

# **The effects of restricted viewing conditions on egocentric distance judgments**

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# Egocentric distance judgments

Visually directed actions are accurate to 20 meters under full-cue conditions in the real world.

- Requires visual system to recover scale.
- The same tasks in virtual environments using Head Mounted Displays (HMD) show underestimation.

# Egocentric distance judgments

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What viewing conditions are necessary for accurate distance scaling?

Two types of viewing restrictions

- Field of view
- Binocular viewing

# Egocentric distance judgments

## Field of view restrictions

- Seeing the floor and one's feet
  - Necessary for computing eye height?
  - Missing in most HMD/virtual environments
- Horizontal field of view
  - Is full field of view necessary?
  - Common restriction in HMD
  - Can head rotation compensate for restricted FOV?

# Egocentric distance judgments

## Binocular viewing

- Weak cue for absolute distance beyond 2 meters with reduced-cues.
- What about full-cue conditions?
  - Can stereo to near targets help scale pictorial cues relating near and far targets?
- Stereo is missing or different in HMD.

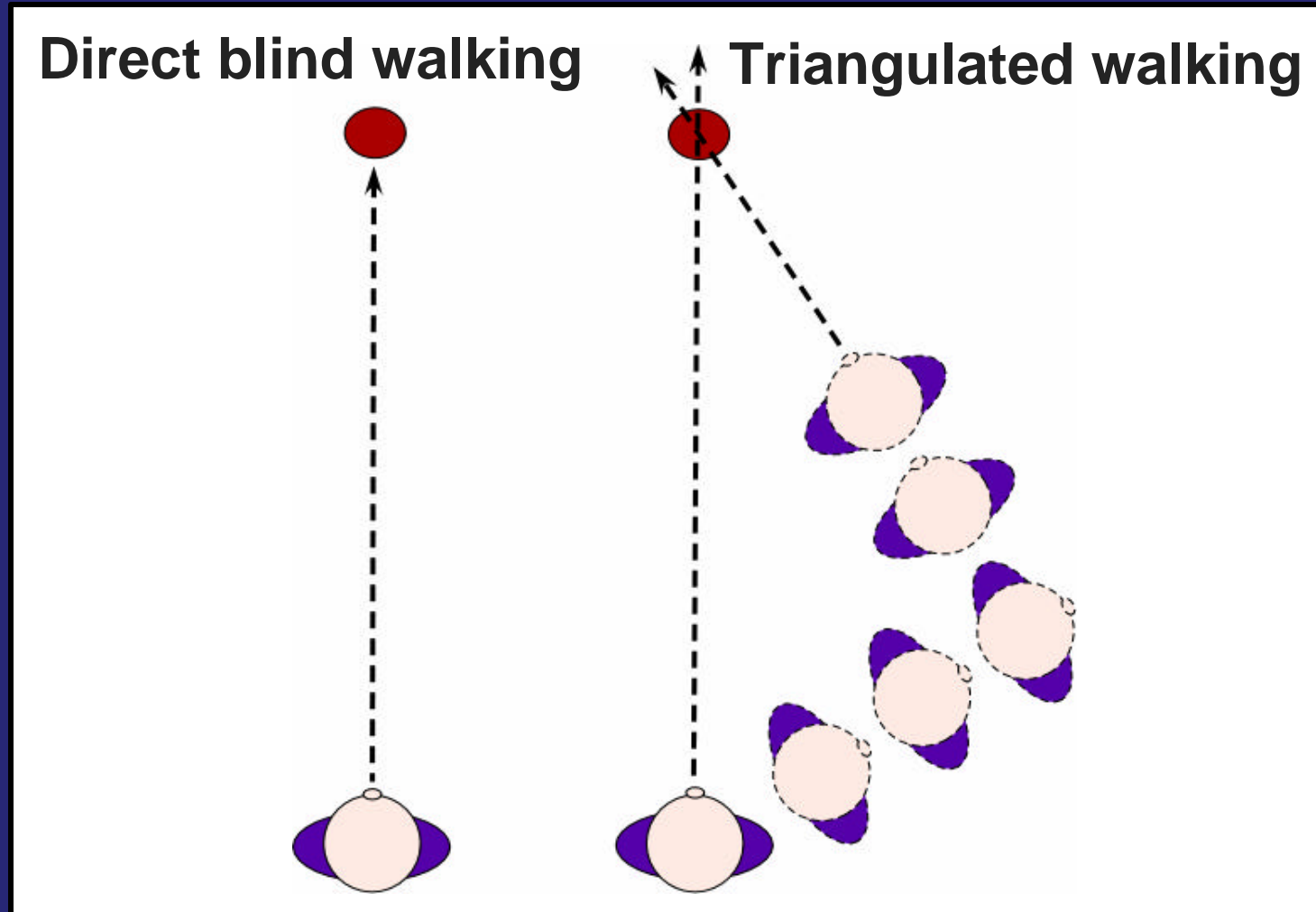
# Egocentric distance judgments

## Research questions:

- What viewing conditions are necessary for accurate distance scaling in the real-world?
  - Near full-cue environment
- Are viewing restrictions a likely account of distance underestimation in HMDs?

# The tasks

## Visually directed walking



# The spaces

## Hallway and Lobby



# Experiment 1

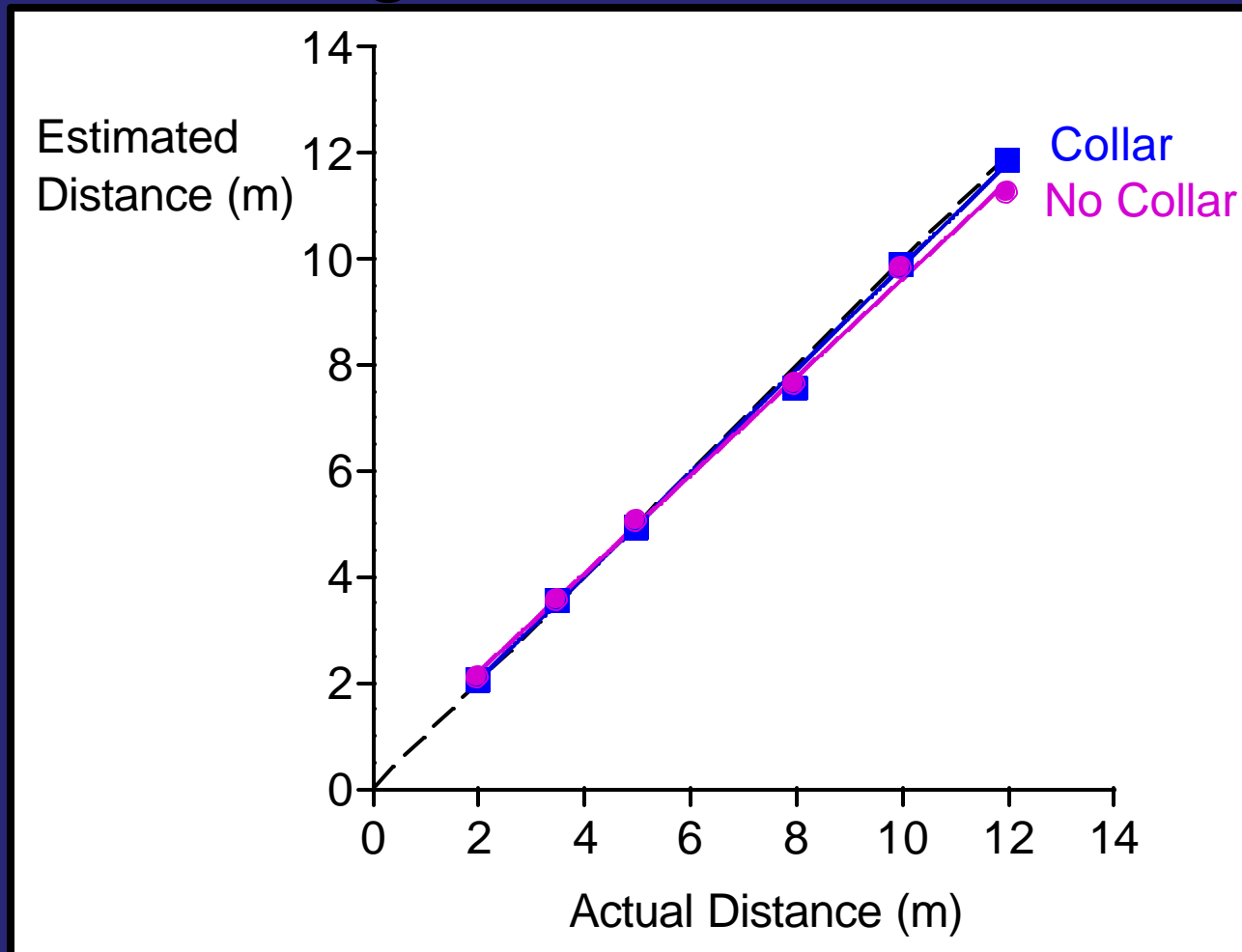
Is seeing your feet necessary?



