2022 – Allocating space-based attention with schemas, words, and scenes
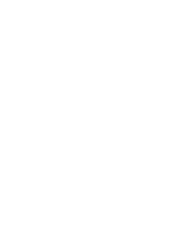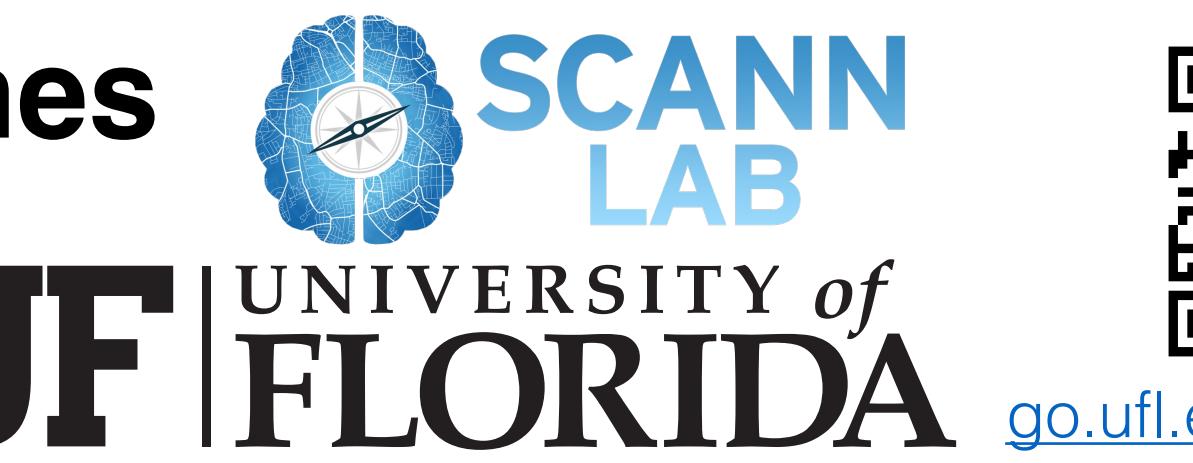
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1. Motivation

Visual navigation cues support spatial navigation abilities

↑ 🧳 Baggage

LEFT LANE MUST TURN LEFT
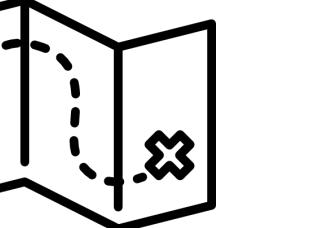
Spatial directions are extracted faster for schemas and words than scenes despite shared neural representation[1]

Attention preferentially allocated with words and arrows[2]

Is the allocation of space-based attention guided by efficient comprehension of spatial direction?

