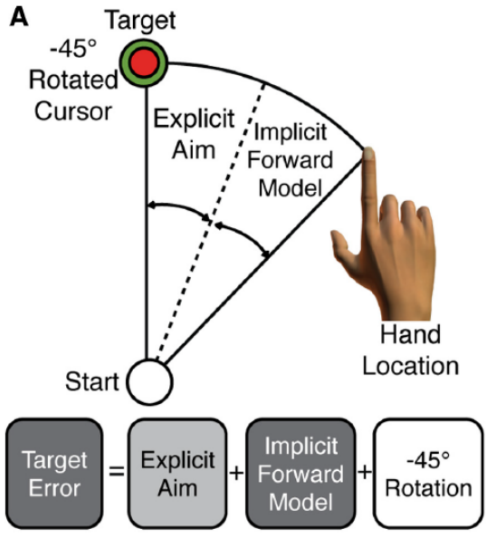
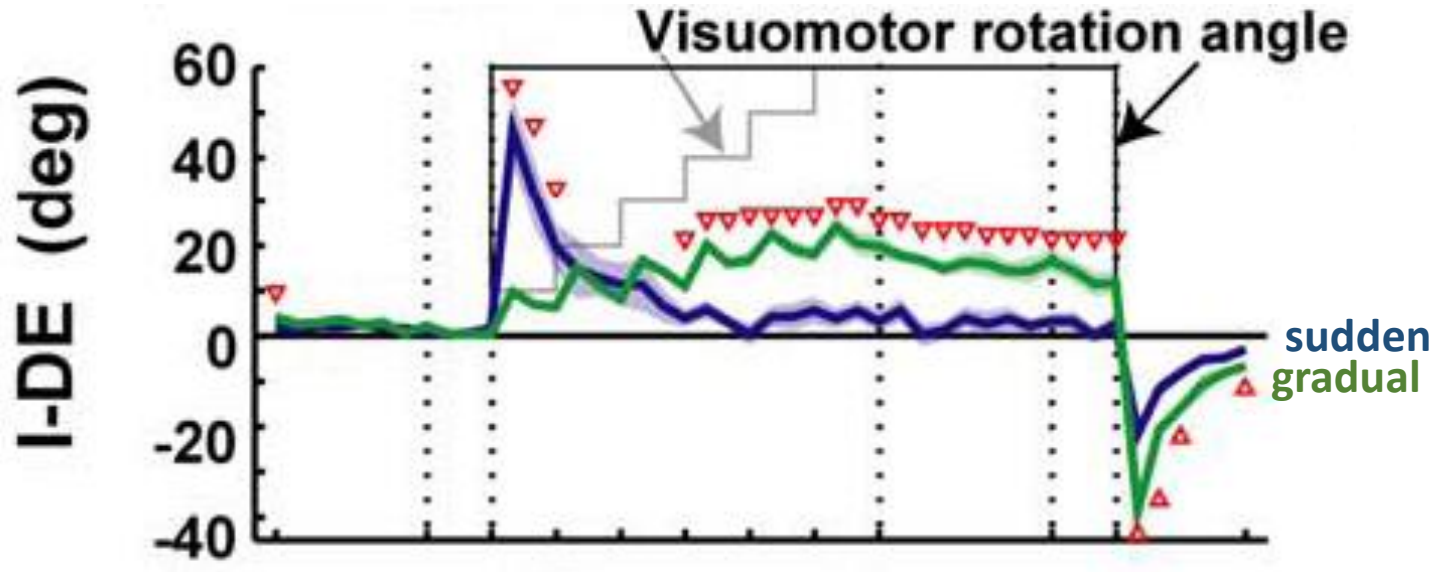


Figure 4. *A*, Target error (performance) is the sum of the explicit aiming direction and impl
subtraction of the aiming direction (see Fig. 2*C*) from the target error. Instruction-Endpoint, blu



