

The Effect of Phasic Arousal on Risky Choice in Younger and Older Adults

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Introduction

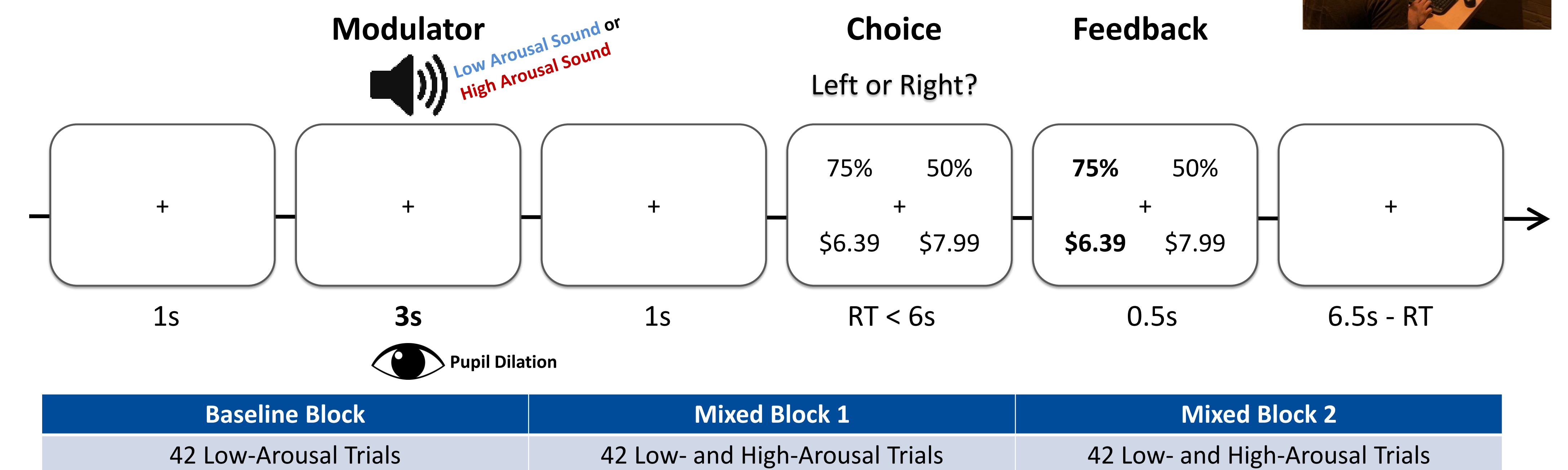
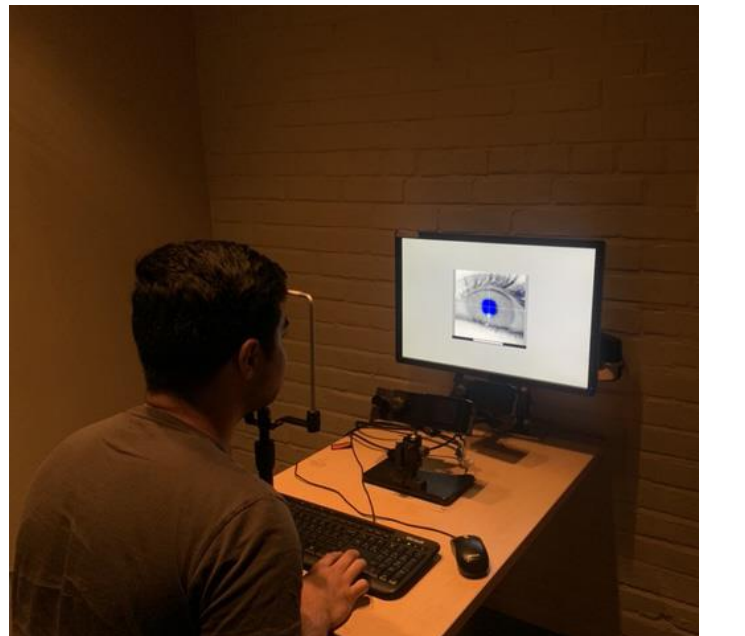
- Arousal-biased competition (ABC) theory** suggests that arousal biases our attention and memory towards goal-relevant stimuli (Mather & Sutherland, 2011). Younger adults show increased attention to more important information (Wichary, Mata, & Rieskamp, 2015) and an increased preference for immediate rewards (Maier, Makwana, & Hare, 2015) when making decisions in high-arousal states.
- Results are mixed as to whether arousal influences value-based decisions, such as risky monetary choices (Sokol-Hessner et al., 2016). A recent meta-analysis found that younger adults tend to be less risk averse than older adults in the context of financial gains (Best & Charness, 2015), but little is known about the influence of arousal on monetary decision making in older adults.
- We examined both **behavioral** (response time, proportion of risky choices, proportion of high expected value choices) and **physiological** (pupil dilation; Bradley et al., 2008) responses in relation to **trial-level (phasic)** auditory manipulations of low (e.g., leaves rustling) and high **arousal** (e.g., a person screaming). This study is preregistered at: <https://osf.io/tfr36>.

