Cue-Target Similarity and Attentional Orienting in Auditory Spatial Discrimination

Yeganeh Modaresnia and Norbert Kopčo

Perception & Cognition Lab, Pavol Jozef Šafárik University, Košice, Slovakia

Introduction

- **Attention** facilitates processing of objects, events, or locations in complex scenes
- Spatial attention is crucial in complex auditory scenes
- Objects can capture attention automatically (**exogenous attention**)
- Exogenous cues can have facilitatory or distracting effects

Very few previous studies looked at exogenous attention in **sound localization**:

- Cueing improves reaction times (Spence & Driver, 1994)
- Small (Sach et al., 2000), location-specific (Maier et al., 2009), or no (Kopčo et al., 2001) improvements in localization accuracy
- Enhancement of auditory discrimination (ILD/ITD) when the listener's gaze was directed to stimulus visually, but not when cue was auditory (Maddox et al., 2014)

Introduction

Šebeňa et al. (2026):

- Modified the Maddox et al. setup
  - Eyes fixated at a neutral location
- Observed an effect of auditory cueing
- However, cue and target were identical
- Possible explanation:
  - Cue–target similarity (flanker effect)

Current Study

Behavioral Experiment

- Examined whether **cue-target similarity** affects performance
- Performed based on Šebeňa et al.
- Used a more complex environment (three cue/target locations in a left-right symmetrical arrangement)
- Tested whether fixation on the cued location modulates the cueing effect

Hypotheses

H1: The cuing effects will be reduced when the cue-target are different
H2: Fixation may also affect auditory cueing
H3: The environment is more complex than in Šebeňa et al. so that will make the task harder.

Methods

Setup

- 11 normal-hearing participants (age range: 20–29 years)
- Virtual auditory environment using anechoic HRTFs
- Eye gaze fixed at central position

Stimuli

Target:

- Two 100-ms 170-Hz **buzz** sounds (T1 and T2)

Cue:

- **Buzz** (identical to target) or **noise** (100-ms 170-Hz broadband white noise), with equal probability

Validity:

Valid (predicting target location), or invalid

Offset:

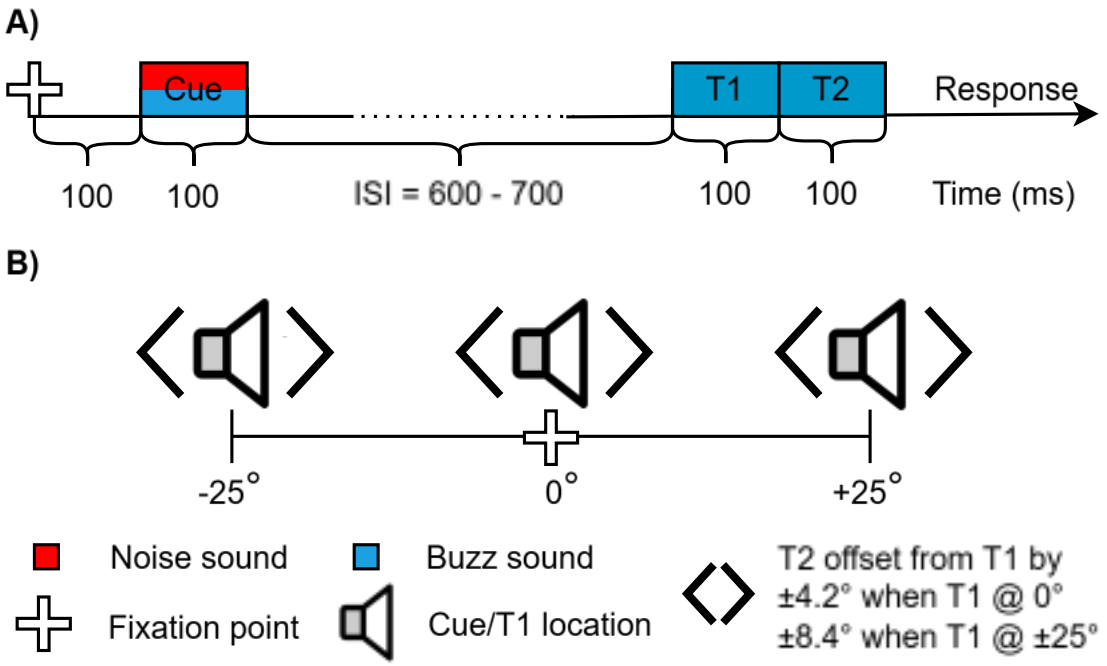
- Random interstimulus interval (ISI): 650 ± 50 ms

Procedure

Task: Discriminate whether T2 was to the left or to the right of T1.

