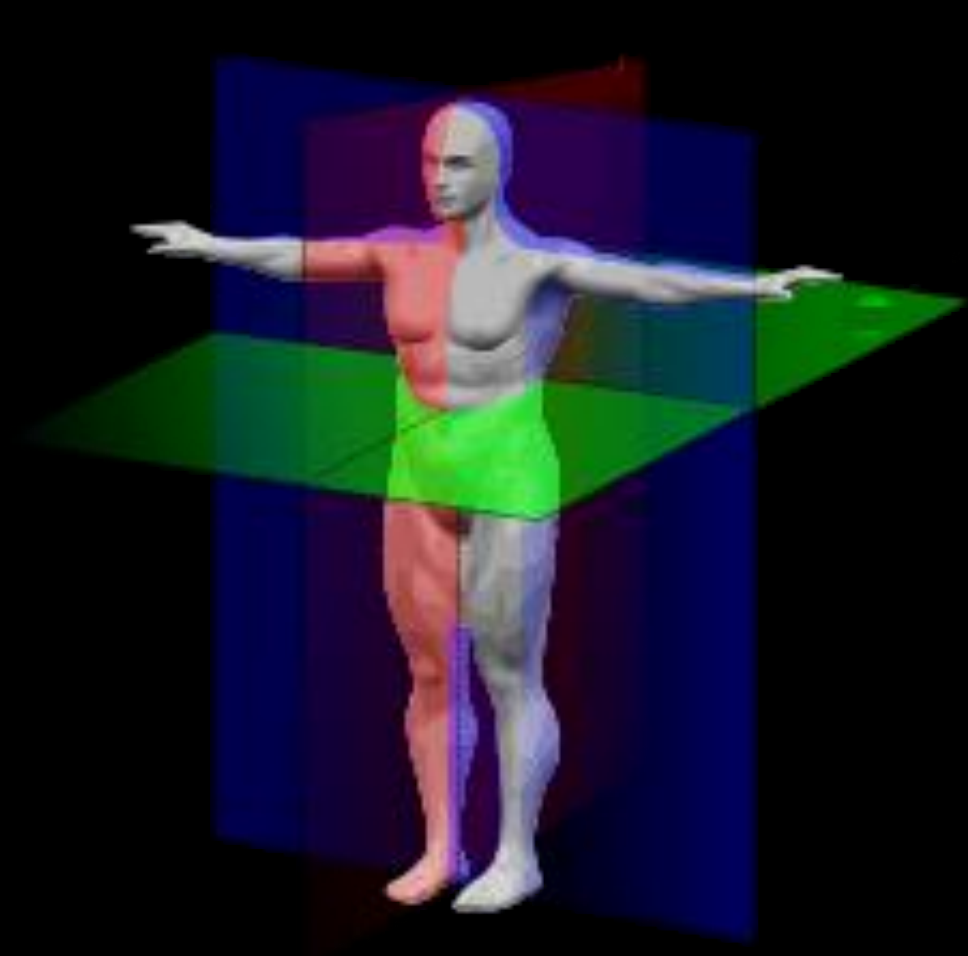


Influence of action execution on reachability and distance perception.

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Introduction

In the scientific literature, it is believed that the behaviours of reachability and distance (magnitude) perception are based on action or grounded cognition that involves parietal lobe processes.

For example, Coello et al. (2008; see also Coello & Delevoeye-Turrell 2007) demonstrated that disruption of primary hand motor cortex moderated the perception of reachability.

Similarly, other studies have demonstrated that distance (magnitude) perception can be moderated by body states (e.g., wearing a backpack Proffitt, 2006; or sport expertise Witt, 2011).

In the current study, we for the first time investigated the effects of dual task motor disruption on reachability and distance (magnitude) spatial perception tasks in a single experiment. Our aim was to determine the differences between the behaviours and better understand their shared reliance on action or grounded cognition.

