

## Introduction

Research has recently demonstrated effects of breathing on

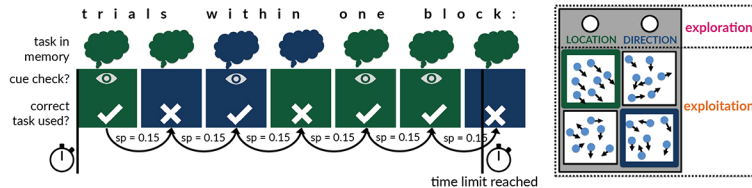
- **perception** (e.g., Grund et al., 2022; Kluger et al., 2021)
- **memory** (e.g., Huijbers et al., 2014)
- **cognitive tasks** (e.g., Perl et al., 2019)

(For a review see Heck et al., 2022)

However, effects of **breathing** on the attentional **exploitation and exploration balance** (seeking information in a narrow vs. wide space, respectively), have not been investigated.

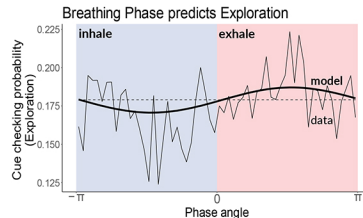
## Experiment 1: Rational Cue Checking Paradigm

- In each trial, four patches of moving dots appeared on the screen. Dots in one of the patches moved coherently.
- Either **Location task** (localize patch with coherent motion) or **Direction task** (identify direction of coherent motion) determined the correct (rewarded) response.
- The valid **task could switch from trial to trial** with a known probability ( $sp = 0.05$  or  $sp = 0.15$ ).
- Participants could choose to **check task cues** (exploration) to confirm the currently active task rule.
- Respiration and cue checking were measured using a chest belt and eye tracker, respectively.

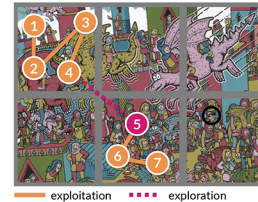


## Results

- $N = 33$
- Wavelet convolution was applied to the respiration data, to derive phase angle (location in breathing cycle).
- Sinusoidal mixed effects models were used to predict cue checking probability from respiratory phase, placeholder condition, and switch probability condition.
- Respiratory phase was predictive of cue checking: Including breathing effects yielded a significant increase in model fit ( $\chi^2(2) = 11.05$ ,  $p < 0.01$ ).



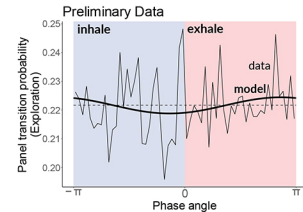
## Experiment 2: Waldo Visual Search Paradigm



- Subjects searched for Waldo and Wenda in 25 paneled *Where's Waldo?* images.
- Exploration was identified as **transitions between panels**.
- Individuals could choose their own search path.
- Respiration and transitions were measured using a chest belt and eye tracker, respectively.

## Preliminary Results

- Data collection is ongoing ( $N = 27 / 40$ )
- Mixed effects models will be used to predict panel transition probability from respiratory phase in each image search.



## Conclusions

- In Experiment 1, we found evidence that an individual's decision to shift attention to explore the environment is influenced by the breathing cycle.
- A similar, yet weaker, relationship appears in Experiment 2, but data collection is not complete.
- This work supports the notion that slow-paced physiological rhythms may shape behavior and how we direct attention.
- Future research should investigate underlying neural mechanisms and the degree to which this relationship between respiration and exploration may be actively used for efficient information gathering.