Fixation point:

- White cross displayed at 0° azimuth



A) Temporal setup and B) Spatial setup

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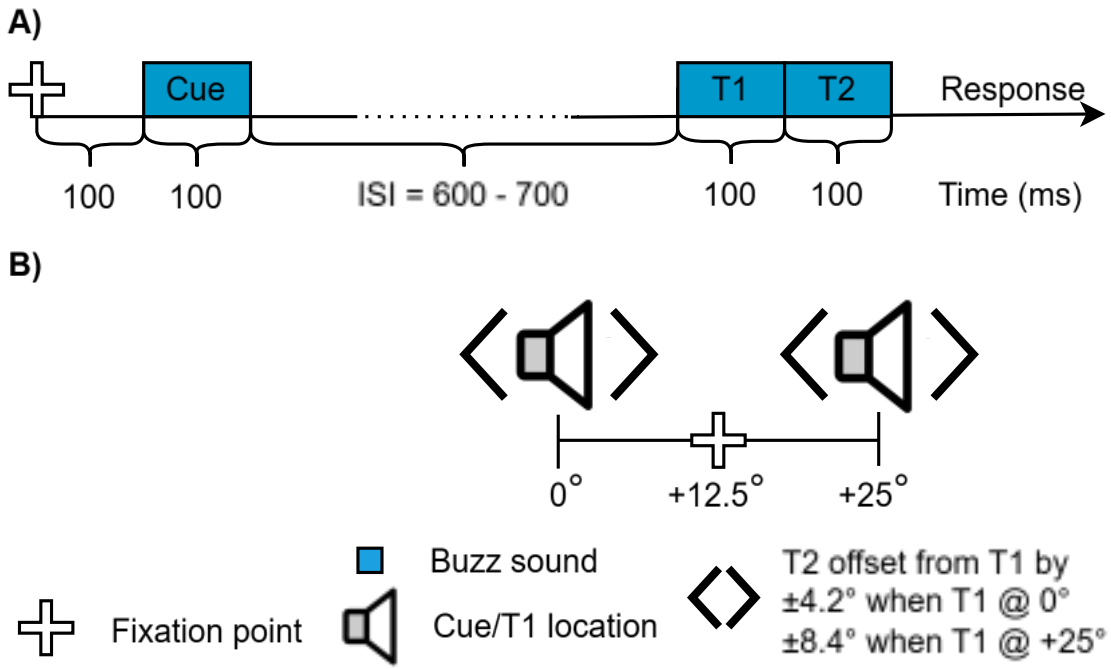
Šebeňa et al. Setup

