

# Sphere in a Box: Psychophysical experiments in reality close context

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## Introduction

Psychophysical experiments are designed to provide highly precise parameter estimations. Thus, numerous highly controlled trials are needed in an isolated environment. But due to this setting we lose realism, because in native environment we always have many confounding variables and a more complex visual stimulus. So our approach to get more reality close results is to embed the experiment in a game-engine created surrounding with Unreal4.

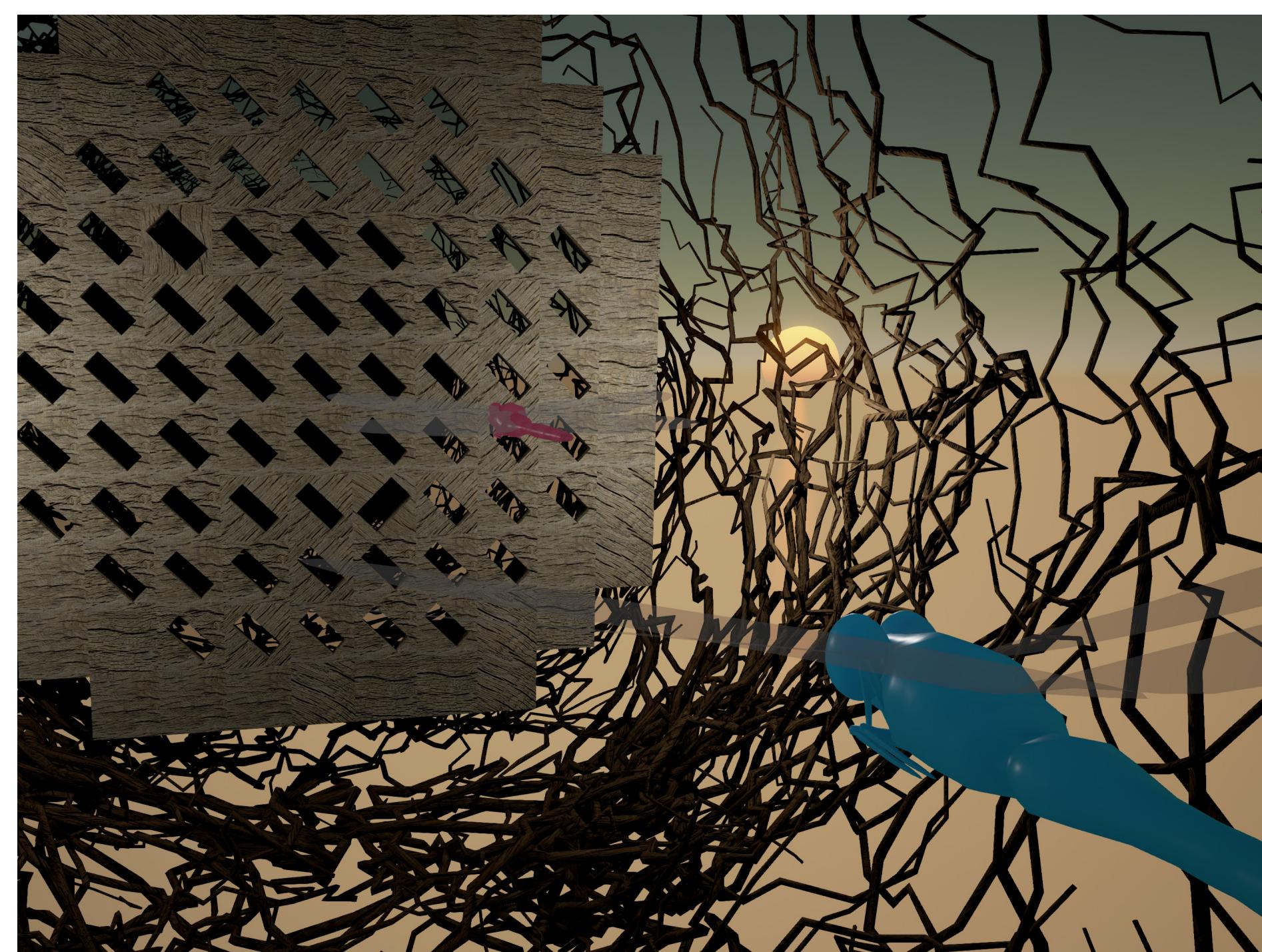


## Theory

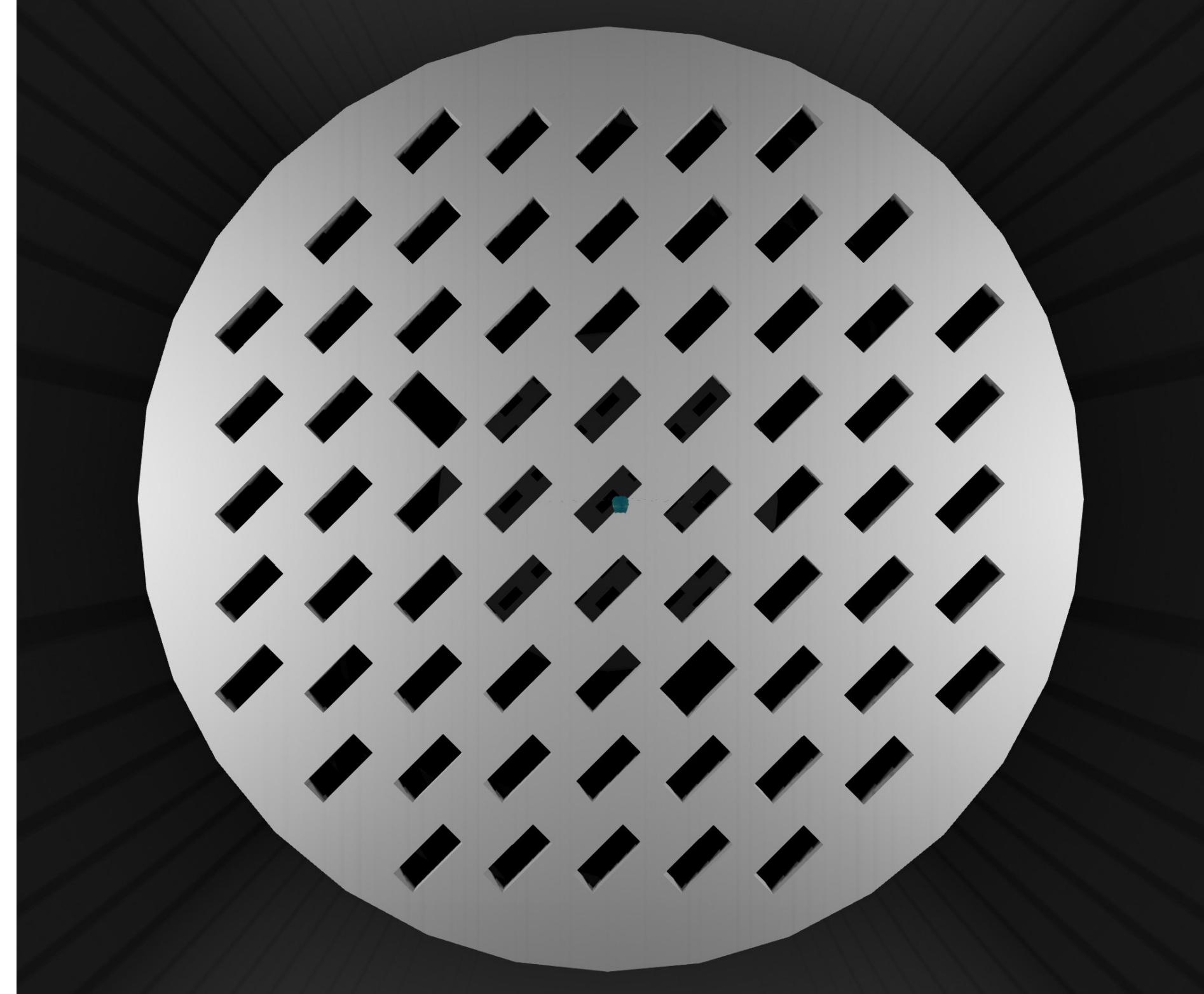
Visual attention is a complex process. Many stimuli compete for attention resources. Due to limited capacity misjudgements can occur. The experiment focuses on these misjudgements in case of one stimulus may get an advantage to the others through a visual contrast. According to Krüger et al. (2016) Bundesen's (1998) theory of visual attention can be applied to temporal-order judgements. Therefor we measure in the experiment associated game the attentional weight  $w$  and  $C$  the overall processing rate.