- Blind-walking
- 4 – 12 meters

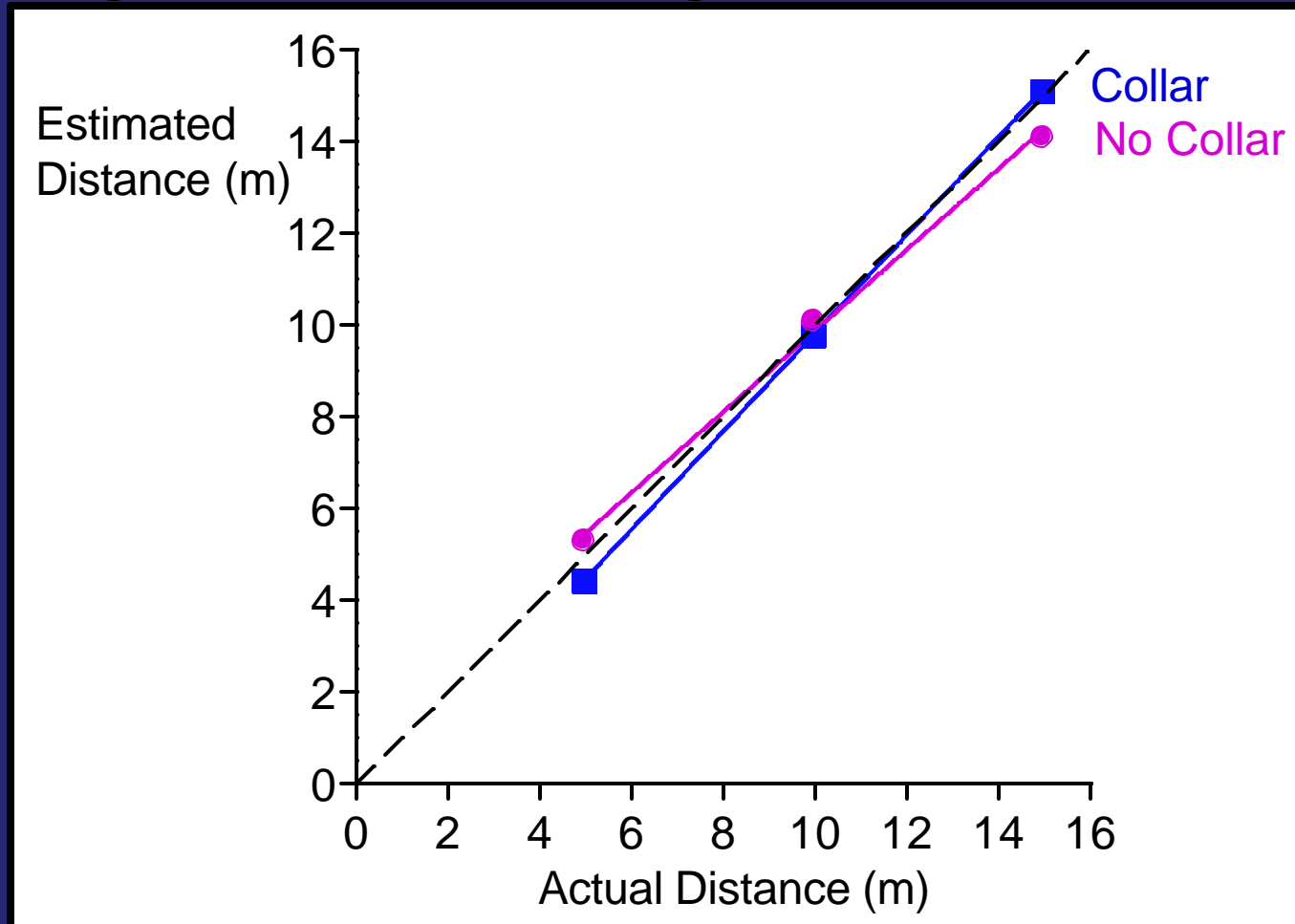
# Does seeing your feet matter?