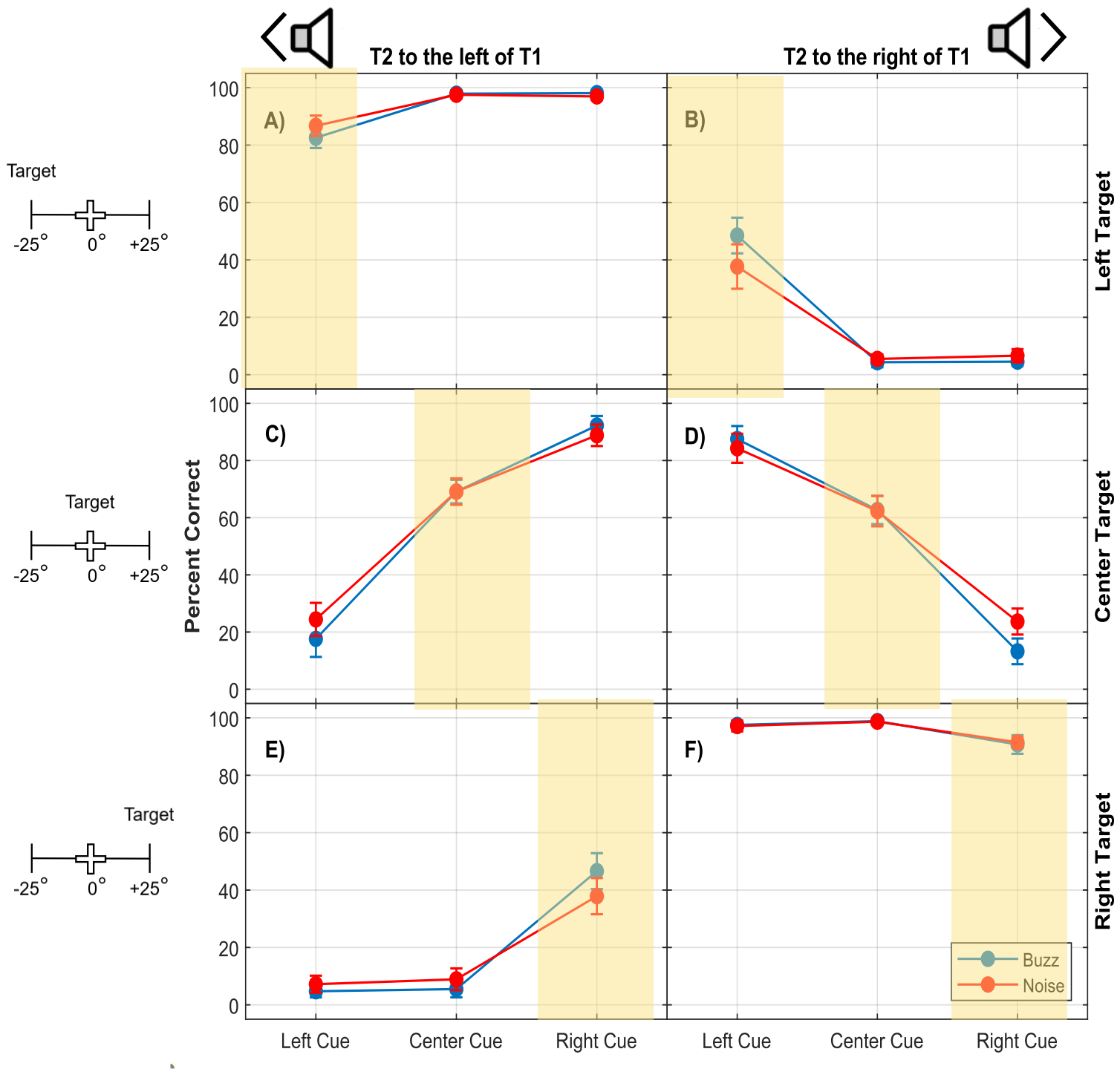


A) Temporal setup and B) Spatial setup

Results:
Percent Correct

Structure

- Percent correct as a function of cue location
- Performance is left-right symmetrical
- Collapsed across symmetrical conditions
- Collapsed across invalid conditions