## Game

- Dragonfly race through a pipe.

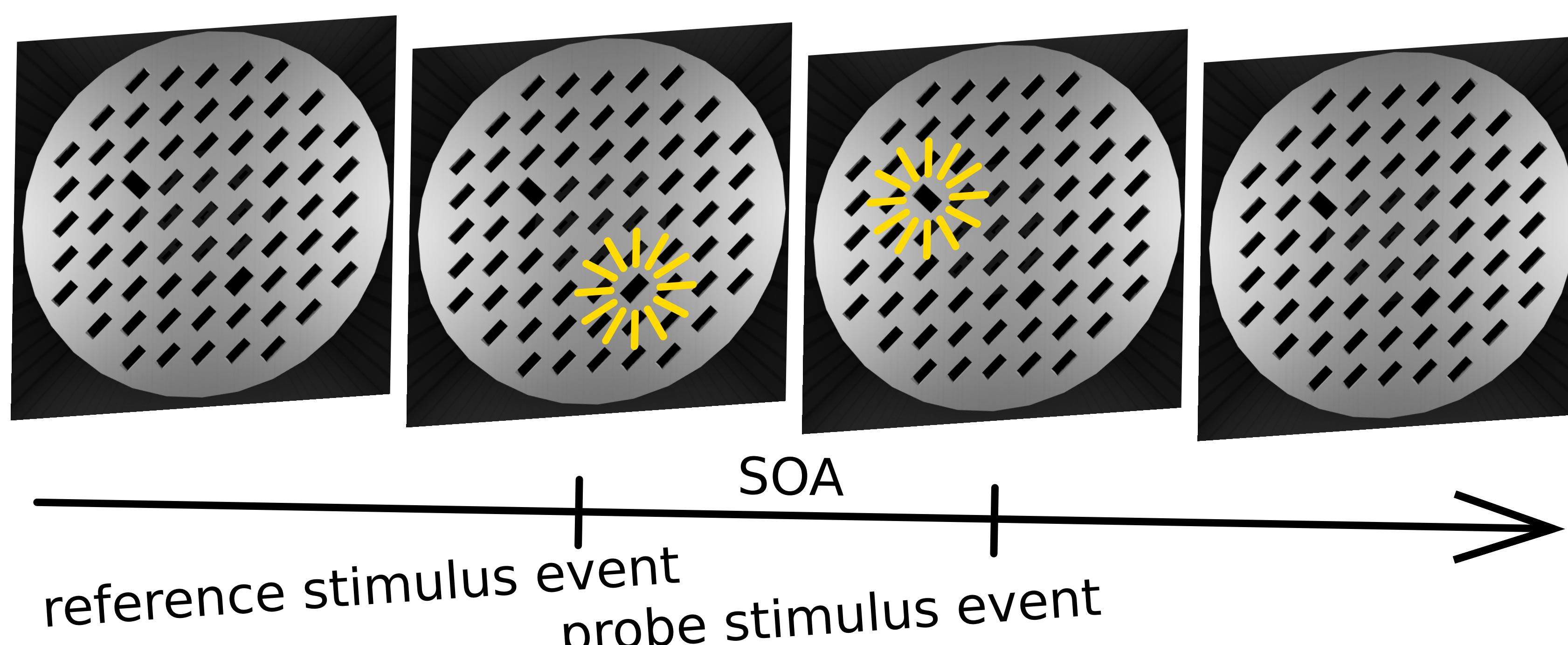


- Multiple grates obstruct the pipe.