Methods

Participants: 39 younger (age 18-32, 20 females), 34 older (age 60-81, 18 females)

Risky Choice Task:

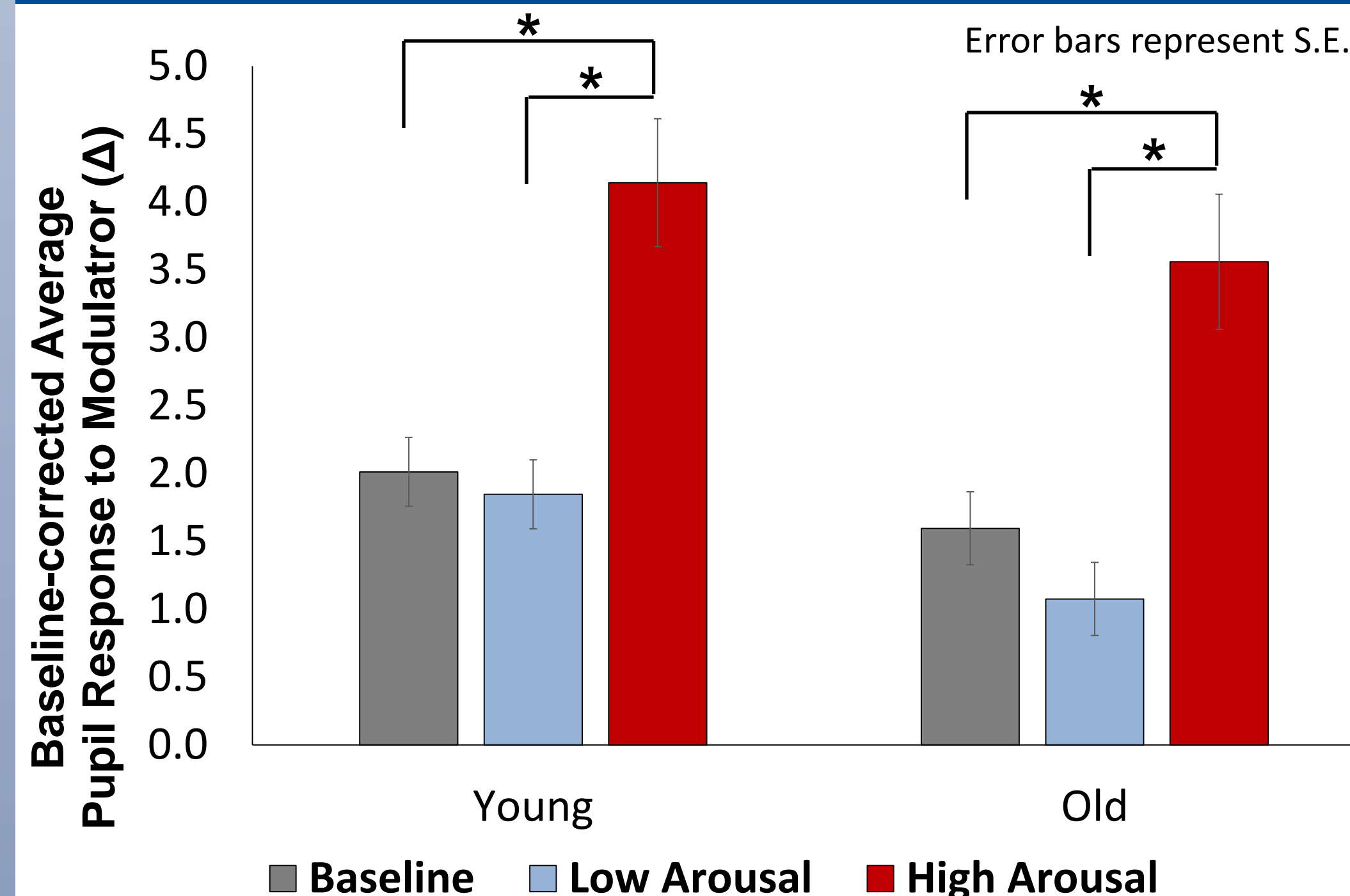
Participants made a series of choices between smaller-safer and larger-riskier financial gains. Half of the safe and half of the risky options were of higher expected value (i.e., probability x amount).