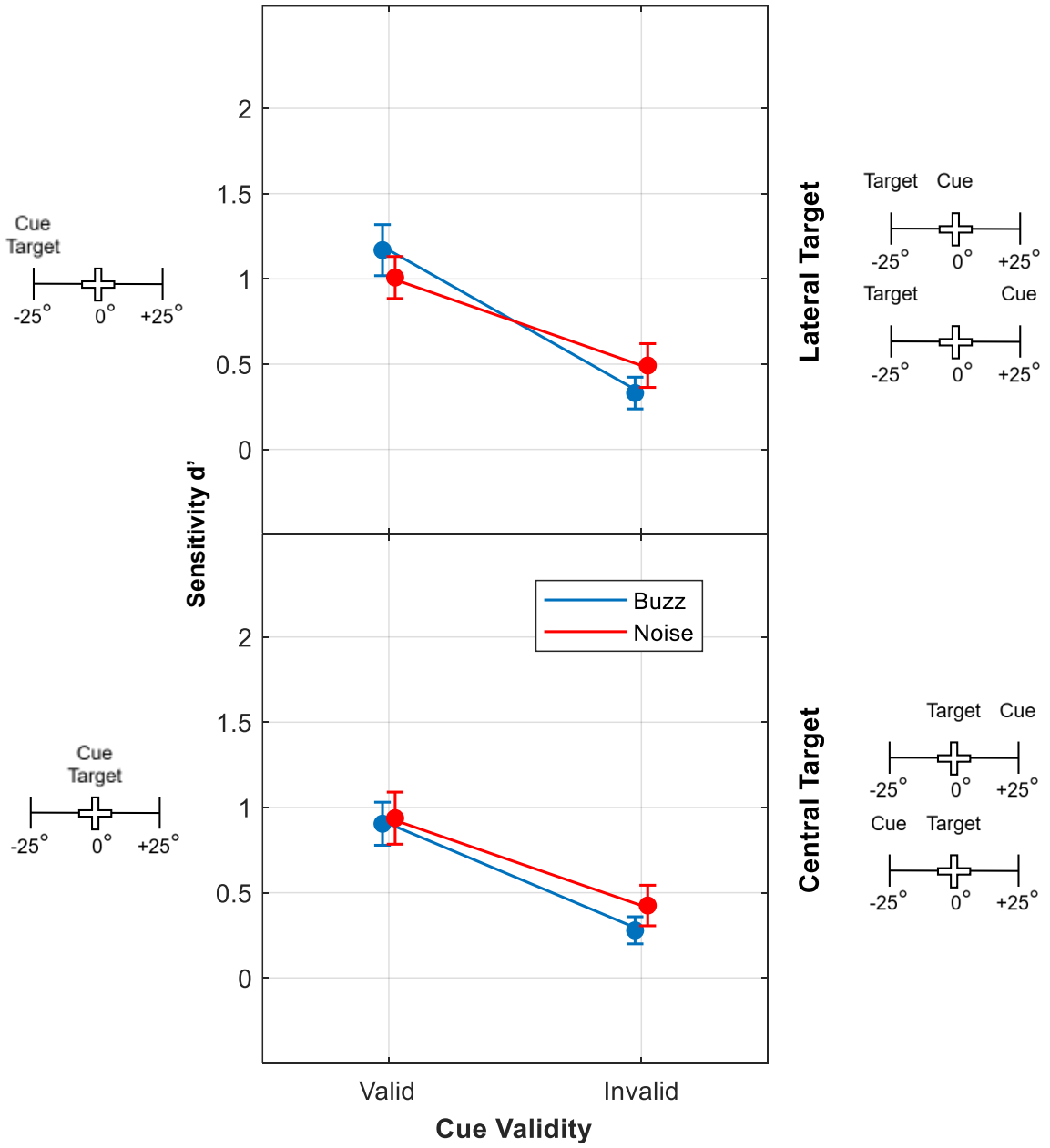


Results: d’

- Main effect of cue validity, higher d′ for valid vs invalid cues
- No effect of cue type
- No effect of fixation

H1: Cue-target similarity had **no** influence on sensitivity.

H2: Fixation does not systematically enhance sensitivity.



