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Audio-Tactile dynamic multisensory integration in sighted and blind individuals



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Introduction

Our performance is typically enhanced when information comes from multiple senses [1]. In addition, one modality can modulate the perception of the information conveyed by another one. For example, as has been reported that a dynamic tactile stimulus can affect the perceived direction of an auditory stimulus' movement and vice versa [2]. However, there are evidence of a different multisensory interaction process for visually impaired individuals. For instance, they exhibit, in the detection of touch, less interference from auditory cues that were task-irrelevant compared to sighted [3]. In the same way, when a tactile and auditory information are presented simultaneously but in two location, blind individuals experience less attraction of the sound towards the touch than their sighted counterparts [4]. These evidence suggest a reduced audio-tactile interactions in the spatial processing due to the lack of visual input [3,4]

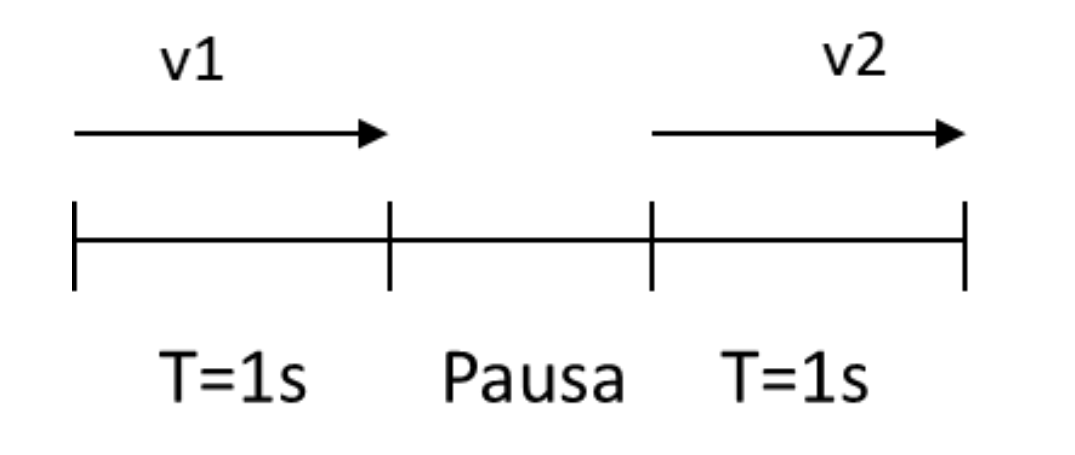
Yet, how blind and sighted individuals process audio-tactile information, in unisensory and multisensory conditions, during dynamic stimuli discrimination is still unclear.

Method

Participants:
 ➤ 13 sighted
 ➤ 10 blind

Task:
 2AFC - The participant has to perceive a sequence of two movement with different speeds and to discriminate which was faster between the two. "which is the interval that contained the faster movement? The first or the second?"

Standard velocity: 3 (slower) cm/s, 7 (faster) cm/s
 + 2 QUEST [5]