## Blind-walking



# Does seeing your feet matter?

## Triangulated walking



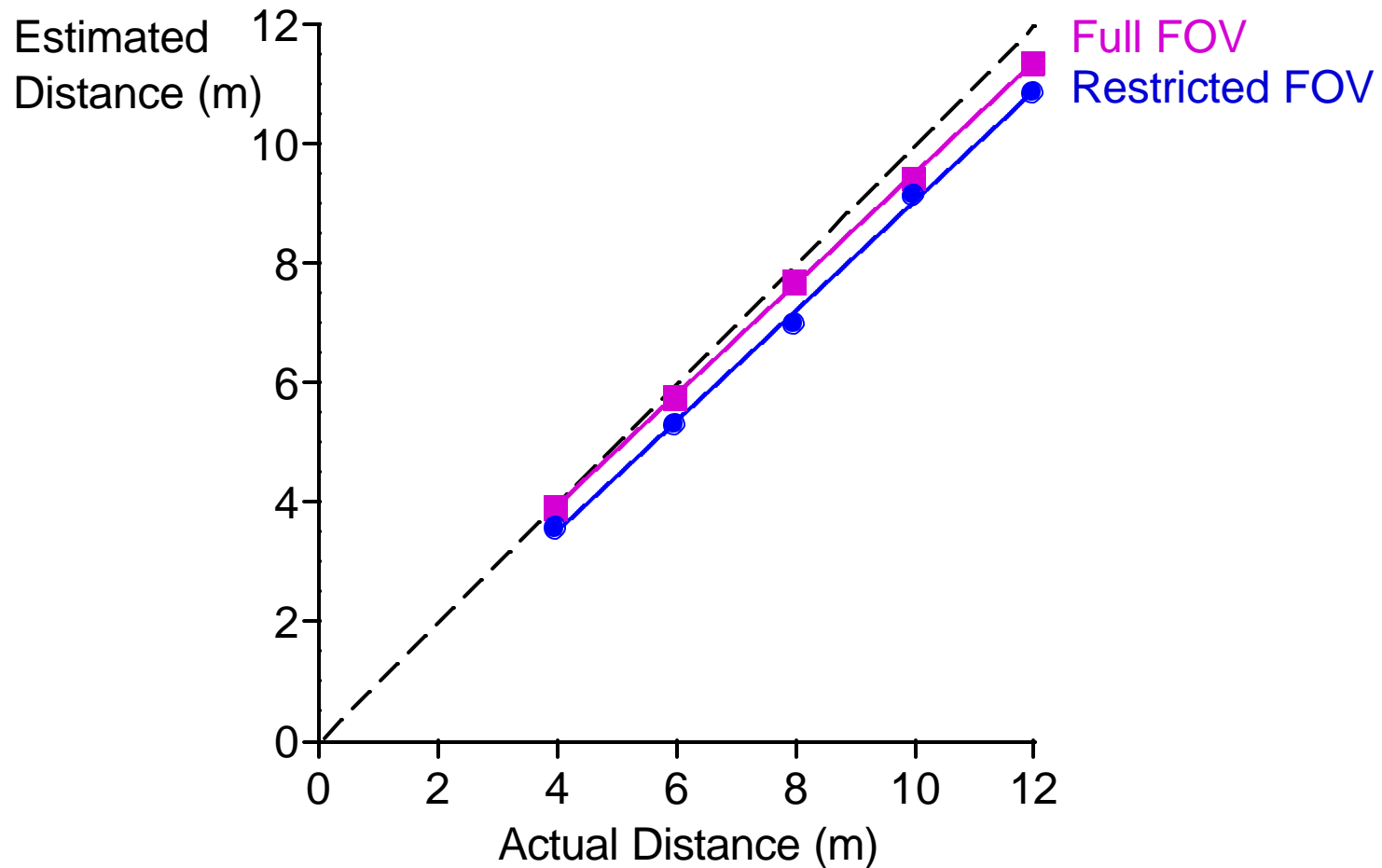
# Experiment 2

Is a normal horizontal field of view necessary?