2. General Method[1,3]

Directions: ahead, left, right
Formats: scene, schema, word

Ahead schema   Left scene   Right word

Fixation: 1000 ms
Cue: 1200 ms
ISI: 0-500 ms
Target: 100 ms
Time

Invalid 15%
Valid 70%
Catch 15%
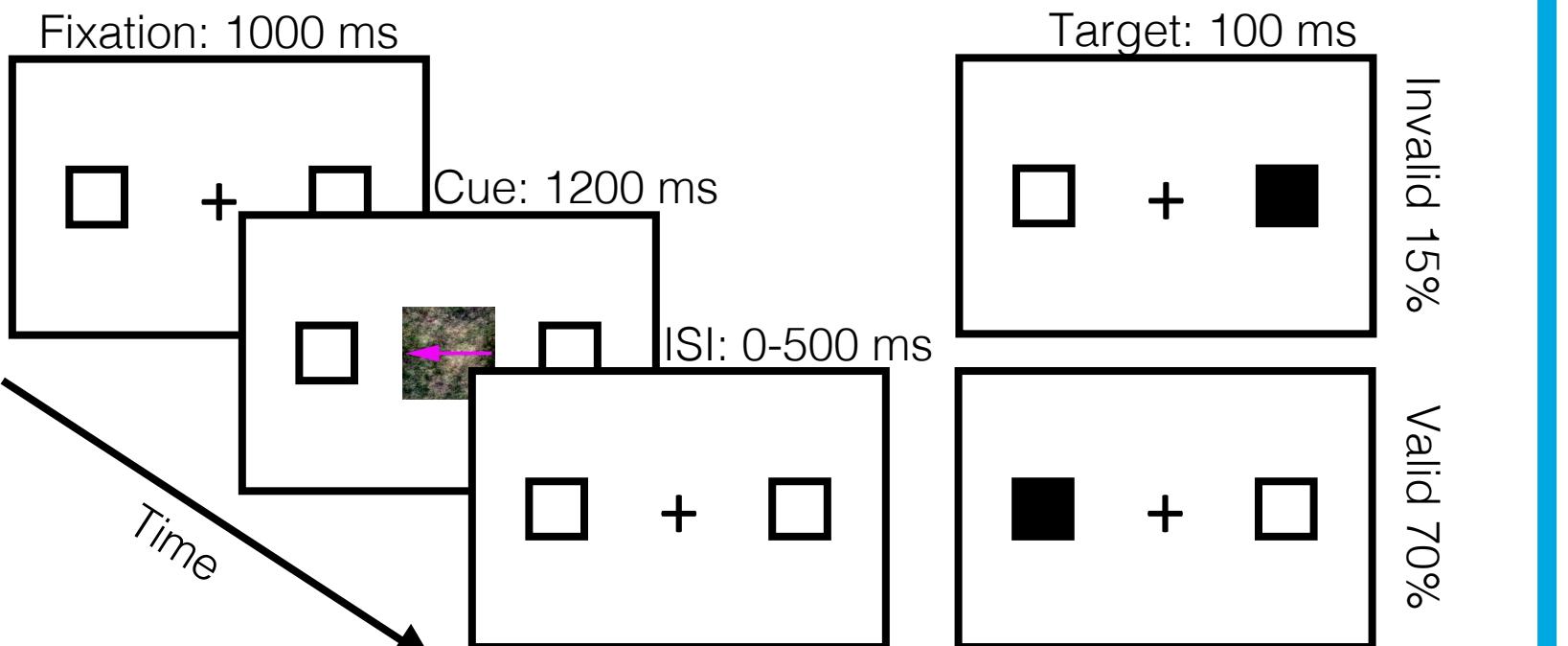
Cue validity effect
Invalid RTs – Valid RTs

3. Cue Format

Cue validity effects will be larger for schemas and words than scenes

* p < .035
** p < .01
*** p < .001

$N = 100$
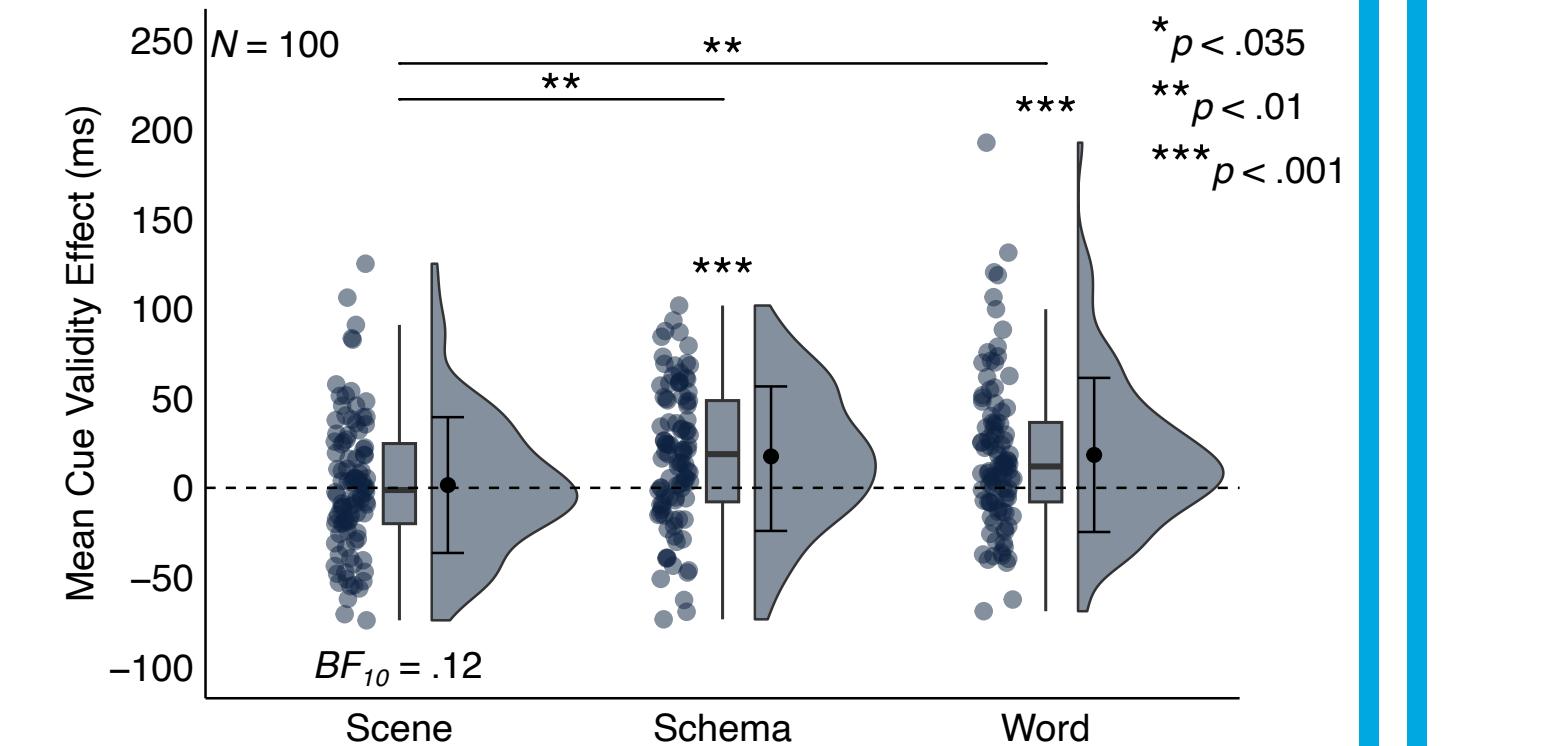
Larger effects for schemas and words than scenes; Scenes may require more costly computations to decode spatial direction