Savings

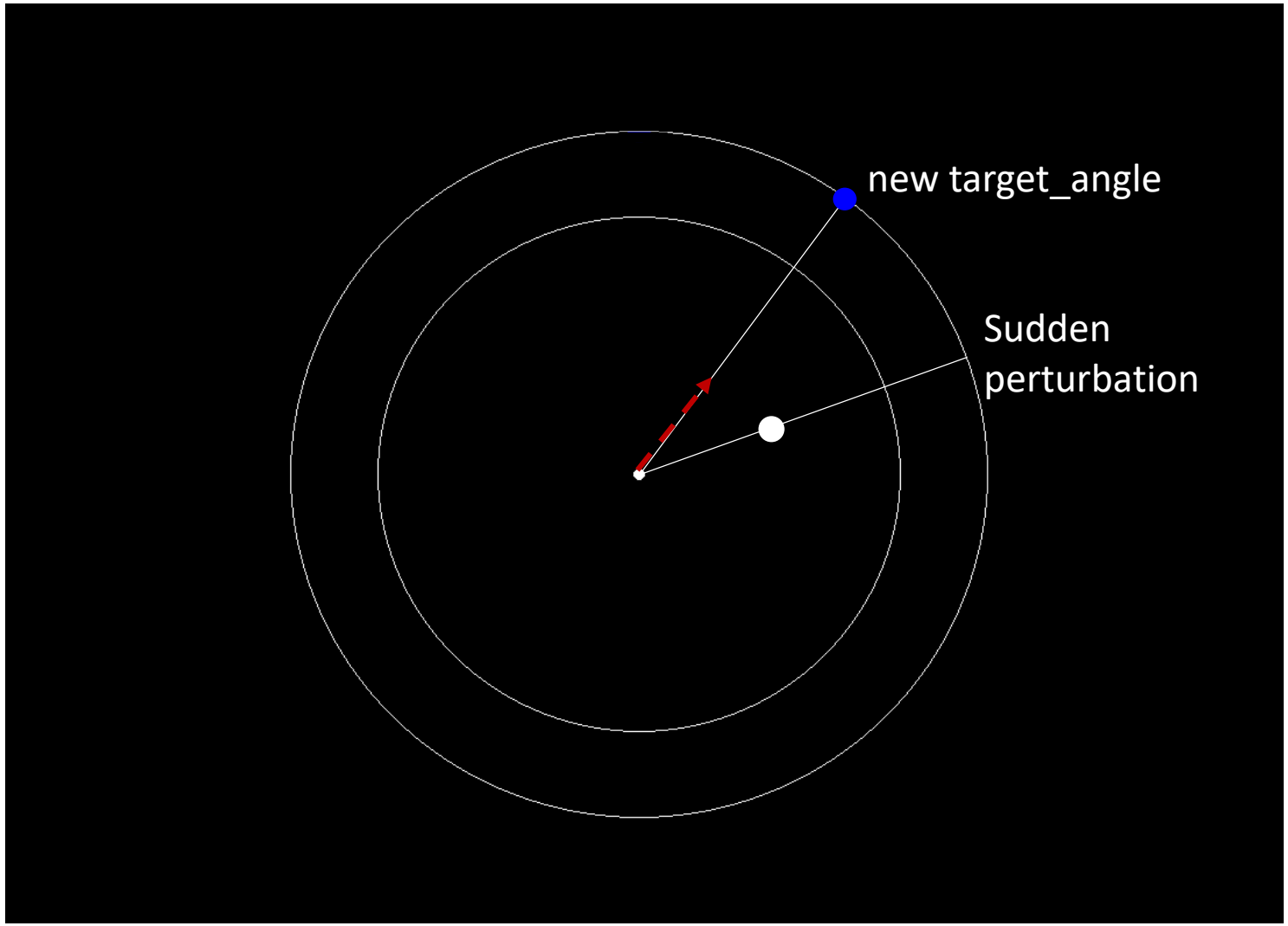
Capture a baseline:

- Rerun the experiment from exercise 1 with two sudden perturbations

  → adapt #trials to 60 with perturbation and 20 without

- Repeat the same experiment on the same subjects after 30 minutes

Design your experiment!



By simply changing the target angles and sequence of the experiment blocks, you can learn something new about motor adaptation!