- Blind-walking, 4 –12 m
- Head rotation allowed



# Does FOV matter?

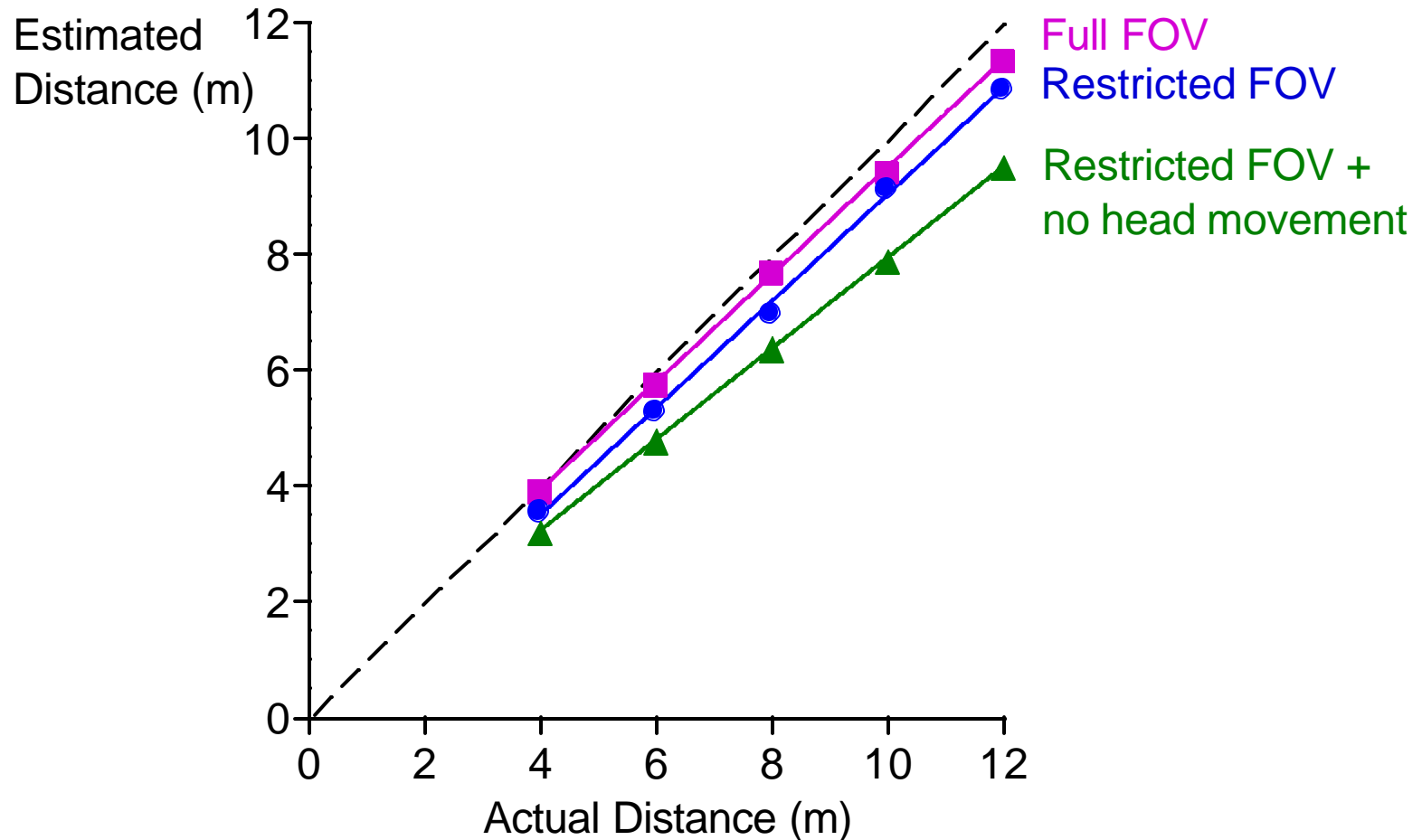


# Does head movement matter?

- Restriction of FOV and head rotation



# Does head movement matter?



# FOV conclusions

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Restricted field of view does not impair distance judgments as long as head rotation is allowed.