4. Scene Interpretation

Interpreting scenes from an egocentric spatial reference frame ("imagine direction you would turn") will result in significant cue validity effect

$N = 101$
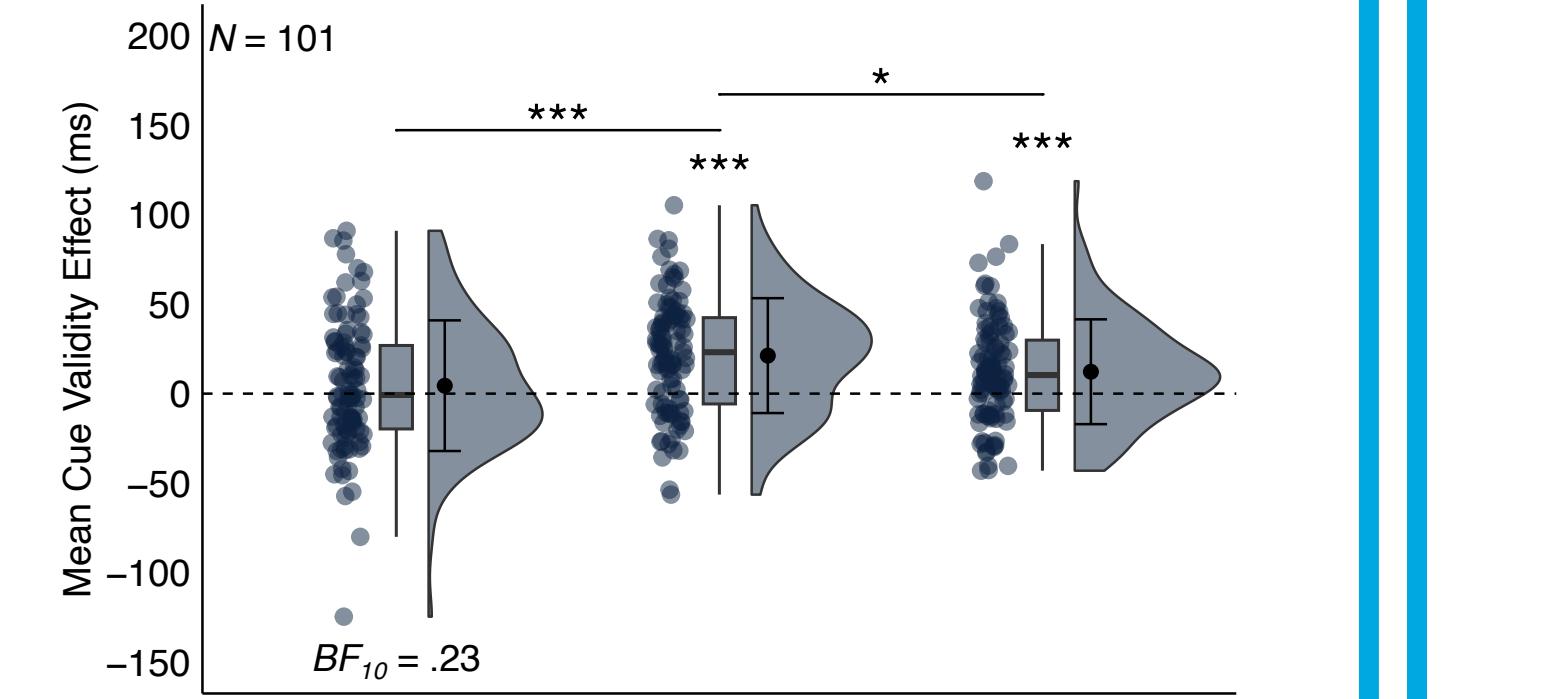
Explicit interpretation of scenes had no effect; Scenes may require more processing time due to costly computations and greater complexity