We predicted that if action processes are needed for all of the tasks, then performing an action at the same time in a dual task might perturb the perception tasks. Moreover, similarities in the perceptual behaviour caused by the perturbation would support the idea that the different behaviours are based on common cognitive processes.

Conclusion

- We observed that the dual task of performing hand actions perturbed the perceptual tasks of:
 - Reachability perception
 - Egocentric Distance perception
- In both cases, reaction time was increased*
- Allocentric distance perception was not perturbed by the action dual task and so unlikely uses action simulation or grounded cognition.
- Therefore, it seems that perceptual tasks evaluating the position of the stimulus relative to the body relies on action or grounded cognition.
- However, although reachability and egocentric distance perception appeared reliant on action cognition, the profiles of the perturbation differed suggesting that action cognition or the simulation processes used for the two perception behaviours may differ.
- It should be noted that : (i) accuracy was not perturbed by the dual task conditions relative to the baseline; (ii) reaction time perturbation effects were only caused by the hand action (and not the arm action) dual task conditions, relative to the baseline

Method

Participants.

18 participants (9 females, 3 left-handed), aged from 18 to 25 years (20.3 ± 2.2).

Apparatus.

- Table (215 x 122cm)
- Projector 300cm above
- Microphone
- Poor luminosity

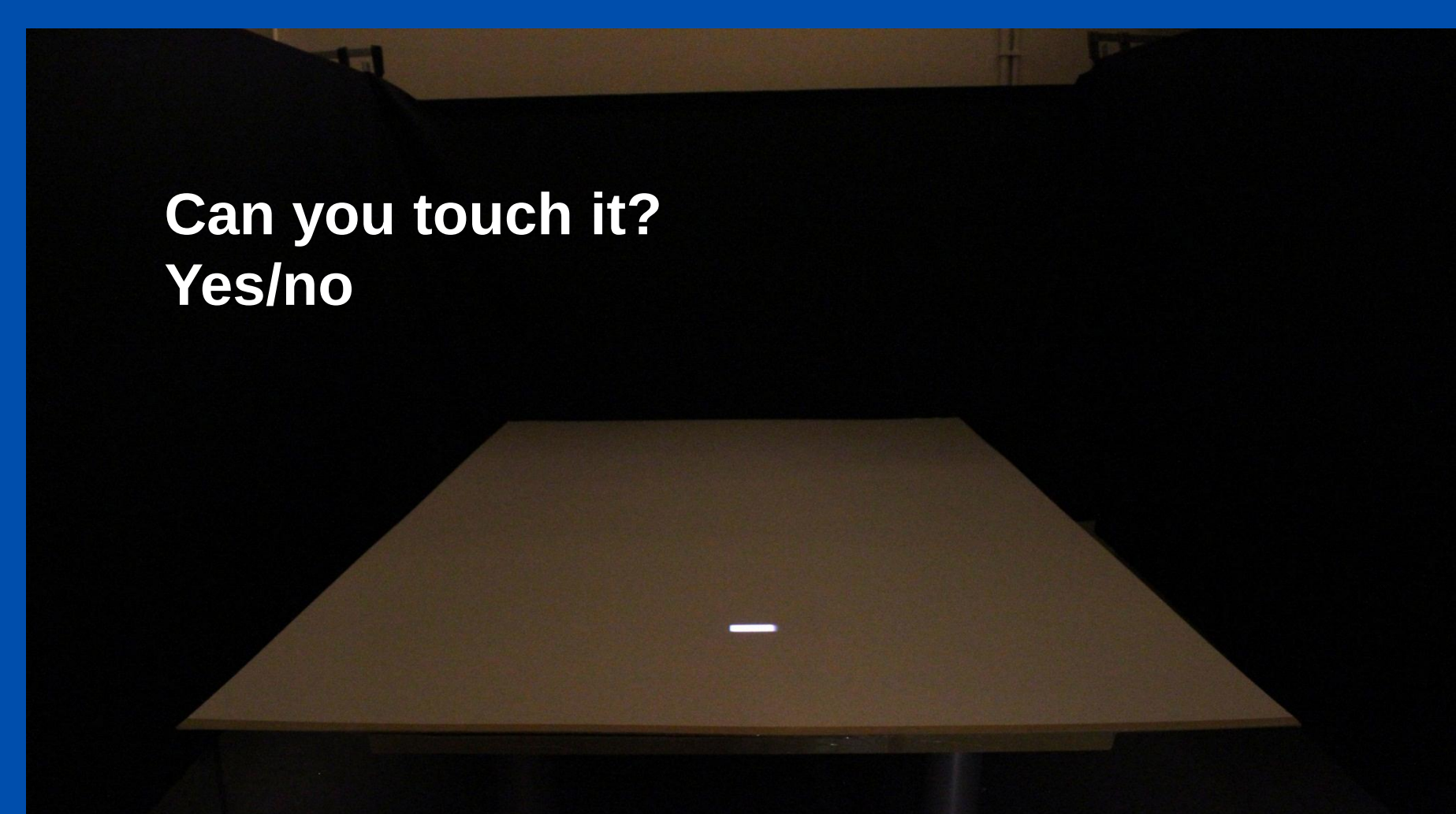


General Procedure

- 3 blocks of 64 trials
- Motor disruption dual task conditions
 - 1) Arm weight lifting (1 kg) actions
 - 2) Hand grasping actions
 - 3) No movement (baseline)
- Training with a metronome for action rhythm
- At the end of the experiment, maximum reach (92 ± 2.3) and arm length (83 ± 5.5) was recorded.

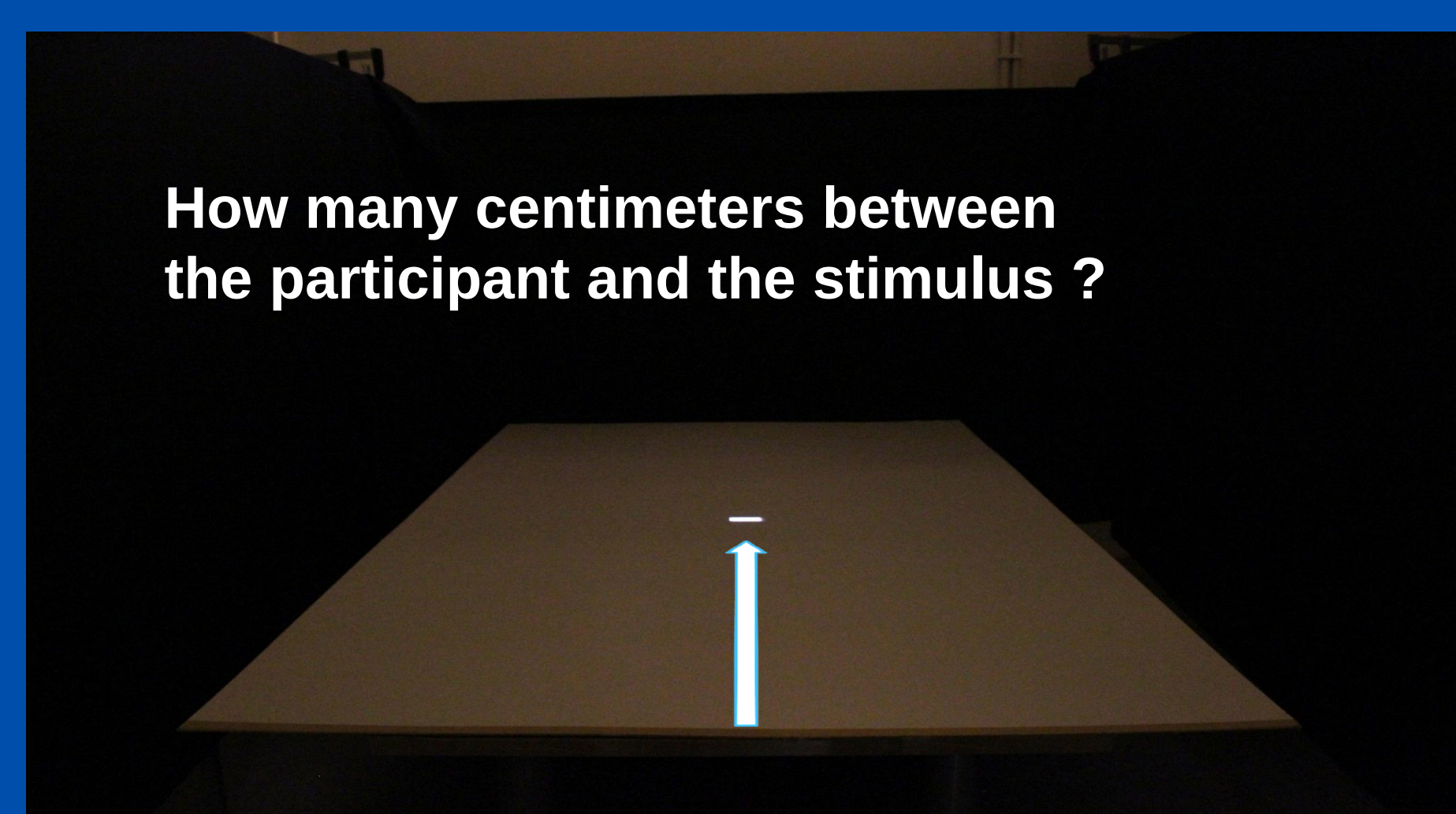
Tasks:

