

Investigating the Factors that Influence Approach-Avoidance Conflict Decision Making in Older Adults

Erin Butler^a, Willem Le Duc, B.A. ^a, Kiah Spencer ^a, Rutsuko Ito, Ph.D. ^{a,b}, & Andy C. H. Lee, Ph.D.^{a,c}

^aDepartment of Psychology at Scarborough, University of Toronto, Toronto, Ontario, Canada; ^bDepartment of Cell and Systems Biology, University of Toronto, Toronto, ON, Canada; ^cRotman Research Institute, Baycrest Centre, Toronto, Ontario, Canada


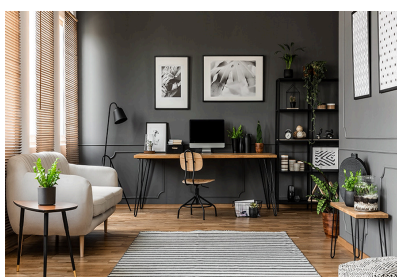







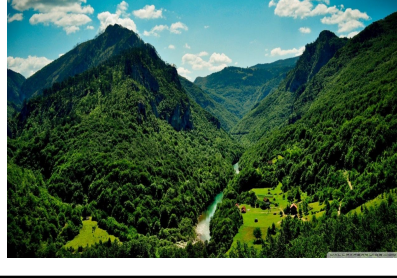


Introduction

- Approach-avoidance (AA) conflict occurs when a stimulus elicits both reward and punishment^{1,2}
- The hippocampus is involved in approach-avoidance conflict decision making²
- Hippocampal lesions produce increased approach behaviour during conflict^{3,4}
- Healthy aging is associated with hippocampal atrophy⁵
- No research examining the effects of aging on AA conflict decision making
- **Research Question:** What are the patterns of AA conflict decision making in older adults?
- **Hypothesis:** Older adults will decide to approach more than young adults during conflict trials
- **Research Design:**
 - *Experiment 1:* Pilot study in young adults (YA) to determine appropriate trial design
 - *Experiment 2:* Aging study to compare older adults (OA) conflict decision making to YA

Experiment 1-Methods

- 14 YA (mean age = 20.5 years; mean education = 12.7 years; 6 female) completed one 2-hour session (compensated 2.0 SONA credits)
 - Decision making game⁶
 - Timed (duration = 4000ms)
 - Untimed (duration = participant controlled)