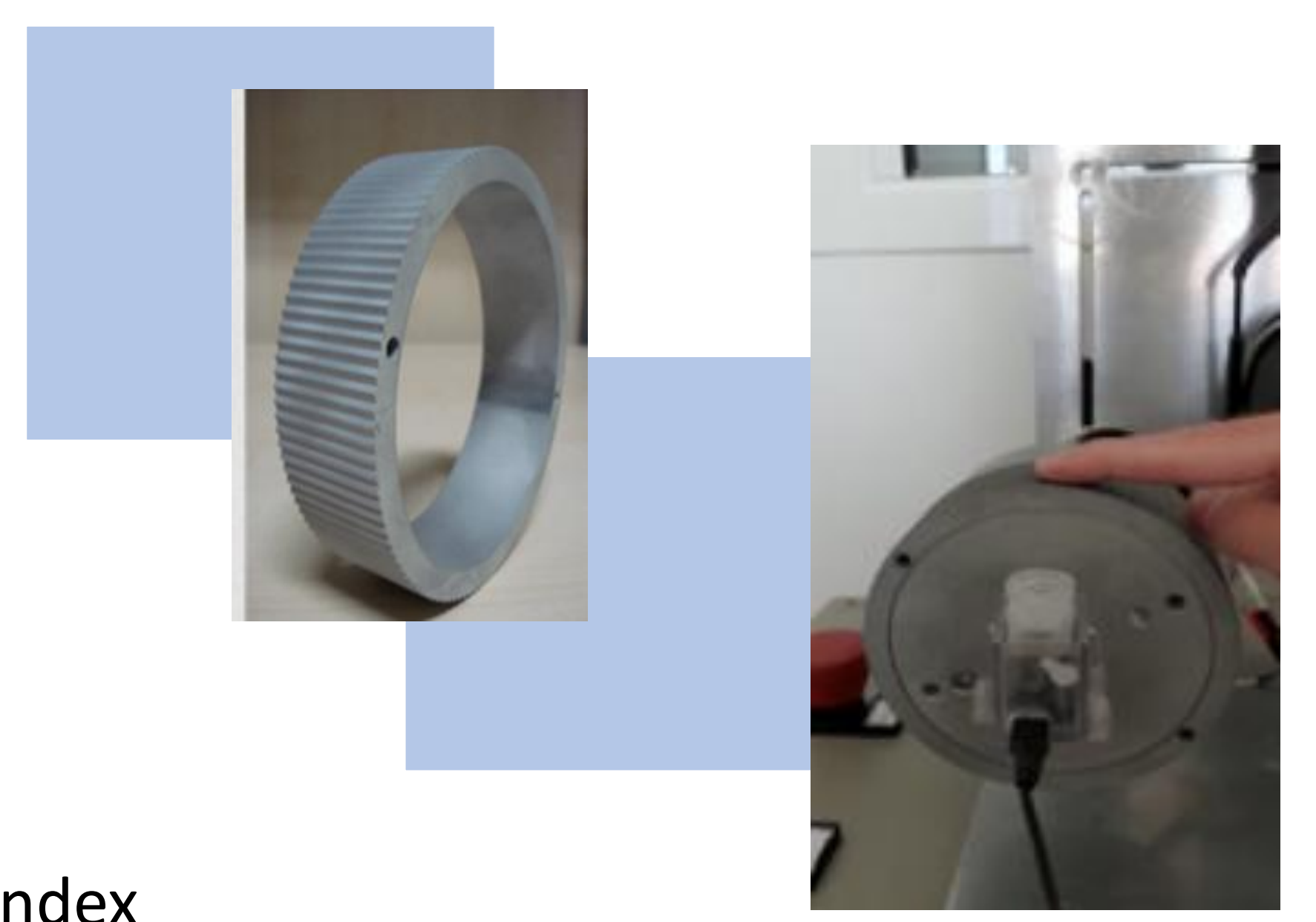


Modality: Uni/bimodal

- 30 trials per Quest: N= 180 trials total.
- Unimodal tactile (60 trials)
- Unimodal auditory (60 trials)
- Bimodal tactile-auditory (60 trials)