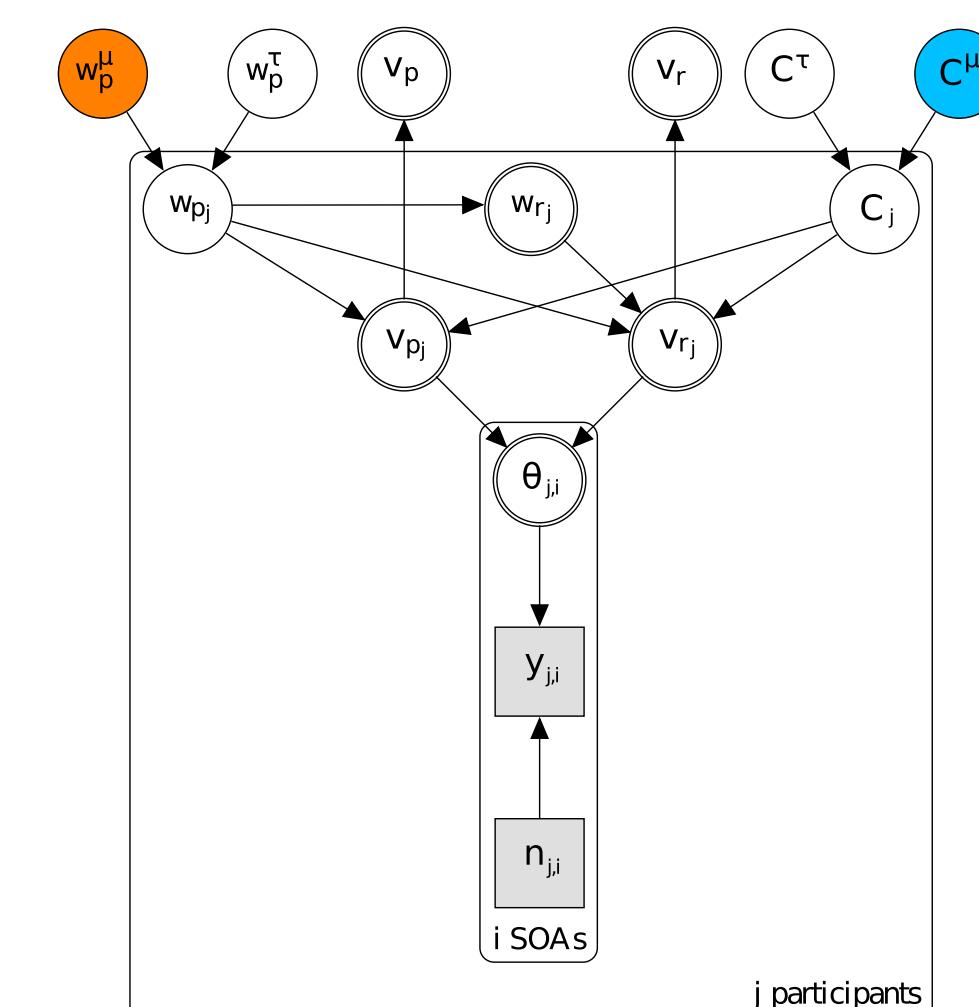
- Flying through two special openings provides bonuses.
- Discriminating their flicker correctly in time and flying through them accordingly increases bonus.