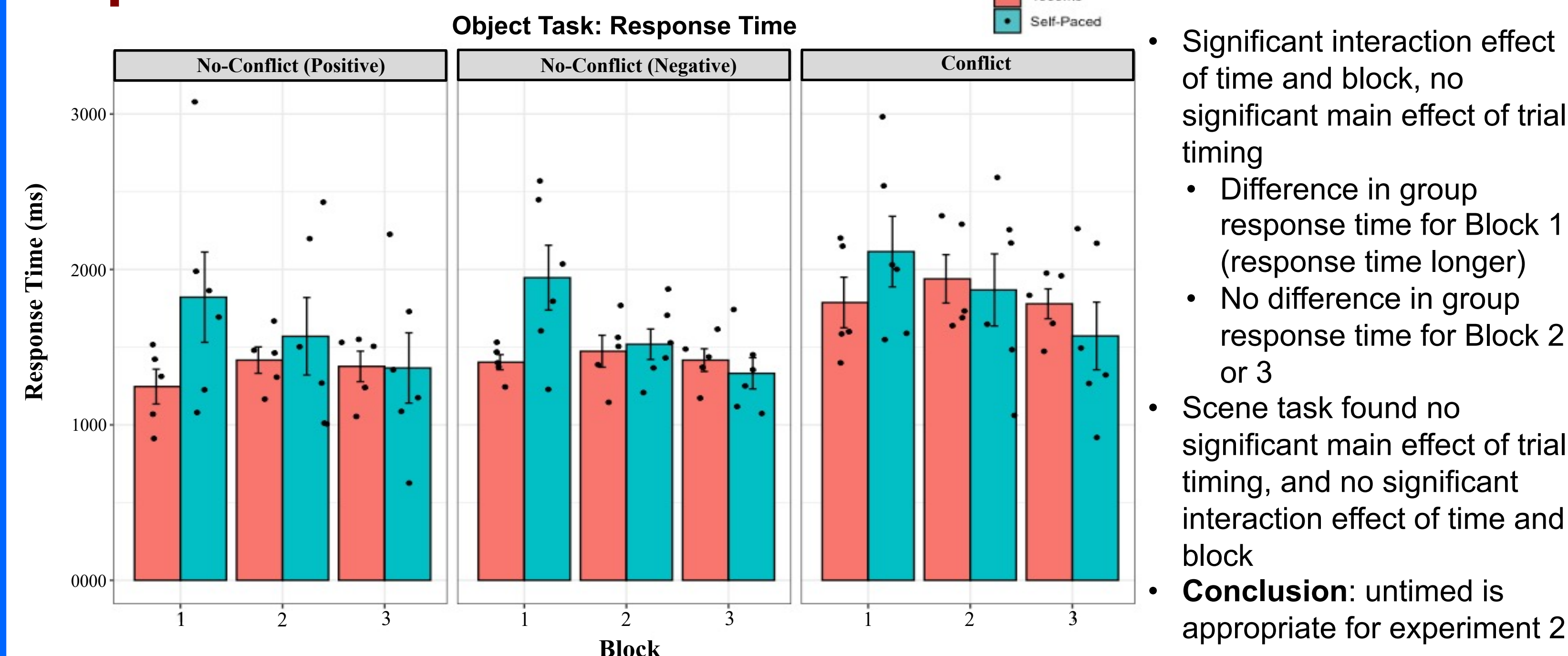
Decision Making Game

DECISION	SCENE		OBJECT	
APPROACH				
POSITIVE PAIR				
AVOID				
NEGATIVE PAIR				
APPROACH OR AVOID				
POSITIVE AND NEGATIVE				

DECISION	POSITIVE PAIR	NEGATIVE PAIR	CONFLICTING PAIR
APPROACH	+\$0.25	-\$0.25	+\$0.25 OR -\$0.25
AVOID	No Impact on Bonus	No Impact on Bonus	No Impact on Bonus



Experiment 1-Results



Experiment 2-Methods

- 9 YA (mean age = 23 years; mean education = 13.3 years; 4 females) completed one 2-hour session (compensated 2.0 SONA credits), and 11 OA (mean age = 67.5 years; mean education = 16.5 years; 5 males) completed two 2-hour sessions (compensated \$18/hour) consisting of:
 - Untimed decision-making game
 - Questionnaires
 - Neuropsychological test battery*

