



The Impact of Play on Stress Resilience: Children's Autonomic Nervous System Arousal Responses and Cognitive Ability



Cate Schultz

Background

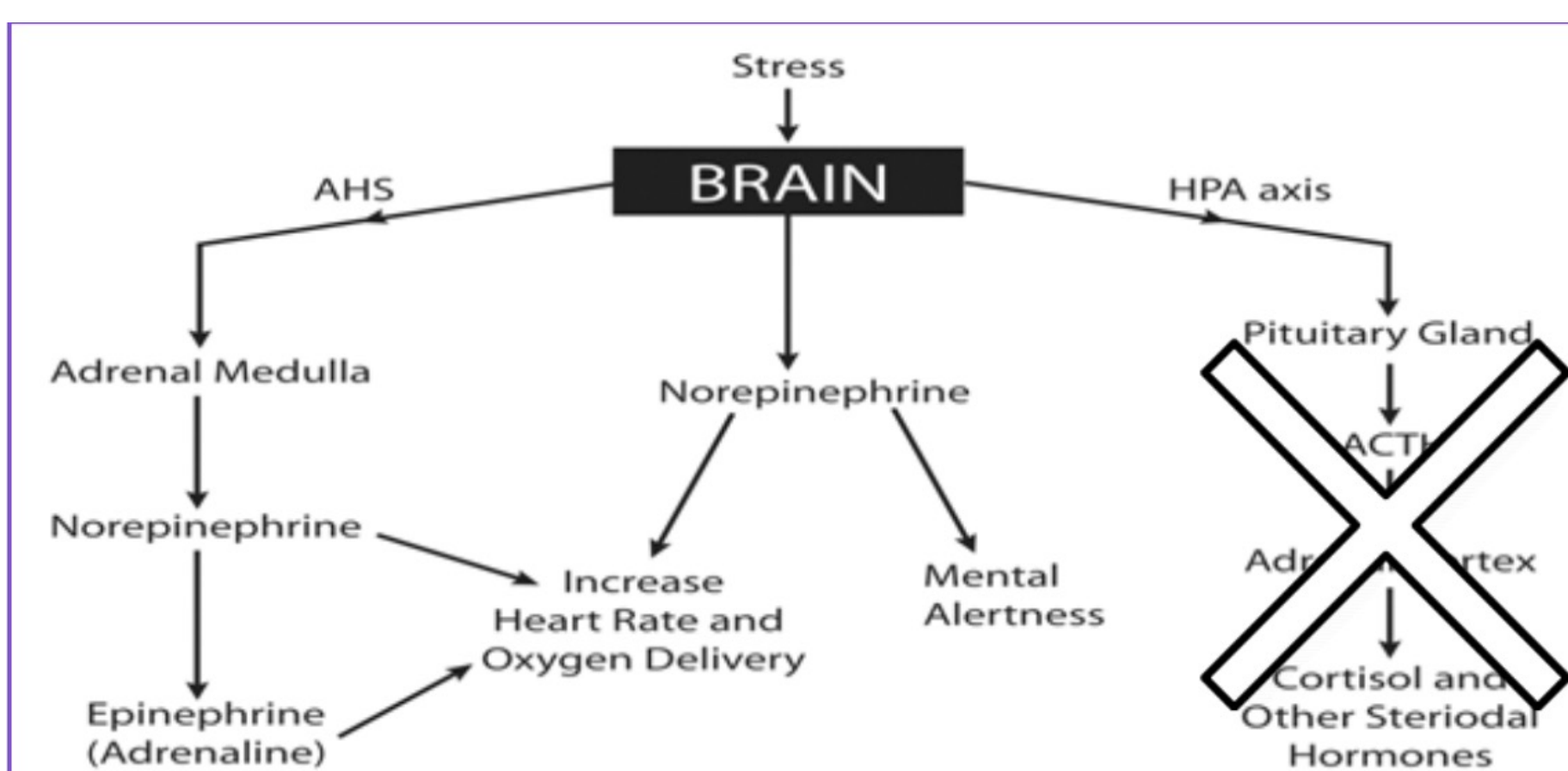
What is play?

- Free play is defined as: intrinsically motivated, free from external stressors, and an opportunity for children to explore and make sense of their world (Alexander et al., 2012).

Why is play important?

- Allows children to explore their environment and cope with stressors
 - Adverse Childhood Experiences (ACEs) are occurring at an unprecedented rate:
 - 67% of the population in the United States has endured an ACE (adverse childhood experience) in their lifetime (Crouch et al, 2019).
- Play can act as a preventative tool for childhood psychopathology (Gray, 2011).
- Play can help will skill development in and outside of classroom contexts

Stress Biology



- Non-negative stress inducing experiences, such as play, can boost levels of acetylcholine AND dopamine.
- Play **uniquely stimulates adrenaline but not the cortisol response** (Carleton, 2016; Dodd & Lester, 2021; Wang & Aamodt, 2012), increasing motivation for children to engage in play.