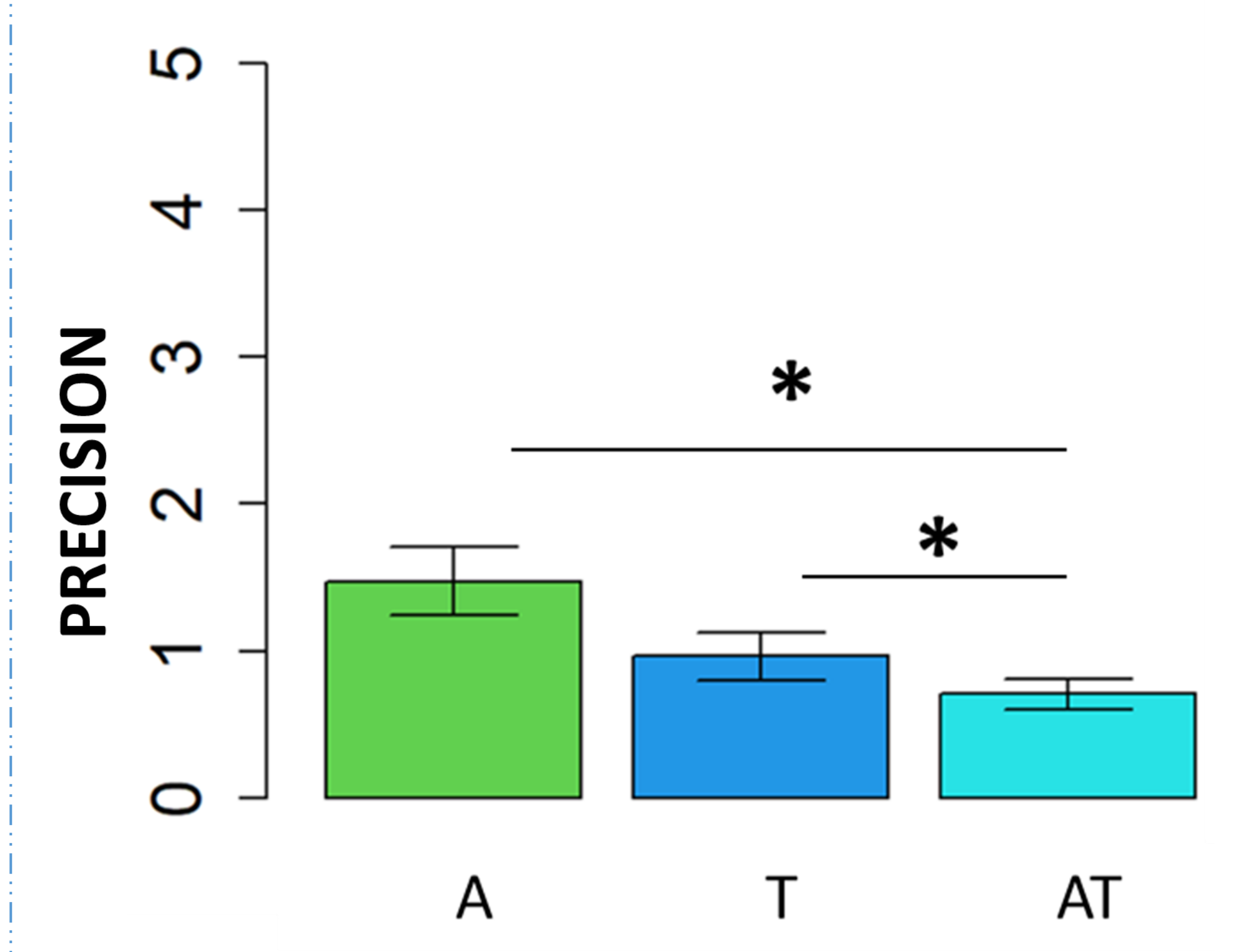
-Duration: 40 minutes

- Stimulation:**
- Tactile stimulus: 10 cycles/cm
 - Audio stimulus frequency: 926 Hz
 - Tactile area of stimulation: fingertip of index