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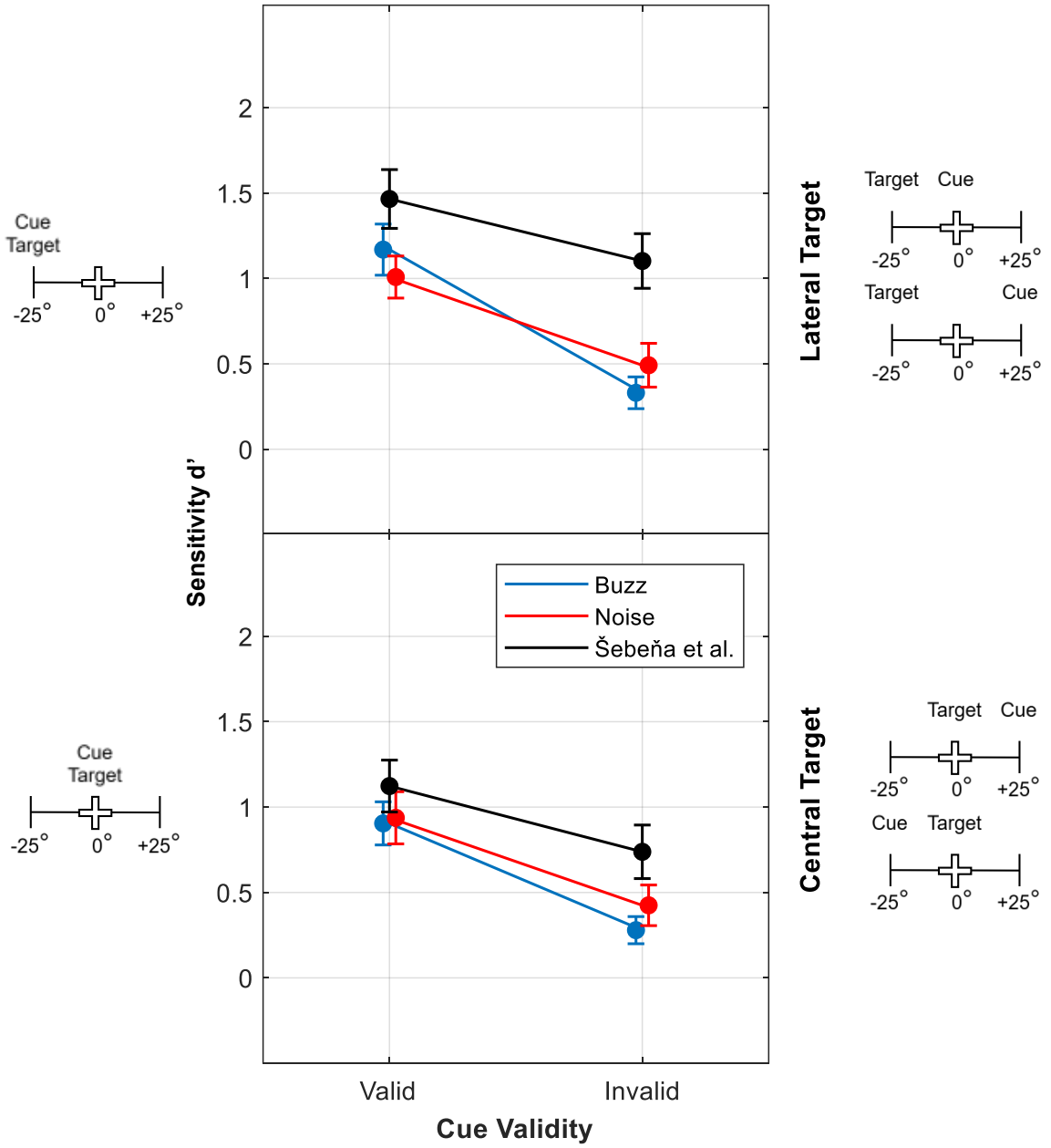
H1: Cue-target similarity had **no** influence on sensitivity.

H2: Fixation does **not** systematically enhance sensitivity.

H3: Overall d′ values are lower than in Šebeňa et al. study.



Results: Response Bias

- Subjects biased to respond **towards left/away from cue**
- Lateral invalid: larger bias with cue-target similarity