Research Questions

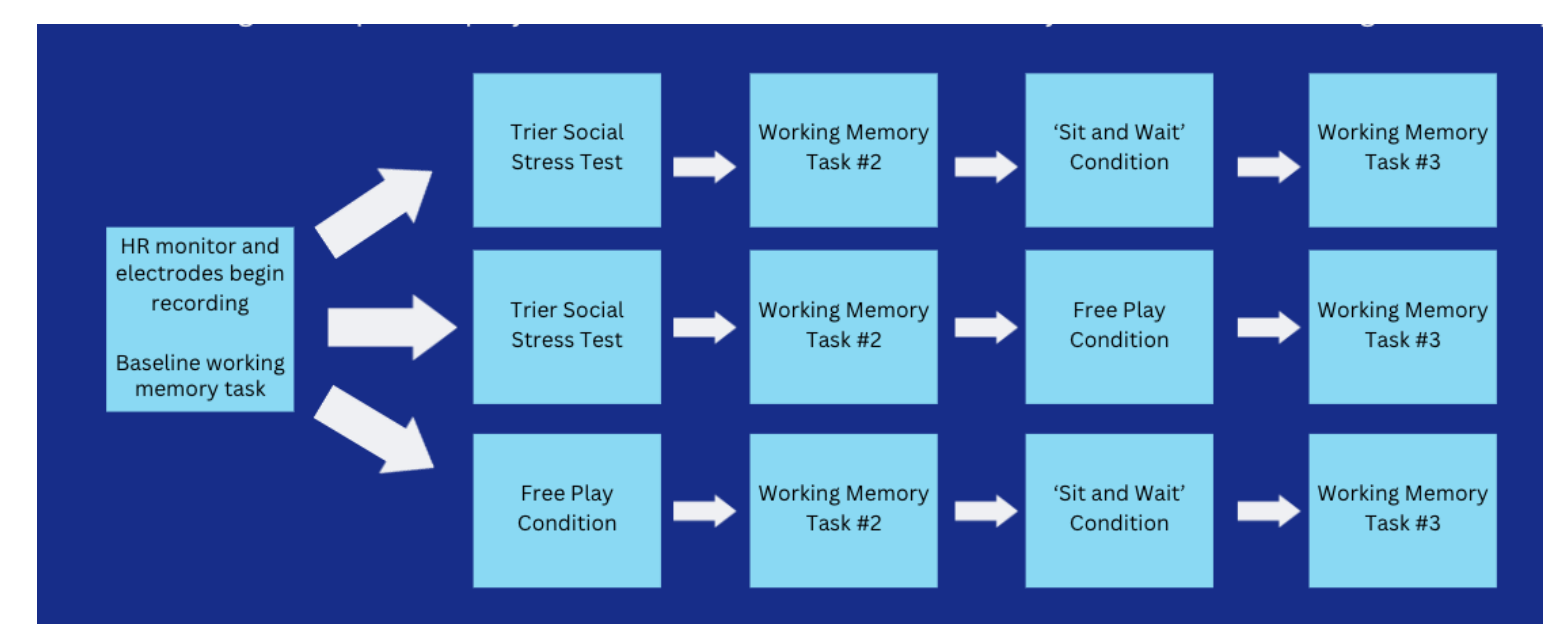
- To what extent can play aid cognitive capacity?
- Can play decrease children's arousal following a stressful situation?
- How is cognitive capacity impacted by aroused states of being (play and stress)?

Hypotheses

- Free play will mitigate the impact of autonomic nervous system arousal from stress
- Play will improve children's cognitive engagement as assessed by the 1bac task
- Qualitatively, play will alleviate the stressful signs of a "high pressure situation" Trier Social Stress test (Kirschbaum et al., 1993)

Methodology

- Data collected at MARBLES Kids Museum
- Participating children aged 5-11 (n=10) randomized to one of 3 conditions:

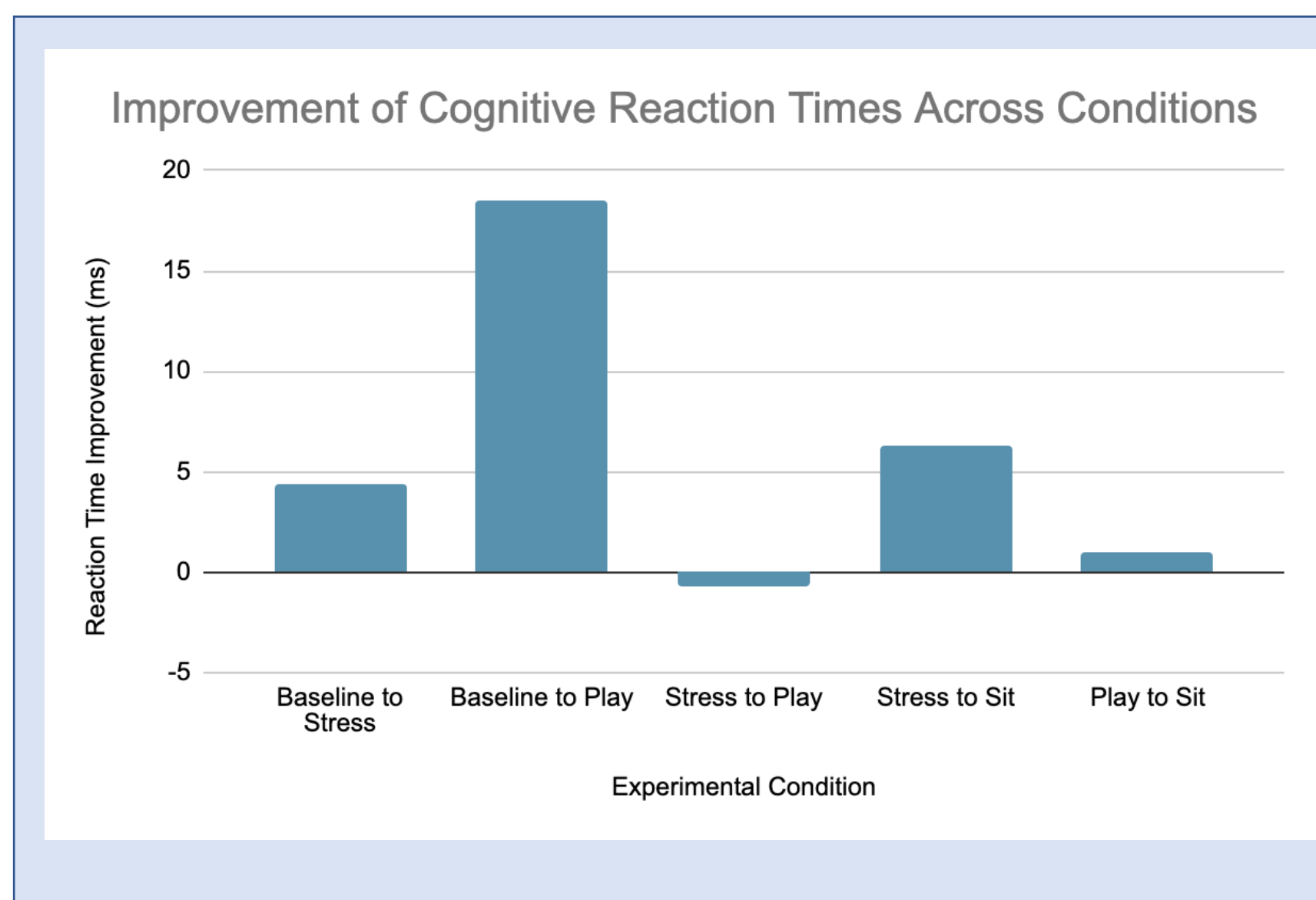
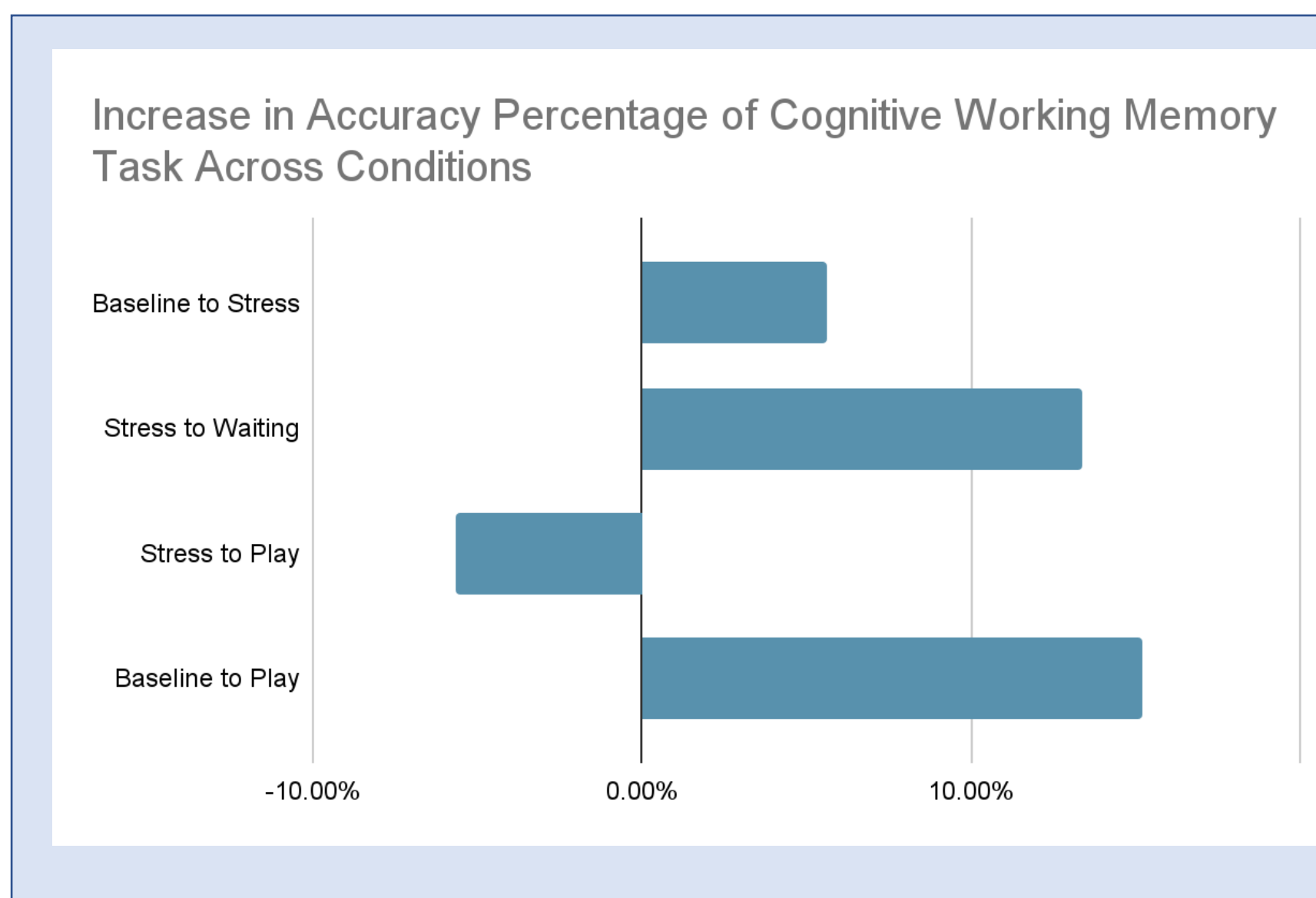