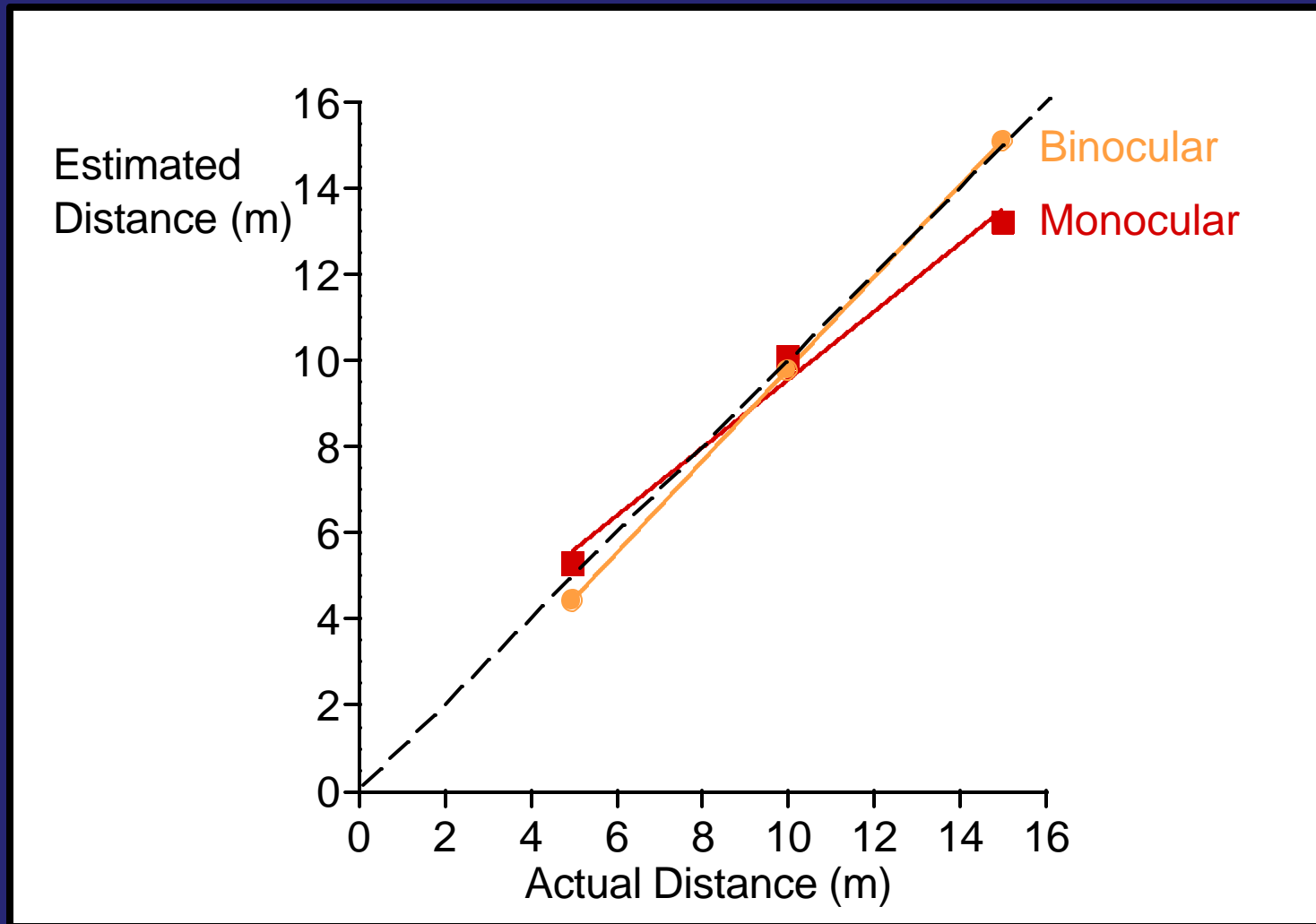
# Experiment 3

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Is binocular viewing necessary?

- Monocular and binocular viewing
- Triangulated walking, 5 – 15 meters

# Does binocular viewing matter?



# Conclusions

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## An examination of viewing limitations

- Rarely studied for action-relevant distances under full pictorial cue conditions.
- Common to virtual environments.

# Conclusions and open questions

Little influence of viewing restrictions on egocentric distance judgments.

- What factors lead to the biases in virtual environments?
- See Thompson et al. (this session) for further investigation of this question.

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