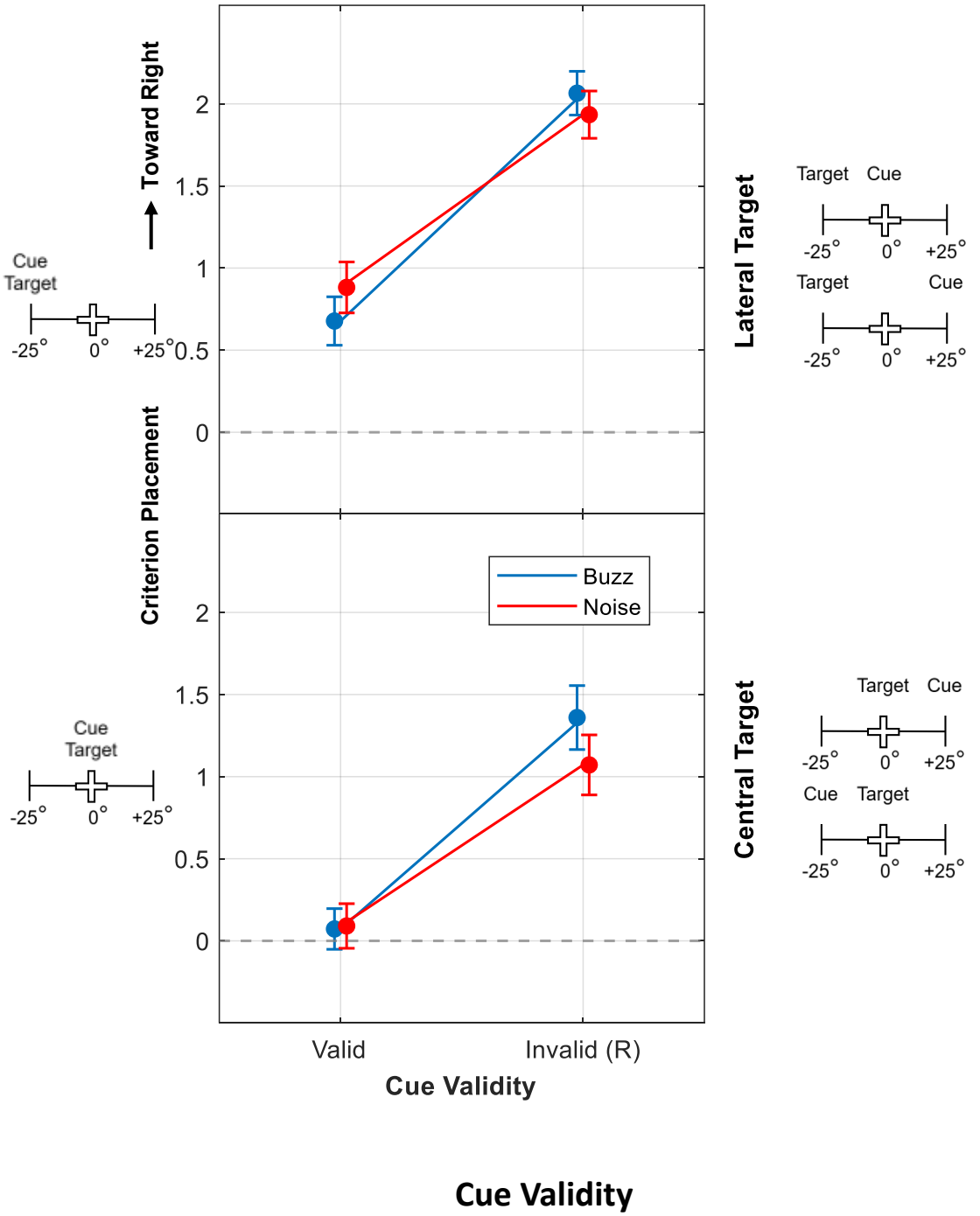
  → **Biased away from fixation and cue**
- Central invalid: similar to lateral invalid

  → **Biased away from fixation and cue**
- Lateral valid: weaker bias, opposite direction of similarity

  → **Biased away from fixation**

H1: cue-target similarity either increases or decreases bias.

H2: Fixation modulates bias.