- Completed the cognitive capacity task at baseline, after activity #1 depending on condition, and after activity #2



Results

- Participant demographics: mean age = 7.7 years at time of participation; 30% male, 70% female; 40% of sample "non-American" origin



Figures 1 & 2: Cognitive Performance and Reaction Times Following Experimental Tasks

- "Misfires" or hitting when not actually the same shape shown, occurred only 4% in play condition compared to 18% in stress condition

Physiological Arousal

- Though it was anticipated that recovery would be significantly improved in terms of HRV for children randomized to the "play" condition, HRV variability proved to be insignificant statistically, with only small dips to be expected during the cognitive assessment task (evaluation)

Conclusions

- On average, the cognitive performance of *play* participants increased by 4.78% and if never exposed to stress, it increased by an average of 15.22%
- Following ANOVA and post-hoc analysis, there were statistically significant differences in accuracy between these conditions
- After play engagement, children were significantly less likely to engage in "misfires" or hitting incorrectly,
- The results of this study lay the foundation for future research in illustrating associations between play opportunities, improved reaction times and accuracy without stress, and less "mistakes" in cognitive scenarios
- In classroom contexts, play should thus be thoughtfully integrated as to not be a distracting factor and rather a more project-oriented methodology to impart dynamic instruction

Limitations and Future Directions

- Limitations included: a small sample size, skewed gender ratio, subjective personality differences of participants, and potential translation difficulties
- Future studies should ideally include: longitudinal replication exploring the impact of play-based interventions over time, larger sample sizes, implementing further neuroimaging techniques (EEG, fMRI) to understand neural responses to the identified play-stress associations/responses, and introducing play interventions and evaluating effects in a classroom.

Acknowledgements

Special thanks to Dr. Aysenil Belger & Dr. Maria Davila for their research guidance, Idil Baran & Lucas Engel for their assistance in data collection, MARBLES Kids Museum for allowing families to be compensated and explore the museum further. Thank you to Honors Carolina, this research was generously supported in part by a Peele Grant. And thank you to Aspen Yordy for inspiring me to research play and health, supporting children enduring adversity on a growing scale.