*Neuropsychological test battery only administered to OA

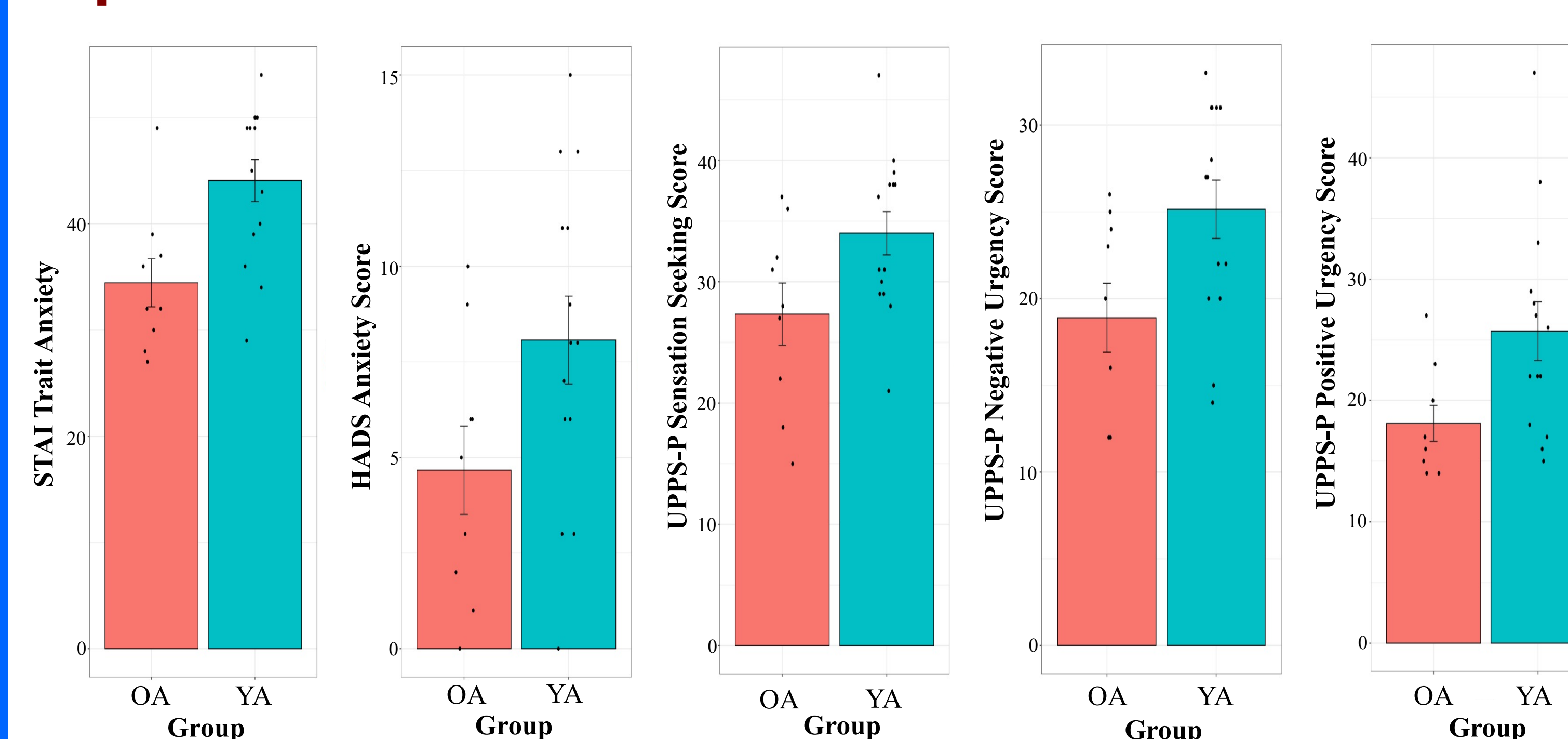
Experiment 2-Neuropsychological Test Results

OA Neuropsychological Test Scores

Neuropsychological Test (n=11)	Raw Score (SD)	Percentile (%)	Qualitative Description
MoCA (/30)	27.8 (2.10)	NA	Pass
WMS-IV Symbol Span (/50)	18 (7.69)	50%	Average
WMS-IV LM Immediate Recall (/53)	38.7 (6.80)	95%	Superior
WMS-IV LM Delayed Recall (/39)	24.5 (5.66)	75%	Average
WMS-IV LM Recognition (/23)	20.9 (1.96)	17-25%	Low Average
WSM-IV VPA Immediate Recall (/56)	35.7 (8.92)	75%	Average
WSM-IV VPA Delayed Recall (/14)	11.4 (2.24)	84%	High Average
WSM-IV VPA Recognition (/40)	38.8 (1.09)	>75%	Average
WASI-II Vocabulary (/59)	44.6 (7.89)	81%	High Average
WASI-II Matrix Reasoning (/30)	20.2 (5.50)	81%	High Average
WASI-II Similarities (/45)	33.5 (4.74)	70%	Average
RCFT Copy (/36)	34.6 (2.01)	>16%	Average
RCFT Immediate recall (/36)	20.5 (4.28)	88%	High Average
RCFT Delayed Recall (/36)	21.9 (3.09)	95%	Superior
RCFT Recognition (/24)	20.9 (1.10)	66%	Average
D and P People Immediate Recall (/36)	27.9 (6.05)	75%	Average
D and P People Delayed Recall (/12)	9.9 (3.00)	37%	Average
D and P Doors Recognition (/24)	15.8 (2.94)	37%	Average
D and P Names Recognition (/24)	19.5 (2.12)	95%	Superior
D and P Shapes Immediate Recall (/36)	33.6 (4.07)	91%	High Average
D and P Shapes Delayed Recall (/12)	11.1 (1.27)	37%	Average
VOSP Dot Counting (/10)	10 (0.00)	100%	Average
VOSP Position Discrimination (/20)	19.3 (1.00)	21%	Low Average
VOSP Cube Analysis (/10)	9.3 (1.12)	47.90%	Average