Reachability perception task



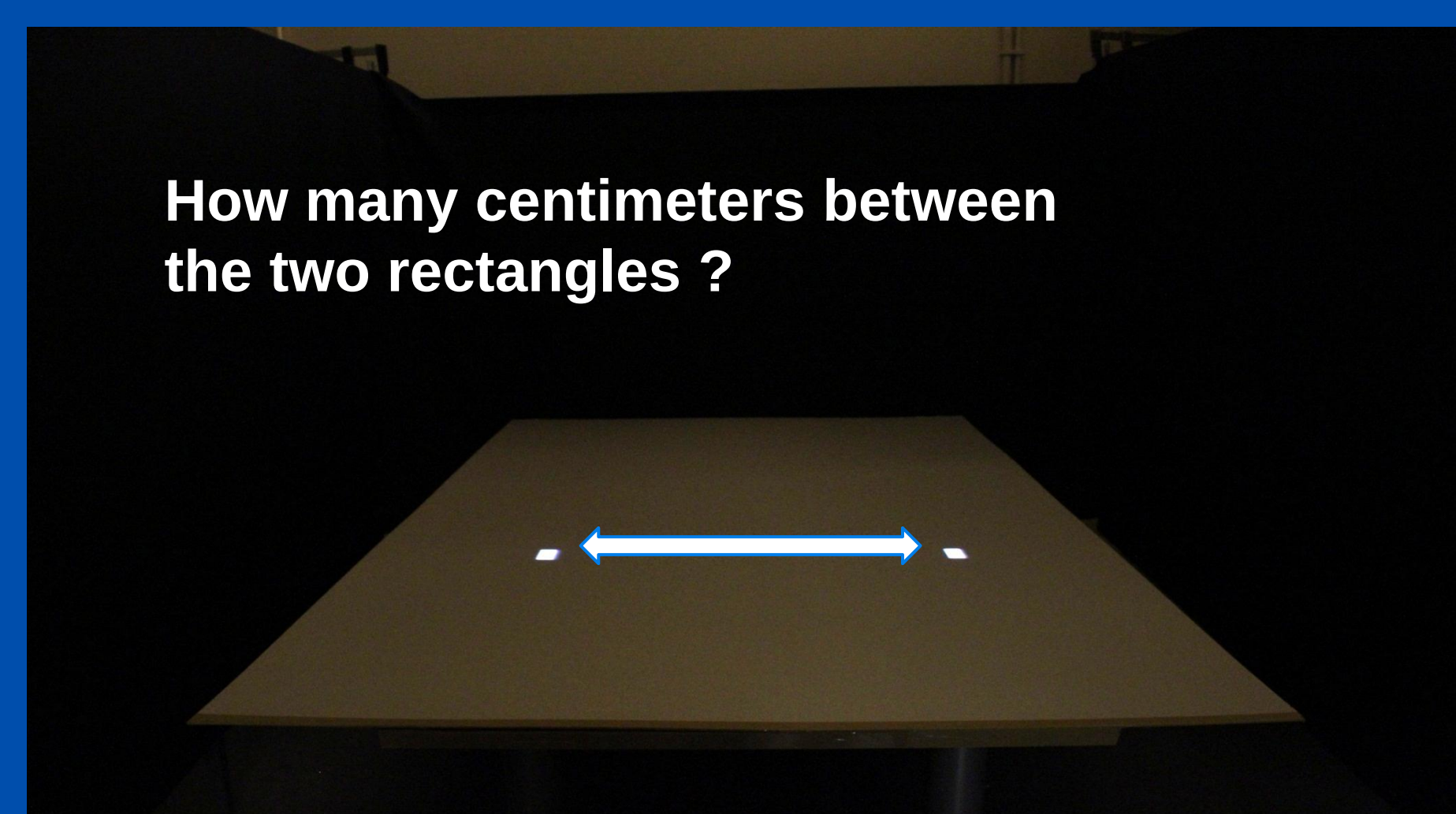
- 16 Distances : 35; 55; 65; 75 / 80; 85; 87.5; 90 / 92.5; 95; 100; 105 / 115; 125; 145; 165 cm.