→ Each team chooses their own target_angles for each block, then we try combining our insights next week

Motivation Generalization

Learning of Visuomotor Transformations for Vectorial Planning of Reaching Trajectories

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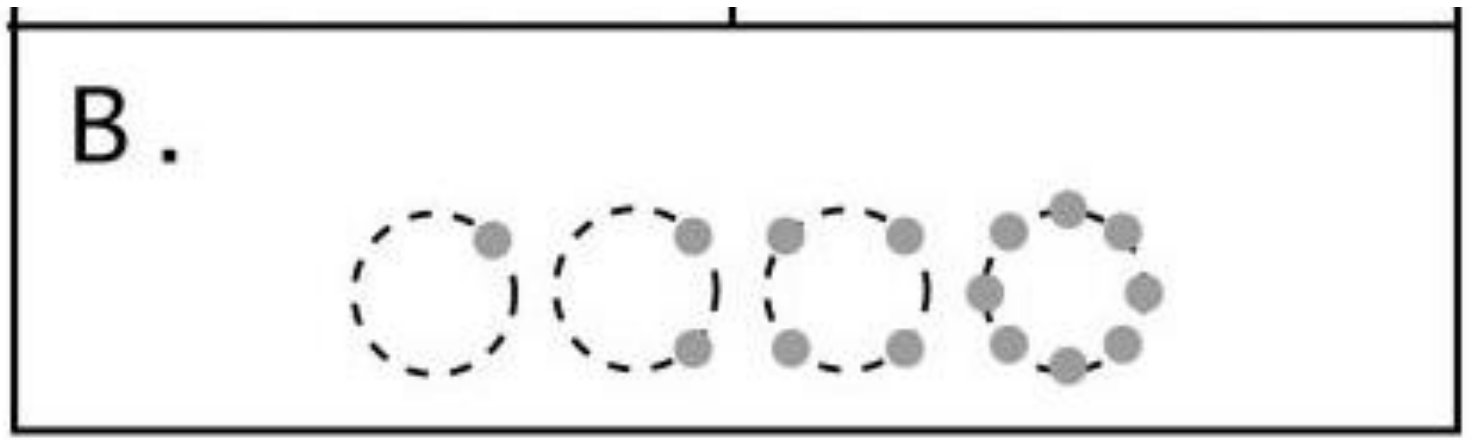
- Visuomotor rotation 30° CCW