5. Cue Duration

Increasing cue duration will allow more time to comprehend spatial direction and result in significant cue validity effect for scenes

$N = 101$
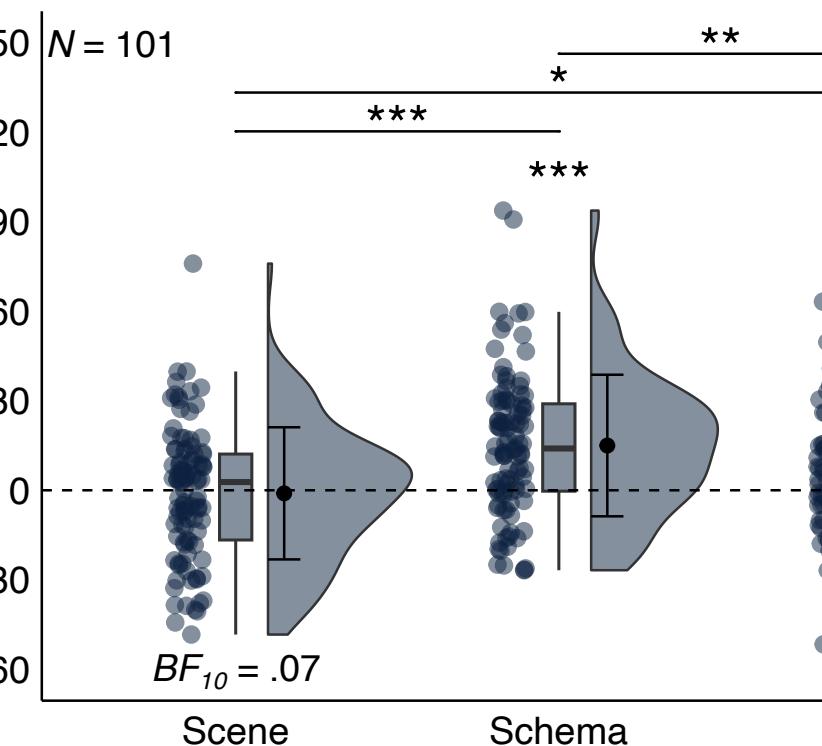
Manipulating cue duration did not significantly modulate effects for scenes; Robust effects for schemas across cue duration

6. Direction Angle

Cue validity effects only when spatial direction and target location match (i.e., orthogonal); no effects for sharp and slight spatial directions