Egocentric Distance perception task



- 16 Distances : 35; 55; 65; 75; 80; 85; 87.5; 90; 92.5; 95; 100; 105; 115; 125; 145; 165 cm.

Allocentric Distance perception task



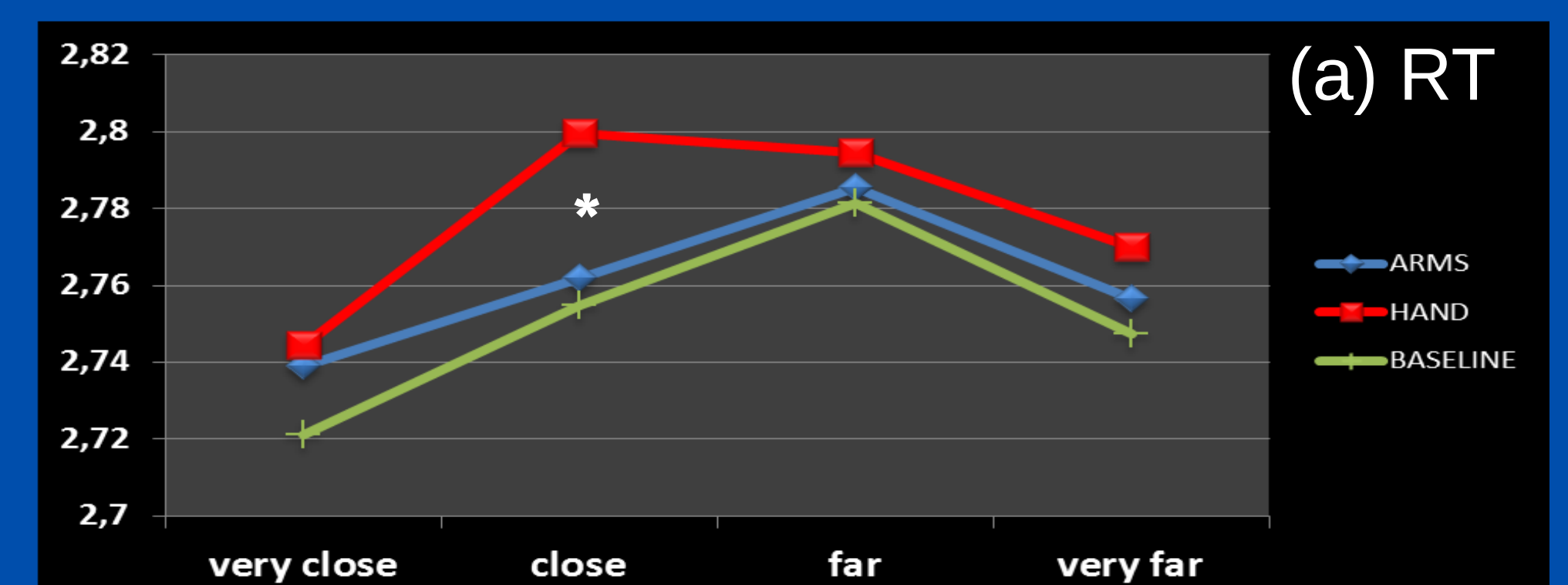
- 8 Distances: 8,16,24,32,40,48,56,64 cm.
- 2 Egocentric space: Close vs. Far
- The middle was always on the sagittal plane

