Exploring the Cognitive Impact of Depressive Rumination: Pupillary Activity During a Working Memory Task

Skylar M. Whittle, Alejandro Leon-Romero, B.A., Whitney E. Kasenetz, M.A., Max J. Owens, PhD.

USF St. Petersburg Department of Psychology

UNIVERSITY OF SOUTH FLORIDA ST. PETERSBURG

Introduction / Background

- "In the future, we will test alternative processing and Analysis techniques and determine to what extent pupil fluctuations are a valid way to determine the biological mechanisms of Rumination"
- Depressive rumination is a repetitive and narrowed attentional focus on feelings of sadness that contributes to increased duration and severity of depressive episodes.
- Effects of rumination on cognitive function are identifiable through pupillary activity during a working memory task.
- Brain functioning has increasingly been studied through changes in pupil size, as they reflect a diverse array of cognitive and emotional states such as arousal, effort, fatigue, and attention.
- Positive correlation between rumination and sustained pupil dilation when presented with negative, self-related information or during tasks that required a moderate cognitive demand. (Siegle et al., 2003)
- There are inconsistent findings about whether rumination is related to larger or smaller baseline ("tonic") pupil size. (Huijster et al., 2020)

Research Objective

Investigate pupillary activity as a measure of cognitive function in ruminators during a working memory task

Hypotheses

- High ruminators will show increased pupil size compared to low ruminators, indicating greater cognitive resource recruitment.
- Larger pupil size during the delay for 6-item arrays compared to 4-item arrays.
- Positive association between pupil size during the delay and depression scores for both array conditions.
  - Variability in pupil size slope during the delay period will connect with task accuracy.
- Pupil size during the delay period will correlate positively with rumination levels.

Measures

- Ruminative Response Scale (RRS), a questionnaire measuring negative repetitive thinking during depressed mood (Treynor et al., 2003)
- Change Detection Task. Participants are shown a sequence of either 4 or 6 targets that appear in random sequence. They must remember the locations of the dots during a 1234ms delay period before indicating whether a probe matches or does not match one of the previously presented targets.

Sample

65 participants (Age M=24, 86% Female) were recruited through the psychology department participant pool.

Current Status

- Previous poster was presented while data collection was in progress.
- Previous poster featured a sample size of existing data was insufficient to detect small effects.
- Complete data processing in progress, results to be added post-analysis.

Pupillometry Data Processing

- Blink artifacts corrected using linear interpolation
- Remaining trials that contained excessive noise or missing data will be rejected.
- Subtractive baseline correction using a 1-s fixation window (Mathôt et al., 2018)

Change Detection Task

125ms   125ms   125ms   125ms   1234ms   No Match / Match

TIME
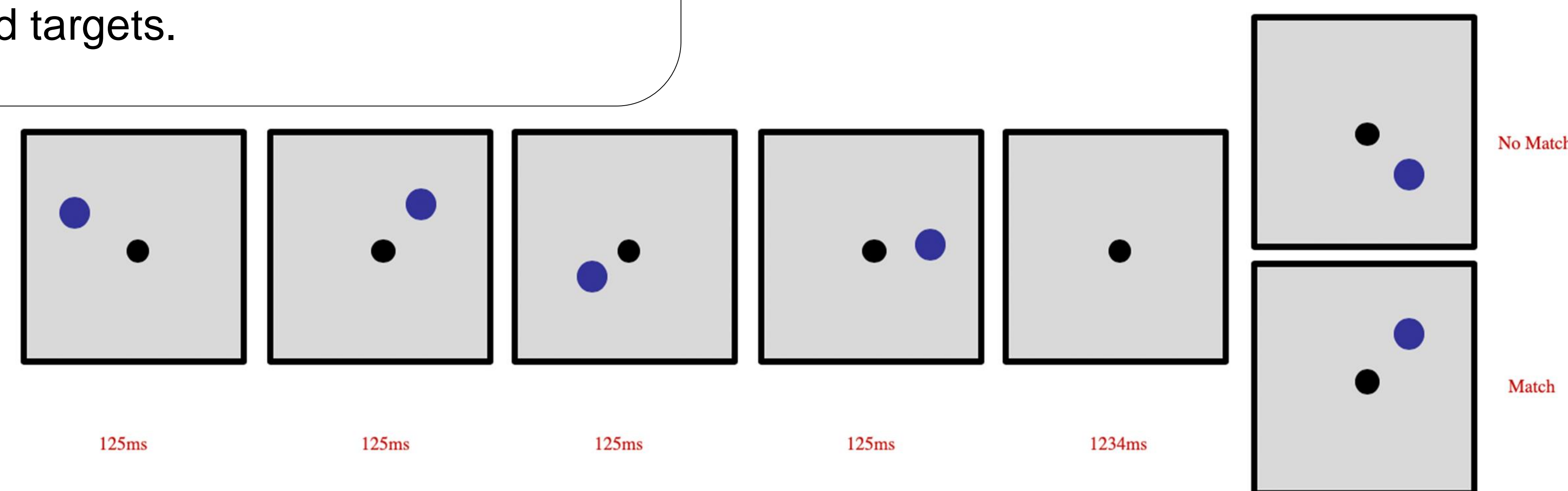
Analyses Conclusions

- We plan to use a linear mixed-effects model to analyze the impact of array size (4 items or 6 items) on baseline-corrected pupil size, adjusting for individual differences by including random intercepts for each subject.
- Previous findings found model estimates indicated that pupil size increased more when participants were asked to remember 6 items compared to 4 items (β = 10.66, SE = 4.09, t = 2.60, p = .009)
- By increasing the sample size from 22 to 65 and with alternative processing through R Studio, we expect to uncover results that were not detectable in the smaller cohort. This increase enhances the robustness of our findings, making them more reliable and applicable to a wider population.

Future Directions

- Finish Data Processing.
- Once we establish some expected patterns from our data (such as hypotheses 1-4), then we know our data are usable and can be used to answer some additional, novel research question
- Pupil fluctuations are multiply influenced and are an imperfect and indirect measure of cognitive processing.

References

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