Motivation Generalization across targets

J. Neurosci., December 1, 2000, 20(23):8916–8924 8921

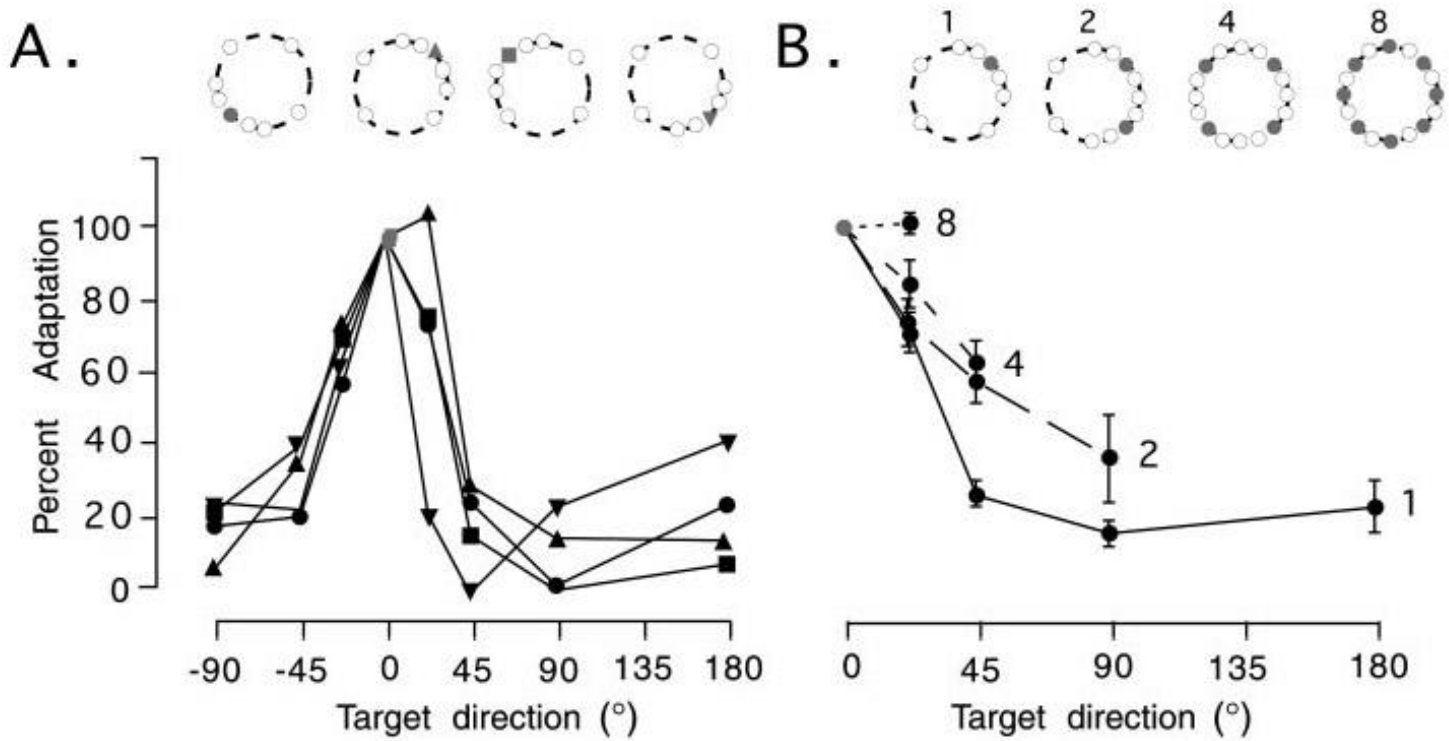
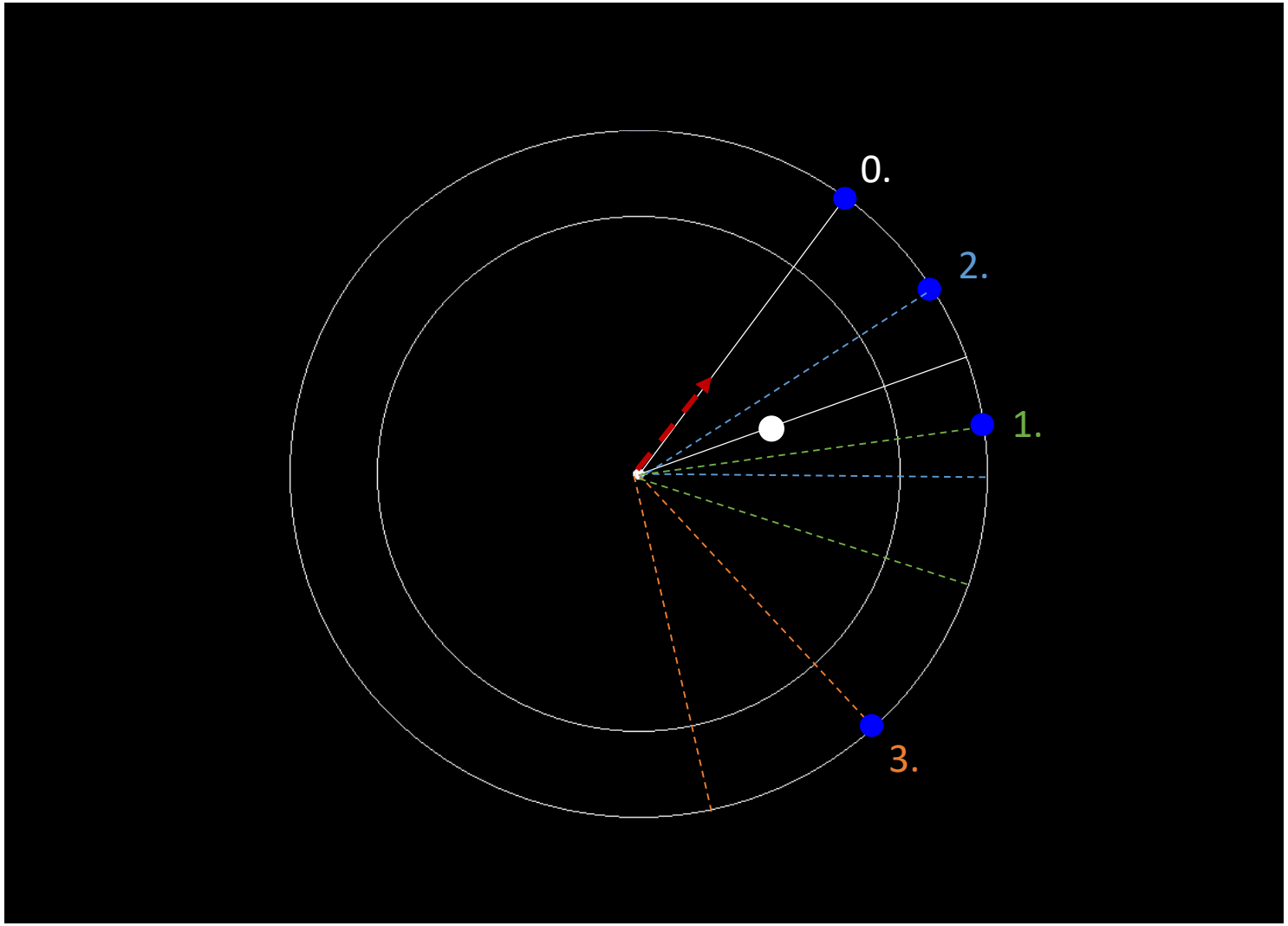