Results

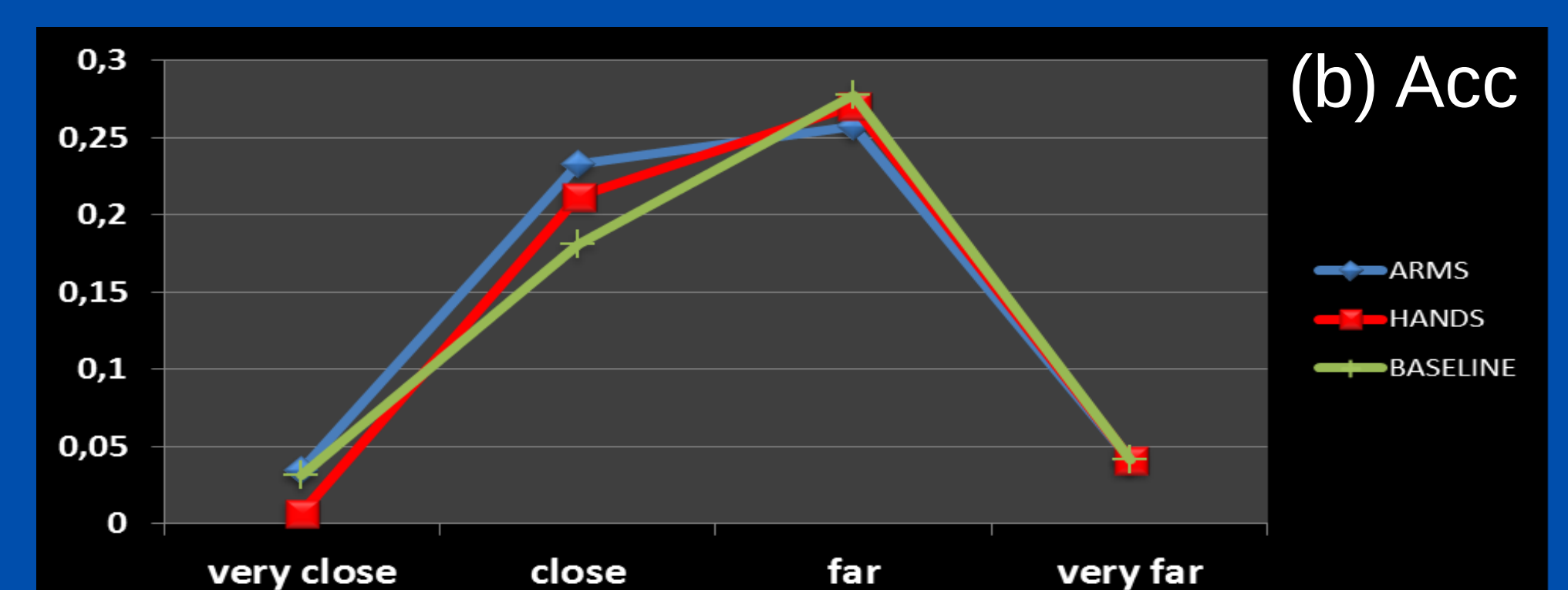
Data analysis with repeated measures ANOVAs