## Procedure (game and classical experiment)

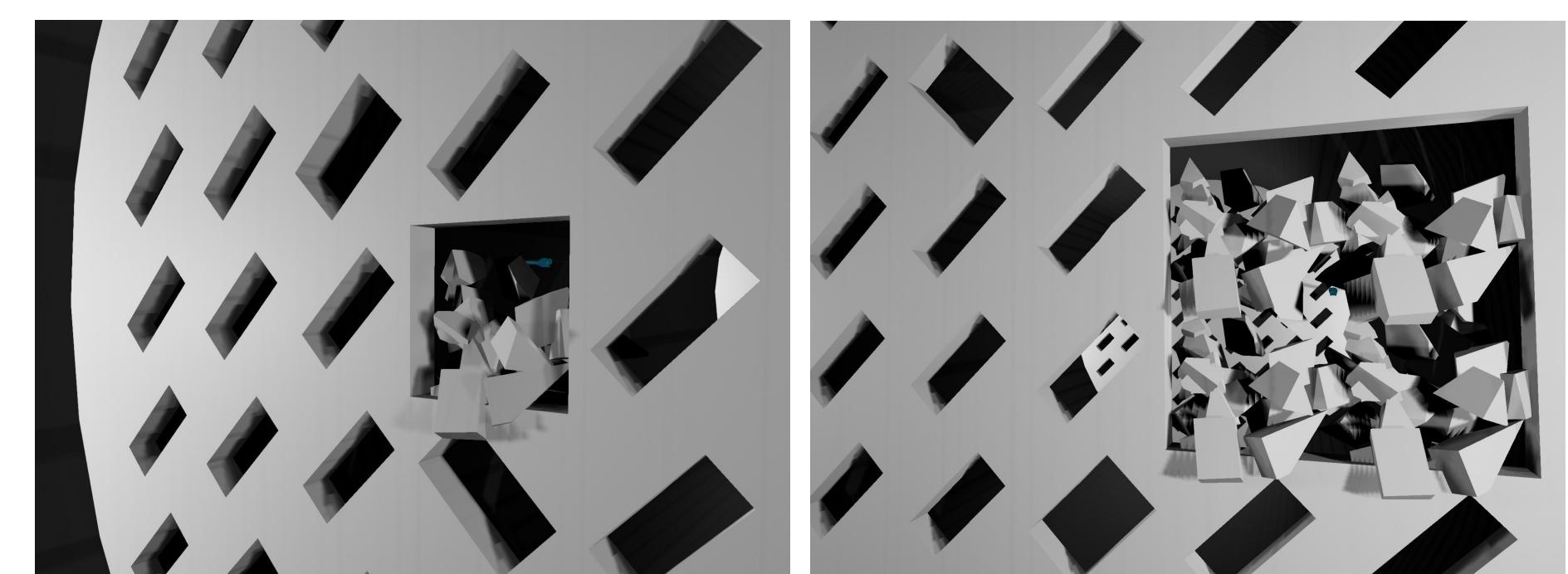


## Analysis

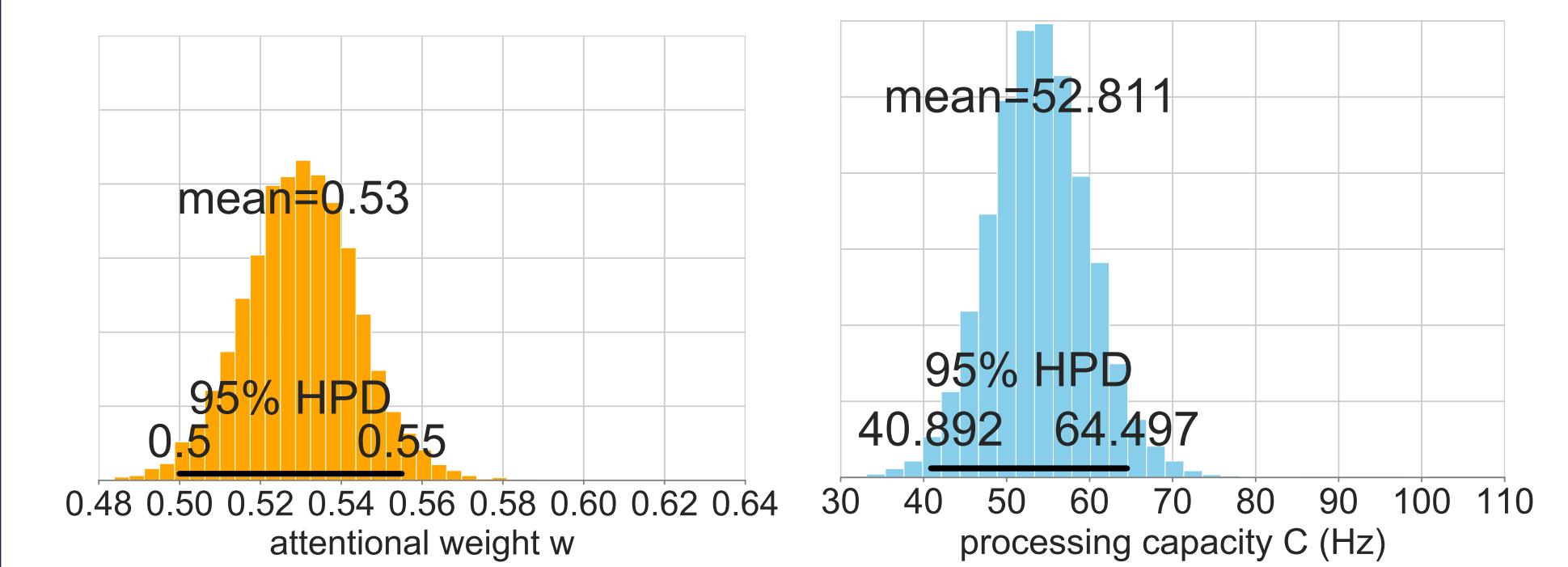
- Theory-based TVA parameters and data were connected by a Bayesian hierarchical model.