Figure 6. Rotation generalization. *A*, Generalization across multiple directions after training in a single direction. The directional data are relative to the training target. *Bottom*, The plot is of mean (±SEM) group data showing the percent adaptation to untrained directions relative to the training target. *Top*, The four different training directions (45, 135, 225, and 315°) for 4 different days are shown by the *gray symbols*. The positioning of the testing targets (in *white*) is shown. *B*, Generalization across multiple directions after training in one, two, four, and eight directions. *Bottom*, The plot is of mean (±SEM) group data showing the relative percent adaptation in the untrained directions relative to the trained directions. When there was more than one training target, the mean performance to all the training targets was used to calculate the relative adaptation in untrained directions. Data were collapsed for clockwise and counterclockwise directions. *Top*, Training targets are shown in *gray*, and testing targets are in *white*.

Group A: Generalization



0. Change starting_angle

1. Increase target_angle

2. Choose a target_angle between the last two.

3. Increase target_angle even more (greater than in 1.)

Keep perturbation_angle always the same
20 attempts without perturbation at the beginning AND end of each block

Motivation Interference

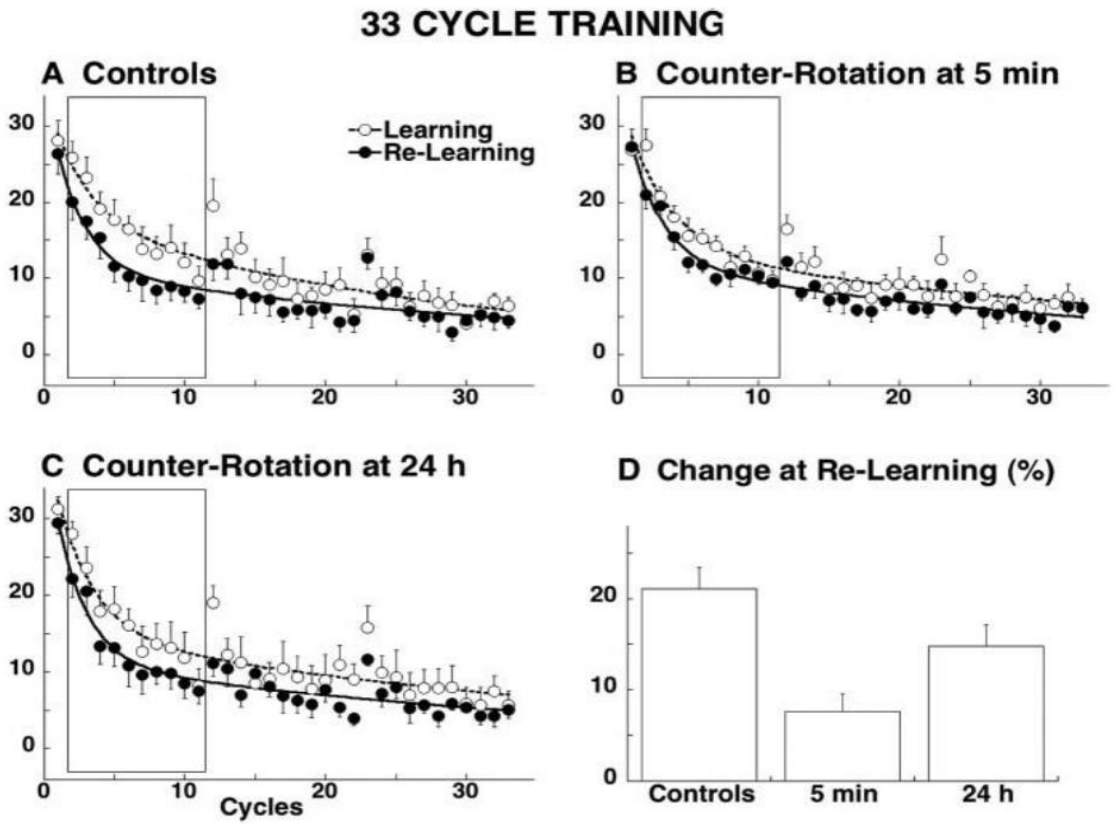


Figure 2. Experiment 2. *A–C*, Rotation learning and relearning curves with washout. Repeated-measures ANOVA revealed a significant effect of session (learning vs relearning) on directional error ($F_{(1,30)} = 10.828$; $p = 0.0026$). There was no significant effect of group ($F_{(1,30)} = 0.097$; $p = 0.9075$) nor a significant session × group interaction ($F_{(3,30)} = 0.439$; $p = 0.649$). *D*, Percentage change in learning from the learning to the relearning session. ANOVA revealed a main effect of group ($F_{(2,15)} = 4.17$; $p = 0.03$). *Post hoc* tests showed a significant difference ($p < 0.016$) between the control and the 5 min interference group but not between the control group and the 24 hr interference group ($p > 0.05$).