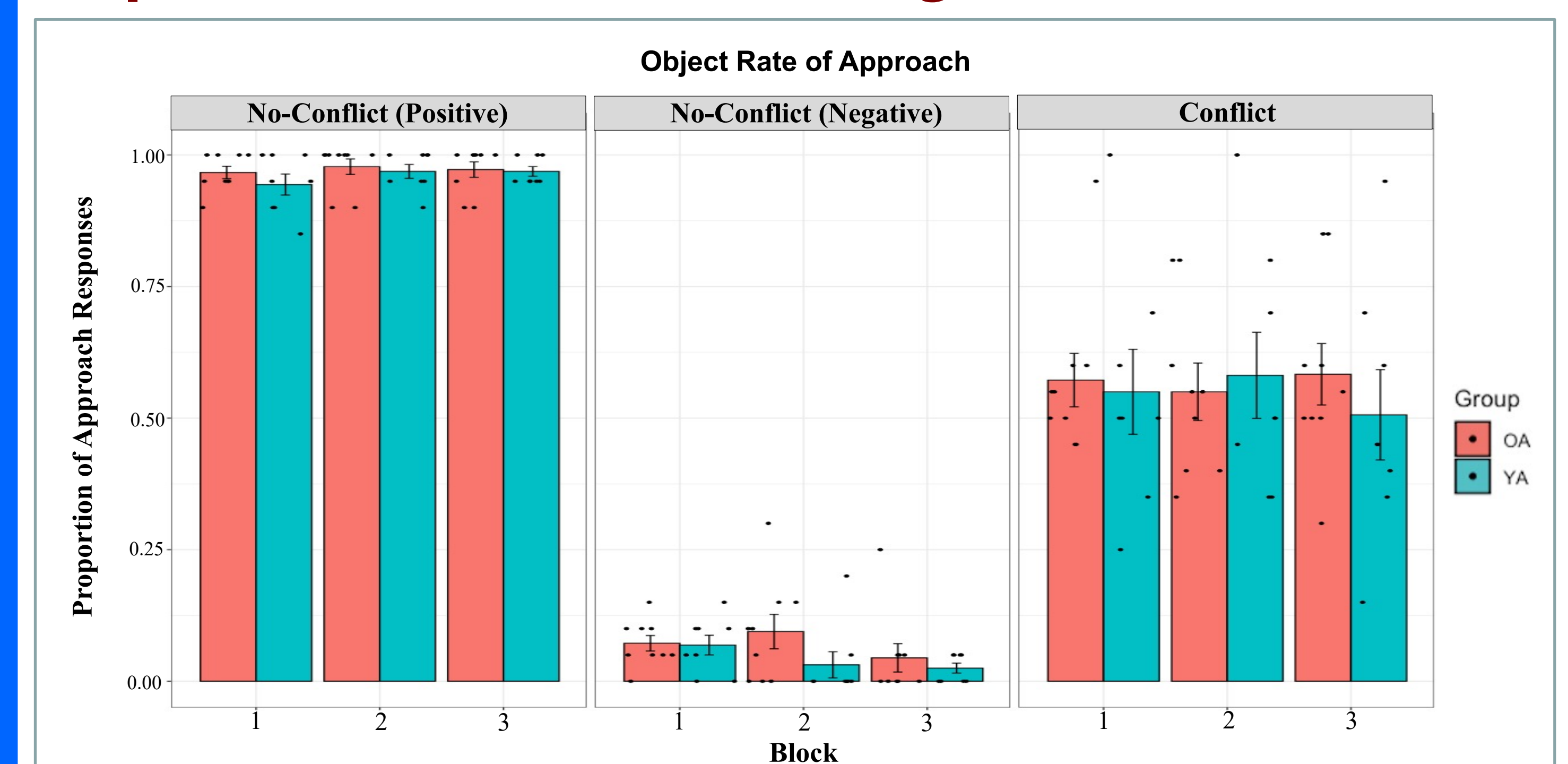
- Neuropsychological tests used to assess overall cognitive functioning of OA to ensure they are a healthy sample of the aging population
- OA demonstrated overall average cognitive functioning, confirming they are a healthy sample