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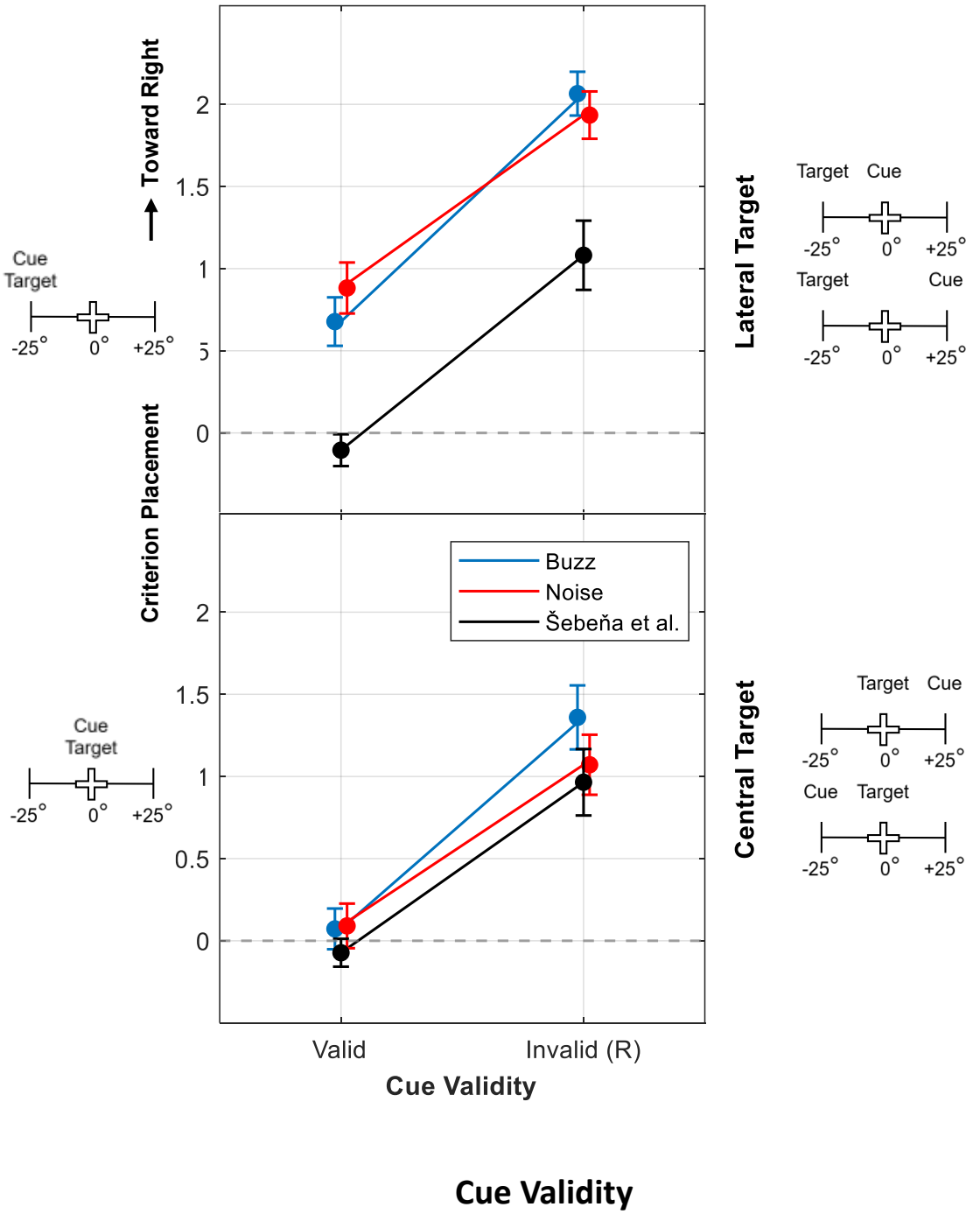
H1: cue-target similarity either increases or decreases bias.

H2: Fixation modulates bias.

H3: Compared to Šebeňa et al., bias is stronger here.



Summary and Interpretation

- Auditory cues trigger automatic spatial orienting, even in a difficult task
- H1: **Cue–target similarity**
  - × Does not affect sensitivity
  - ✓ Modulates bias---
- H2: **Fixation**
  - × Does not affect sensitivity
  - ✓ Is likely modulates bias
- H3: Increased spatial setup **complexity** compared to Šebeňa et al.
  - ✓ Reduces sensitivity
  - ✓ Increased bias

Future Work

- ERP and oscillatory EEG analysis to investigate neural correlates of behavioral effects

Thank you

Any Questions?

Contact

Yeganeh.Modaresnia@student.upjs.sk

Kogneuro@gmail.com

http://pcl.upjs.sk