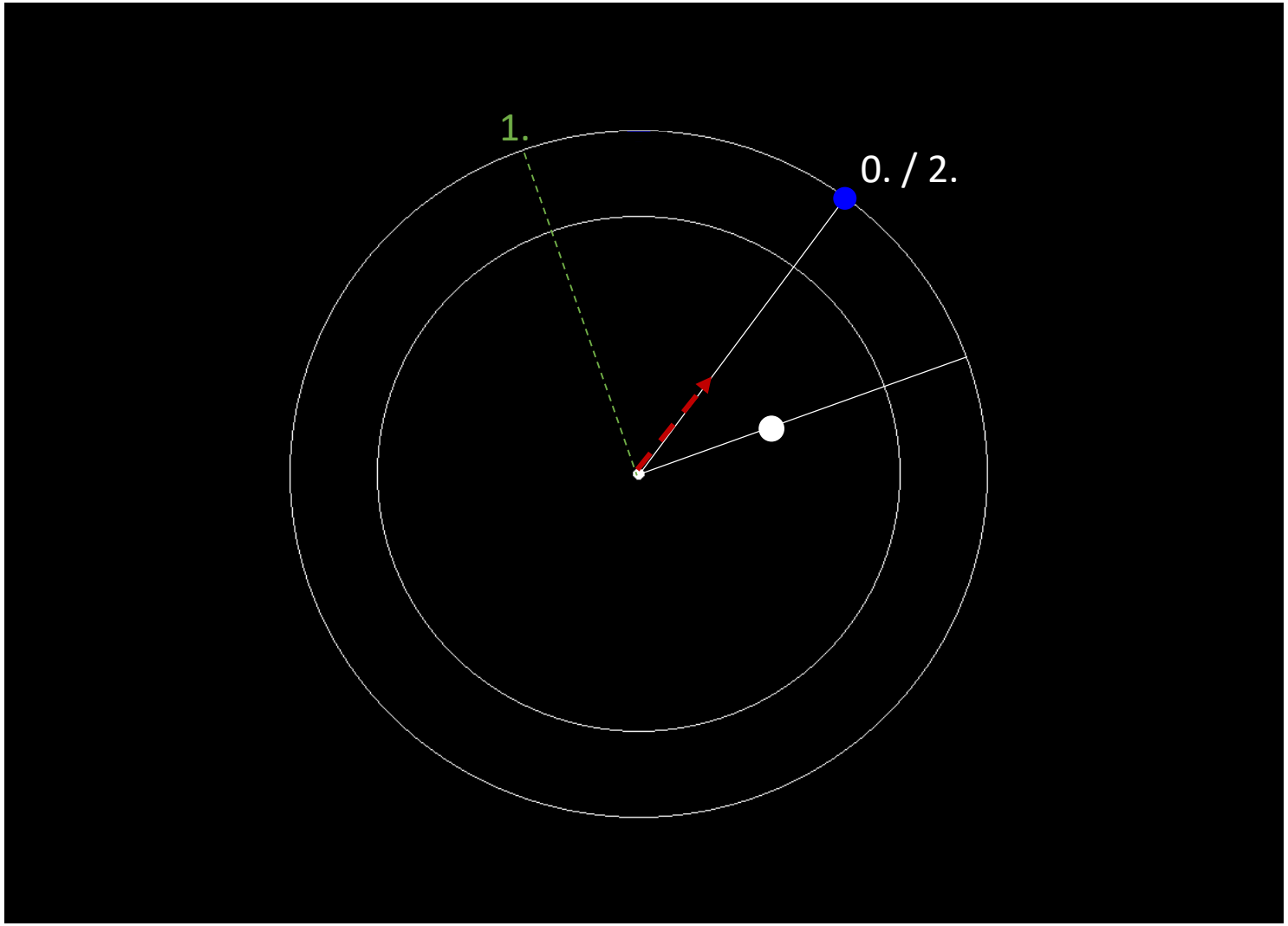
Experiment 2

Group 5 (6 subjects)	B, B, R		B, R (48 h)
Group 6 (6 subjects)	B, B, R	B, CR (5 min)	B, R (48h)
Group 7 (6 subjects)	B, B, R	B, CR (24 h)	B, R (48 h)