Sharp left scene   Sharp right schema   Slight left word   Slight right scene

$N = 101$
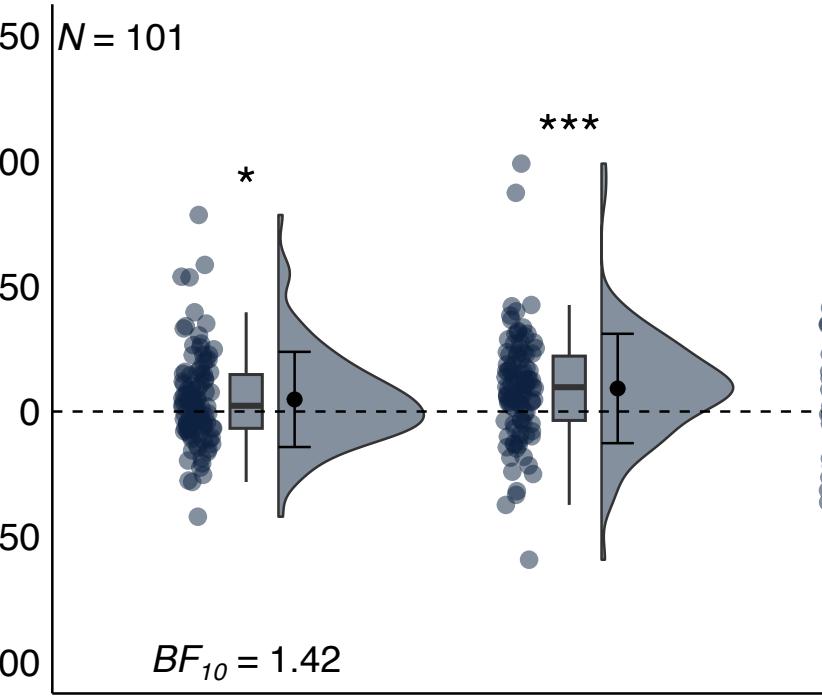
Significant effects across all cue formats with orthogonal directions; Additional variability in direction angle may have contributed to significant effect with scenes; Robust effects for schemas across direction angle
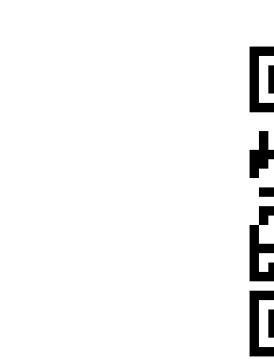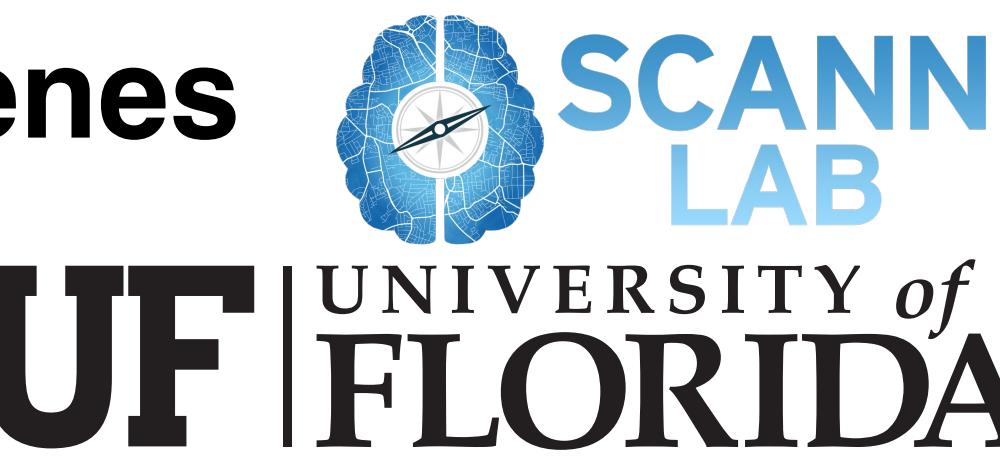
7. Simplified Scenes

Cue validity effect will emerge for scenes when the turn is depicted with a geometric shape
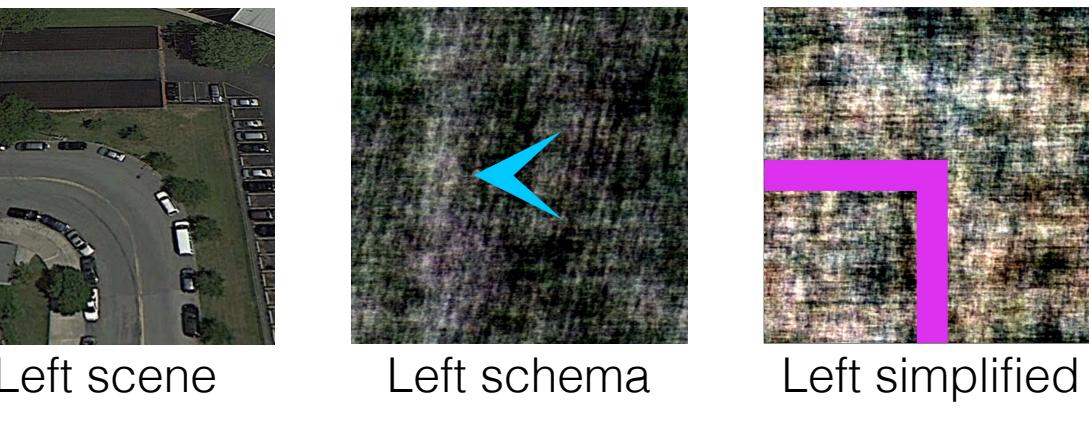
Left scene   Left schema   Left simplified scene