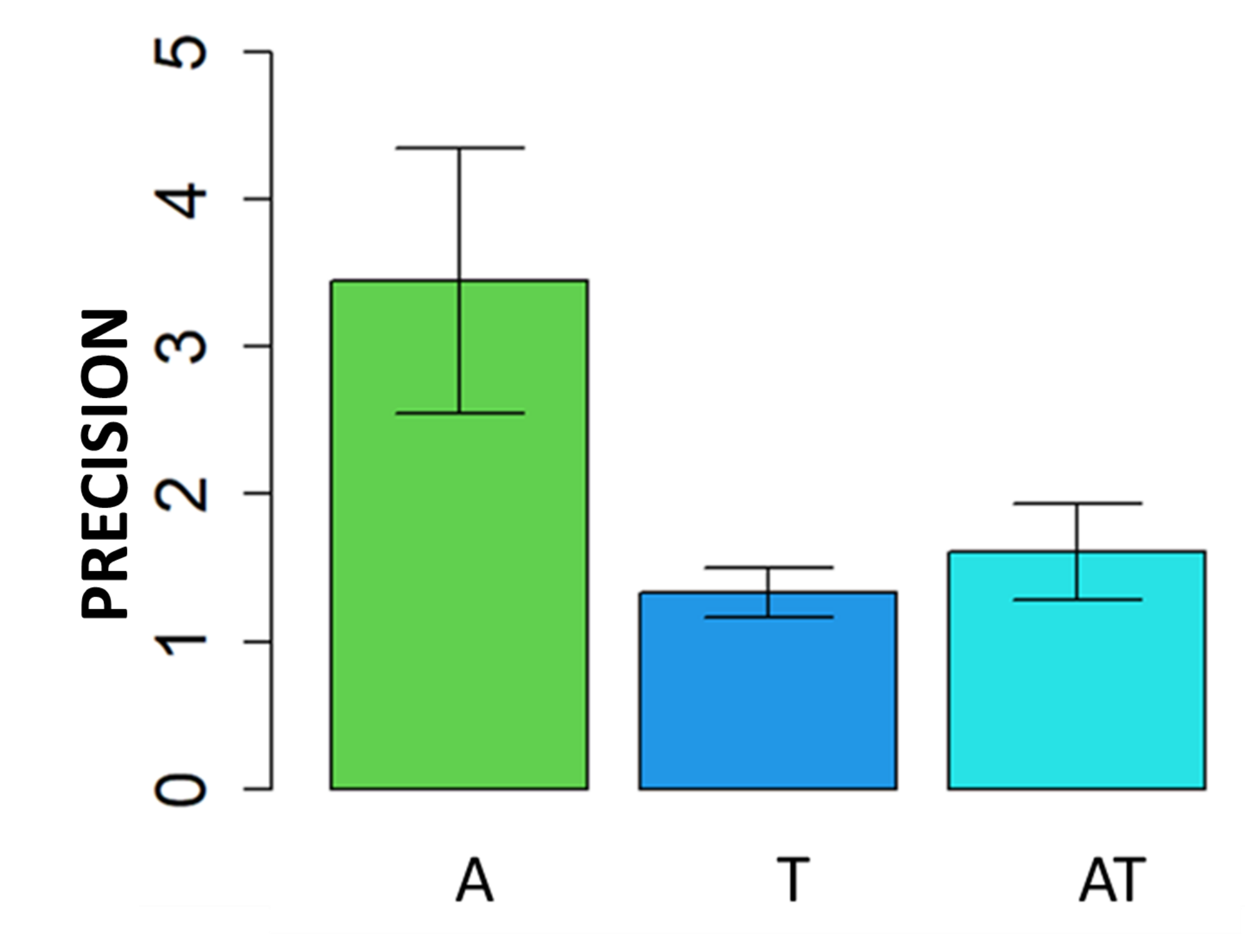
Results

➤ **Sighted:**
 Slower standard velocity



Benefit in the perception

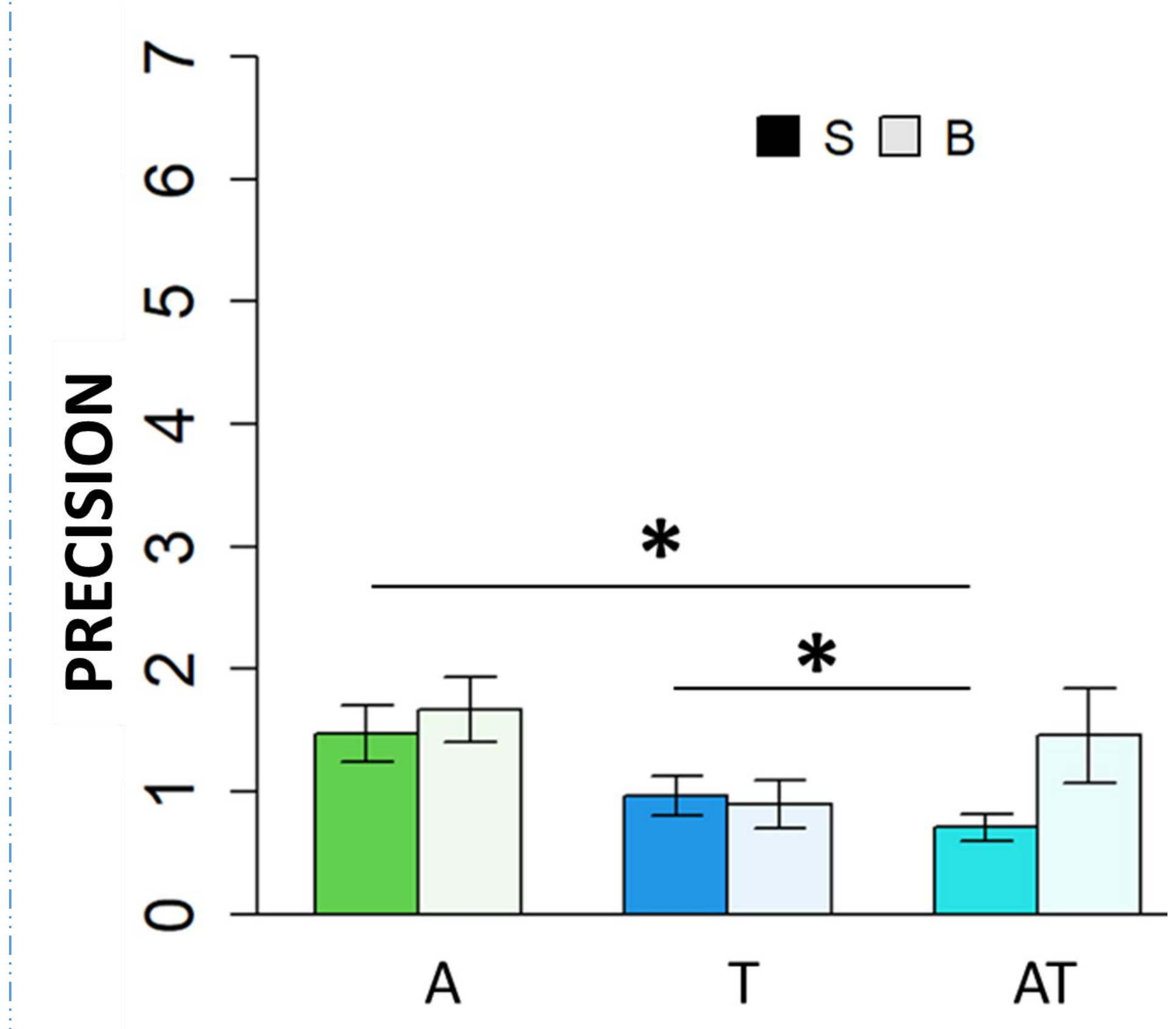
Faster standard velocity: faster



No significant interactions

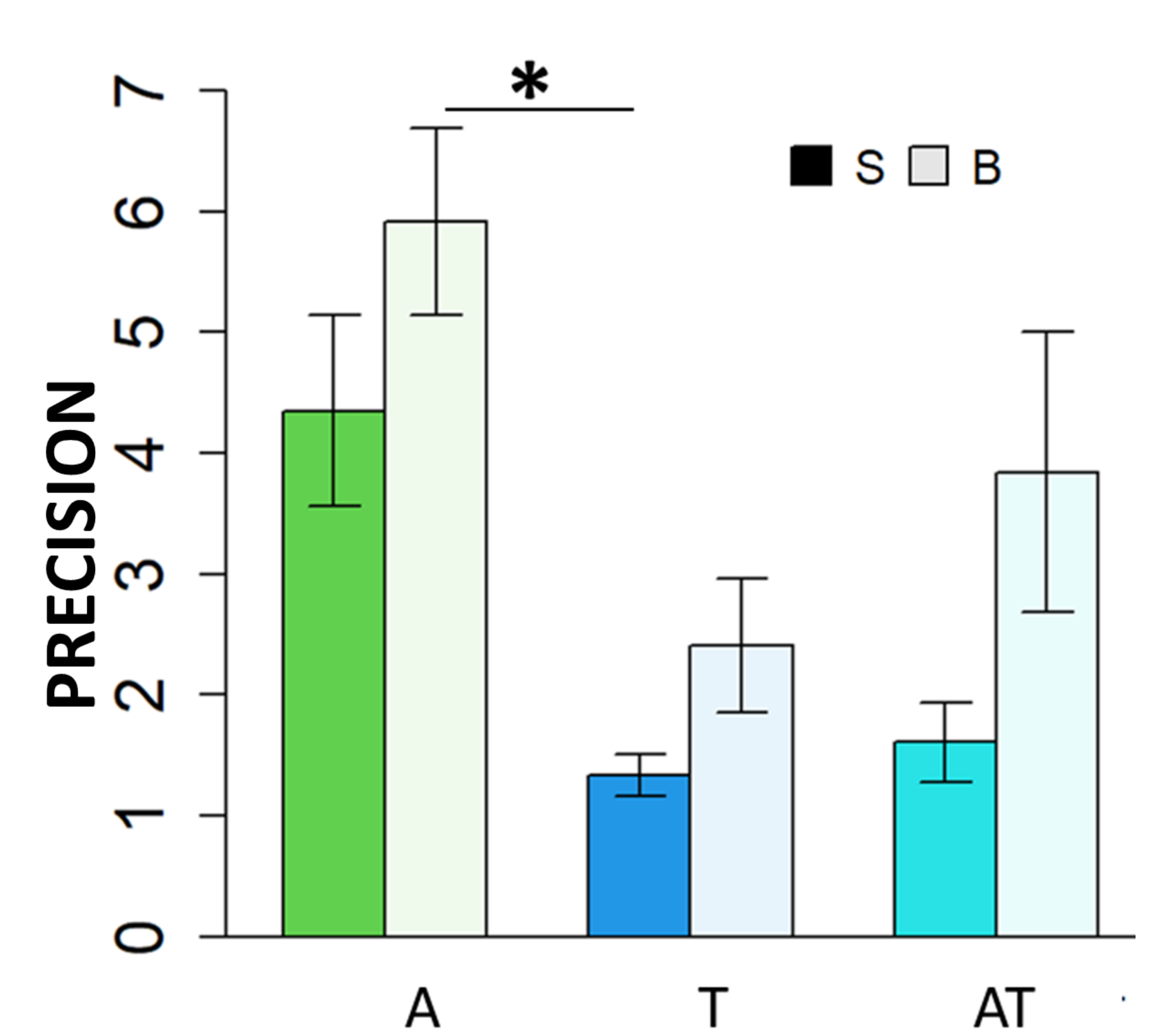
Velocity effect: better performance for the slower one

➤ **Sighted vs blind:**
 Slower standard velocity



Group effect: blind individuals are less precise than sighted
 Velocity effect: worse performance for the faster velocity

Faster standard velocity:



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Conclusions

1. There is a benefit in the performance when tactile and audio information are provided simultaneously for sighted individuals.

The worse performance on the audio modality for the faster condition might lead to a tactile dominance during the task → no benefit when both modalities are combined.

2. Blind individuals do not benefit of the bimodal condition.

Blind individuals do not activate automatically an external coordinates for the processing of sensory stimulus, which might be responsible of a reduced multisensory integration [6].

3. Worse performance for both groups for the faster condition, being the blind participants even more affected than sighted.

Some authors suggest a worse precision in the perception of faster movements [7].

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