Experiment 2-Questionnaire Results

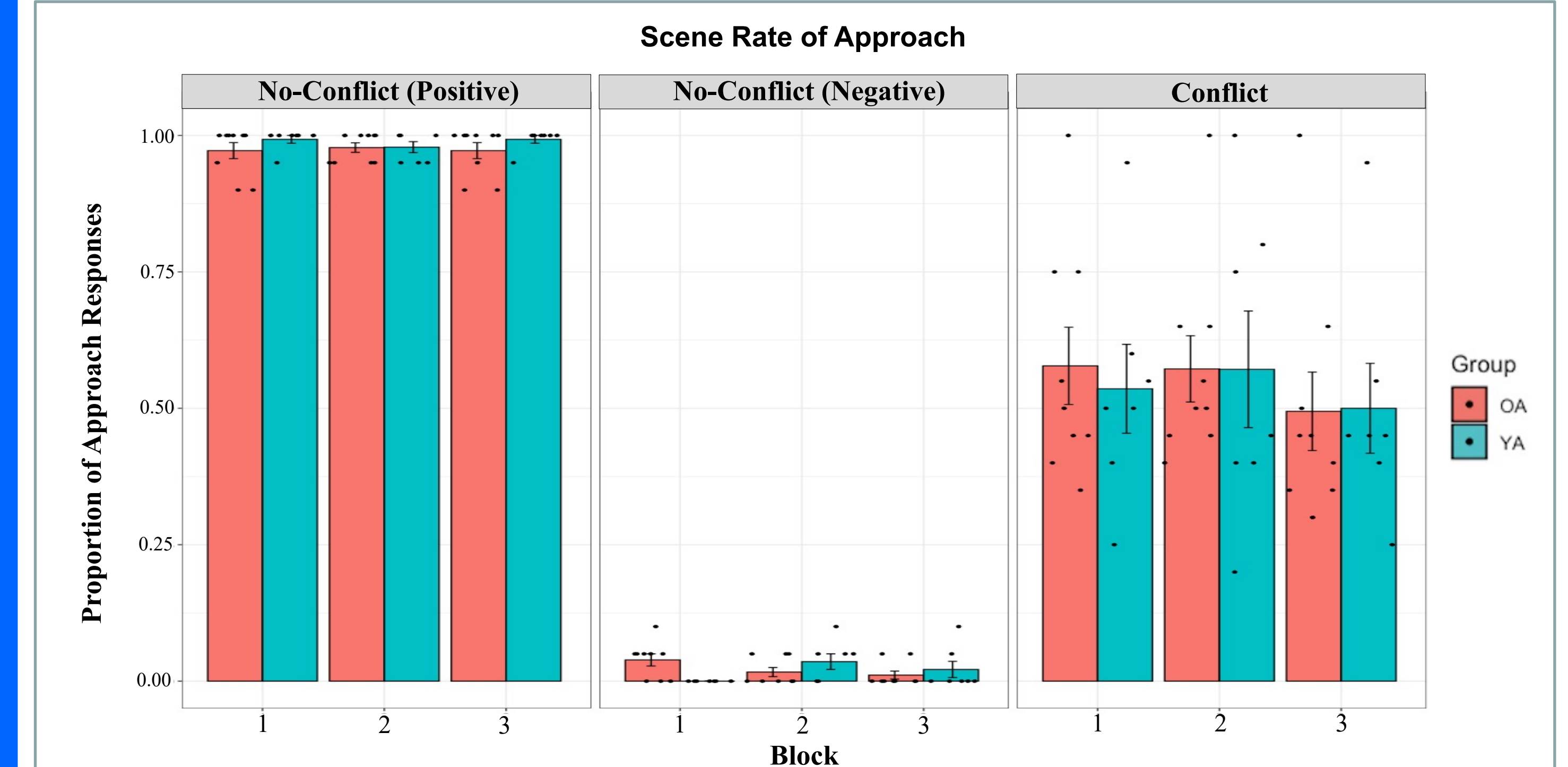


- Questionnaires measuring constructs related to approach-avoidance conflict decision making (state/trait anxiety, depression/anxiety, behavioural inhibition/activation, and impulsivity)
- YA scored higher than OA on measures of trait anxiety, general anxiety, sensation seeking, and negative and positive urgency
- YA and OA scored similar on state anxiety, depression, and behavioural inhibition/activation

Experiment 2-Decision Making Results



- Significant interaction effect of rate of approach and trial condition (both groups approach more during positive condition than conflict condition, and more during conflict condition than negative condition)
- No significant main effect of age on rate of approach during object version of the decision-making game



- Significant interaction effect of rate of approach and trial condition (both groups approach more during positive condition than conflict condition, and more during conflict condition than negative condition)
- No significant main effect of age on rate of approach during object version of the decision-making game

Discussion and Conclusions

- Healthy aging does not result in increased approach decision making in conflict
- YA have higher scores than OA on tests of anxiety, positive and negative urgency, and sensation seeking
- Despite the finding that healthy aging does not have an effect rate of approach during conflict decision making, it may be useful to include an unhealthy aging sample (e.g., Alzheimer's disease)