$N = 101$
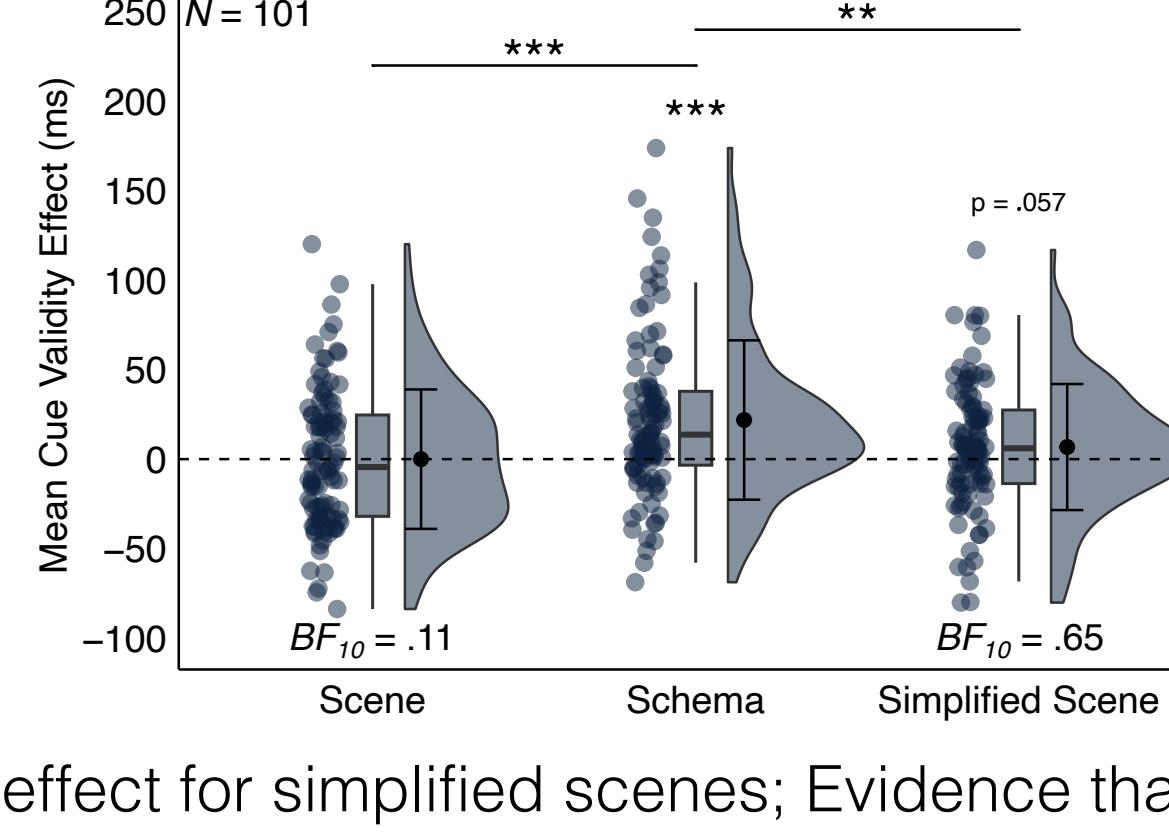
Marginal effect for simplified scenes; Evidence that attention is modulated by scene complexity (and perhaps other factors)

8. Conclusion

Rapid spatial direction comprehension contributes to efficient allocation of space-based attention[4]

Schemas and words may be more effective supports for facilitating successful real-world navigation

Future work will continue to investigate factors of scenes (i.e., decision points, perspective) that modulate attention allocation

9. References

[1]Weisberg et al. (2018). *J Neurosci*. PMID: 29720551; [2]Hommel al al. (2001). *Psychol Sci*. PMID: 11554667; [3]Posner (1980). *Q J Exp Psychol*. PMID: 7367577; [4]Barnas et al. (in press). *J Cogn*.

10. Acknowledgments

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