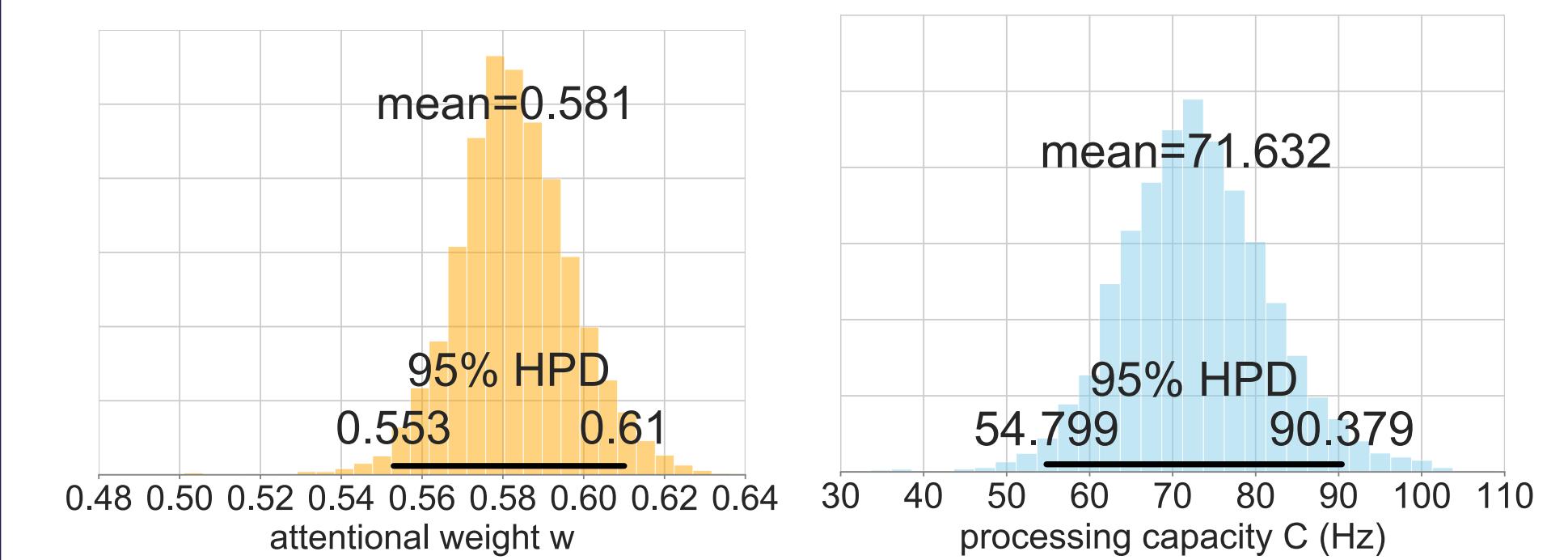
- Repetitions of trials per participant vary because of the freedom in the game – difficult to model with classical statistics.



- psychophysical parameter estimation: game (19 participants, ongoing)



- psychophysical parameter estimation: classical experiment (13 participants, ongoing)



## Conclusion

The results from the game and the classical experiment are similar: The salient probe stimulus receives an increased attentional weight in contrast to the reference stimulus. Importantly, estimation accuracy was comparable. Quantitatively, there is a difference: In the game, the probe stimulus receives less attention and the overall visual processing capacity is reduced that may be caused by the necessity to visually monitor the position of the dragonfly. This requires capacity and attention to be distributed among three instead of two positions. We conclude that the gaming approach is viable in general and that Bayesian data analysis allows for precise estimation despite the freedom in games.

## References

- Bundesen, C. (1998). A computational theory of visual attention. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 353, 1271-1281., doi: 10.1098/rstb.1998.0282
- Krüger, A., Tünnermann, J., & Scharlau, I. (2016). Fast and conspicuous? Quantifying salience with the theory of visual attention *Advances in Cognitive Psychology*, 12(1), 20, doi: 10.5709/acp-0184-1