- **Limitation:**
 - Small sample size (research is ongoing)

References

- Miller, N. E. (1944). Experimental studies of conflict. In J.M. Hunt (Ed.), *Personality and the Behavior Disorders*, pp. 431-465. Ronald Press, Oxford
- Ito, R., & Lee, A. C. H. (2016). The role of the hippocampus in approach-avoidance conflict decision making: evidence from rodent and human studies. *Behavioural Brain Research*, 313, 345-357. <https://doi.org/10.1016/j.bbr.2016.07.039>
- Schumacher, A., Vlassov, E., & Ito, R. (2015). The ventral hippocampus, but not the dorsal hippocampus is critical for learned approach-avoidance decision making. *Hippocampus*, 26, 530-542. <https://doi.org/10.1002/hipo.22542>
- Schumacher, A., Villaruel, F. R., Ussling, A., Riaz, S., Lee, A. C. H., & Ito, R. (2018). Ventral hippocampal ca1 and ca3 differentially mediate learned approach-avoidance conflict processing. *Current Biology*, 28(8), 1318-1324. <https://doi.org/10.1016/j.cub.2018.03.012>
- Burger, C. (2010). Region-specific genetic alterations in the aging hippocampus: Implications for cognitive aging. *Frontiers in Aging Neuroscience*, 2, 140. <https://doi.org/10.3389/fnagi.2010.00140>
- Chu, S., Thavabalasingam, S., Hamel, L., Aashat, S., Tay, J., Ito, R., & Lee, A. C. H. (2019). Exploring the interaction between approach-avoidance conflict and memory processing. *Memory*, 28(1), 141-156. <https://doi.org/10.1080/09658211.2019.1696827>