B= Baseline

Washout the Rotation

Group B: Interference



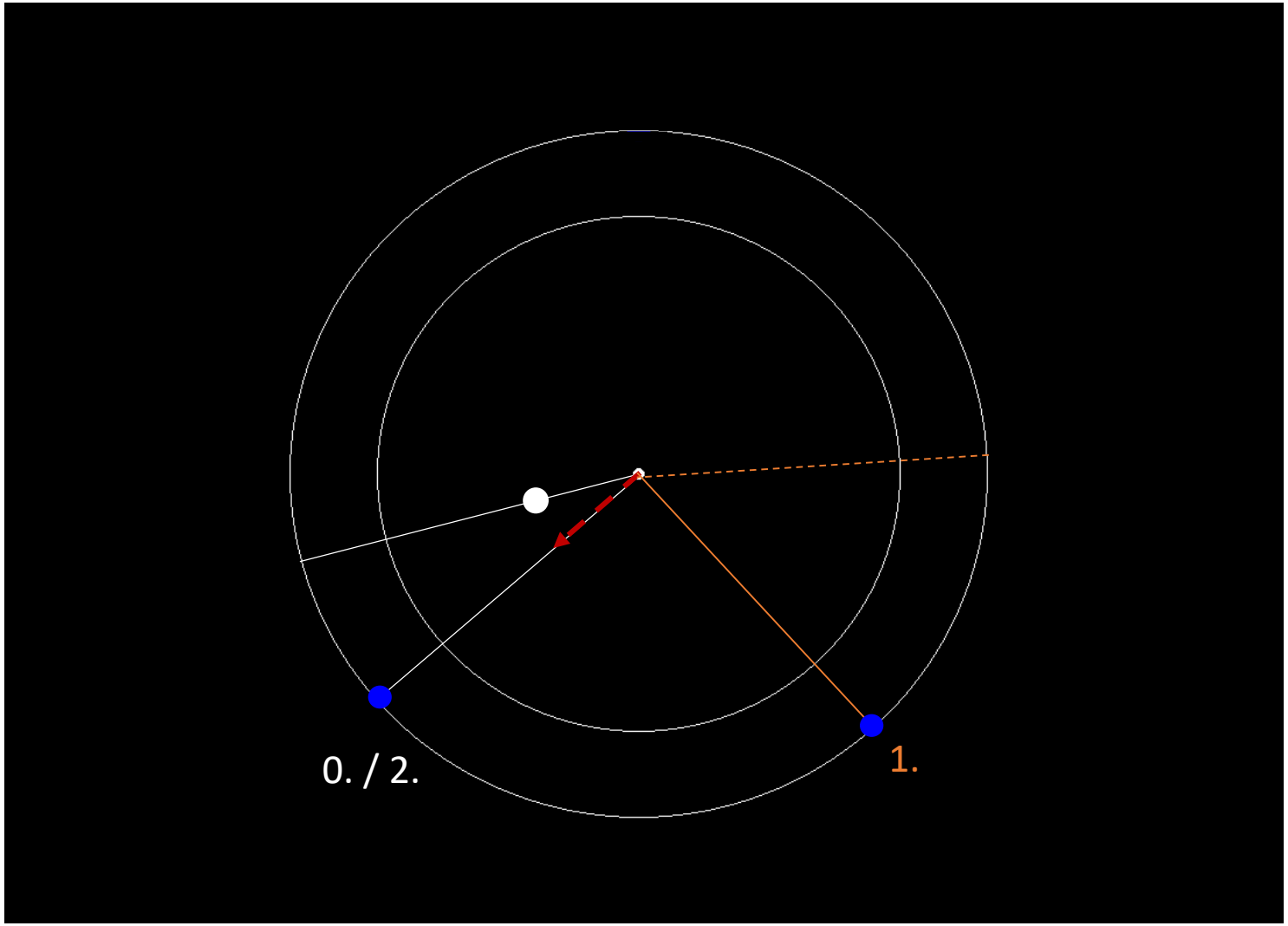
0. Change starting_angle + sudden perturbation

1. Interfere adaptation with an interference_angle in the other direction **at the same target_angle**

2. Stop interference

Keep perturbation_angle always the same
20 trials without perturbation at the beginning AND end of each block &
60 trials with pertubation resp. interference

Group B: Interference



Repeat the experiment but interfere at another target_angle

0. Change the starting_angle to another position

1. Interfere adaptation with an interference_angle in the other direction **at another target_angle**

2. Stop interference

Keep perturbation_angle always the same
20 trials without perturbation at the beginning AND end of each block &
60 trials with perturbation resp. interference

Exercise 2

- TASK 1: Implementation of recording mode and new experiment
  - **Design** your own experiment according to your group [A **or** B]
- TASK 2: Analysis of experiment on unbiased subjects
  - **Rerun** first experiment with two sudden pertubations, **repeat** it after 30 minutes (all)
  - **Record** the same subject performing your own experiment (A or B)
  - Plot the error_angles, add **better plot** to observe the motor adaptation (e.g. see lectures)
- TASK 3: Discussion of your results
  - Is there any motor adaptation left after 30 minutes? (all)
  - Under which conditions was your subject able to generalize to new target positions? (A)
  - What was the effect of interference to your subject's motor adaptation? (B)