- Dependent variables
 - (a) Logged reaction time (RT)
 - (b) Accuracy (Acc)
- Independent variables
 - Motor disruption (dual task) (3 levels)
 - Grouped distances (4 levels)

Reachability perception task

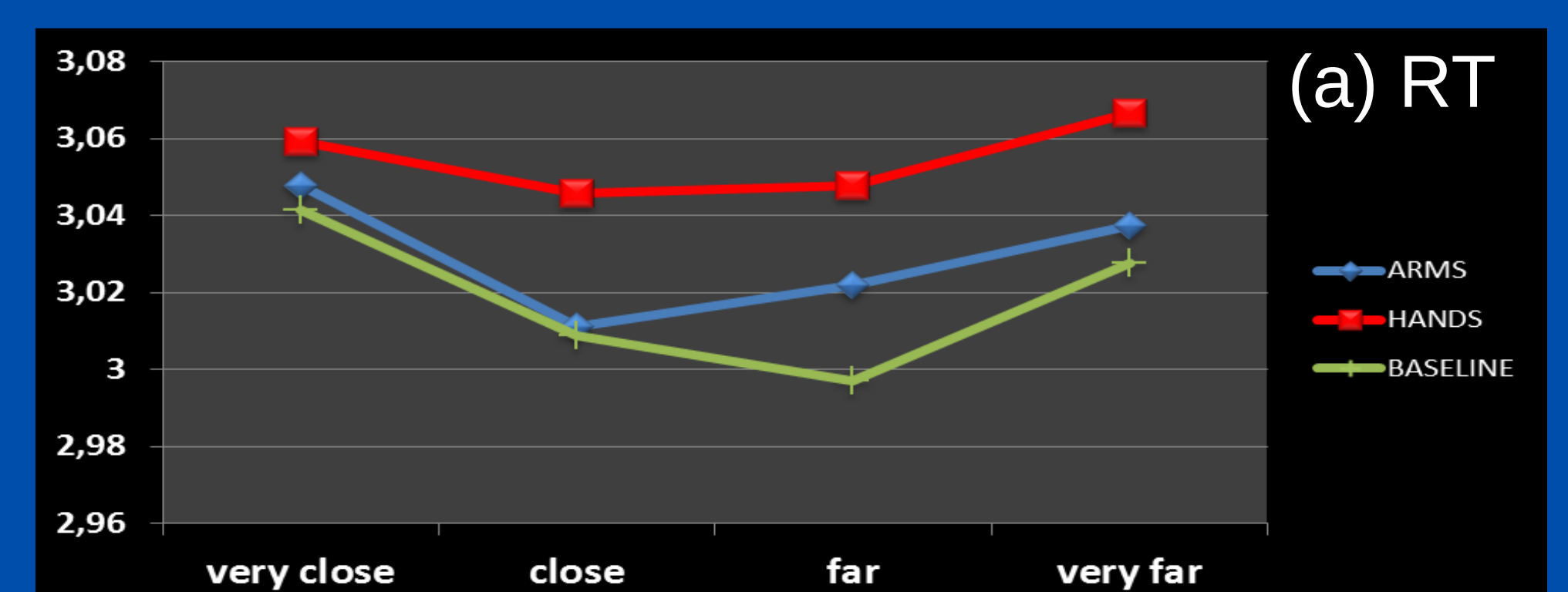


- Motor disruption ($F(2, 34) = 4, p < .05$)
- Grouped distances ($F(3, 51) = 10.5, p < .001$)
- Interaction * ($F(6, 102) = 2.6, p < .05$)



- Motor disruption ($F(2, 34) = 0.1, p = ns$)
- Grouped distances ($F(3, 51) = 8.5, p < .001$)

Egocentric Distance perception task



- Motor disruption ($F(2, 34) = 7.7, p < .01$)
- Grouped distances ($F(3, 51) = 6.2, p < .001$)

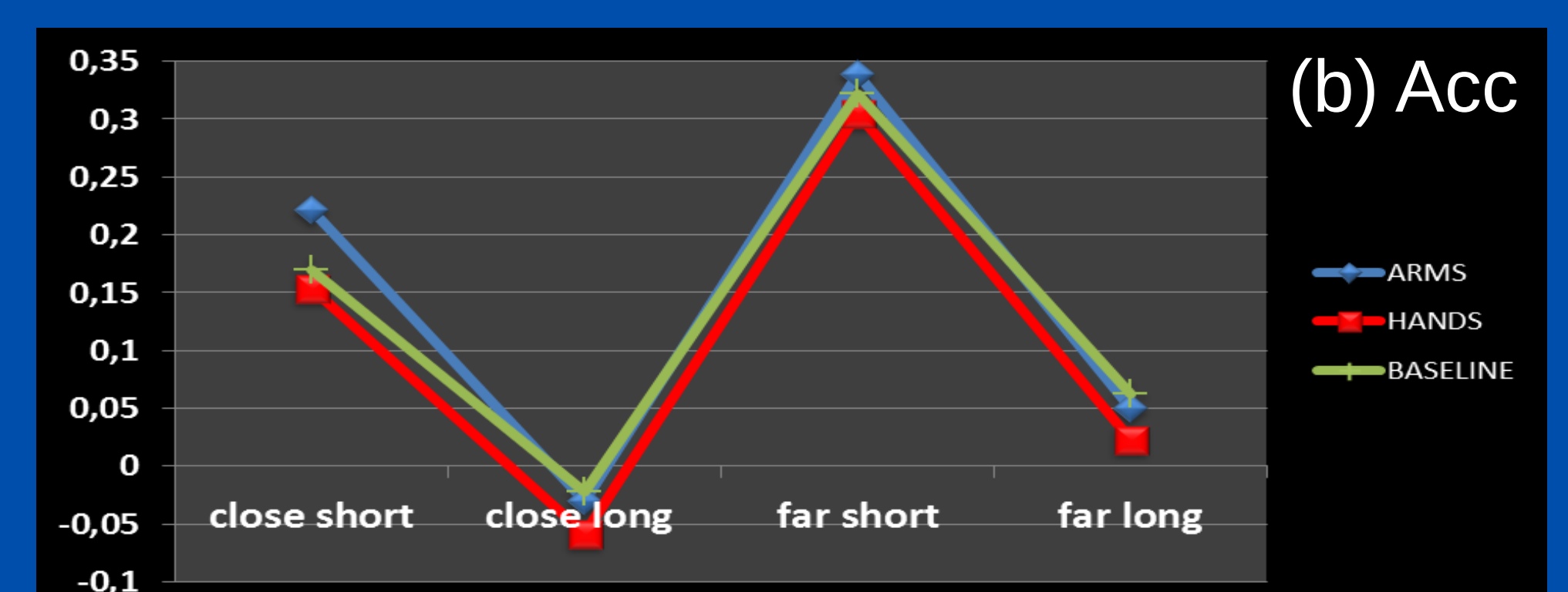


- Motor disruption ($F(2, 34) = 2.1, p = ns$)
- Grouped distances ($F(3, 51) = 2.9, p = .06$)

Allocentric Distance perception task



- Motor disruption ($F(2, 34) = 0.9, ns$)
- Grouped distances ($F(1, 17) = 7.5, p < .05$)
- Egocentric space ($F(1, 17) = 13.5, p < .01$)



- Motor disruption ($F(2, 34) = 0.75, p = ns$)
- Grouped distances ($F(1, 17) = 30.3, p < .001$)
- Egocentric space ($F(1, 17) = 38.9, p < .001$)
- Distance x Space ($F(1, 17) = 4.9, p < .05$)

References

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