Research Question:

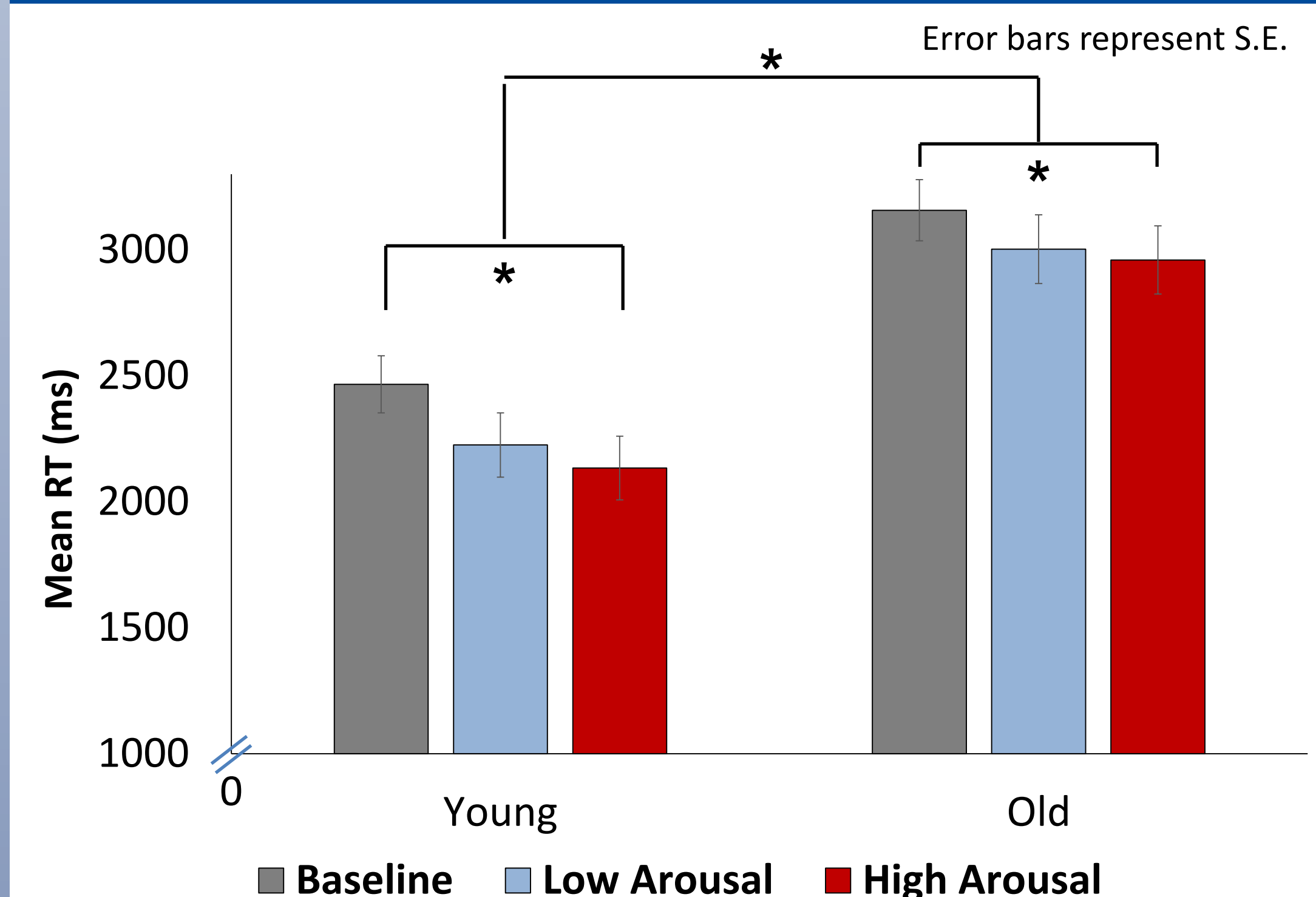
Does the influence of arousal on value-based decision making change as we get older?

Manipulation Check: Arousal Increases Pupil Dilation in Younger and Older Adults



- Trial-level pupil response data was averaged 3 secs post-onset of the modulator and was baseline-corrected relative to pre-trial baseline (500 ms) as well as normalized by participant-specific maximum pupil range.
- There was a main effect of condition for pupil dilation, $p < .0001$.

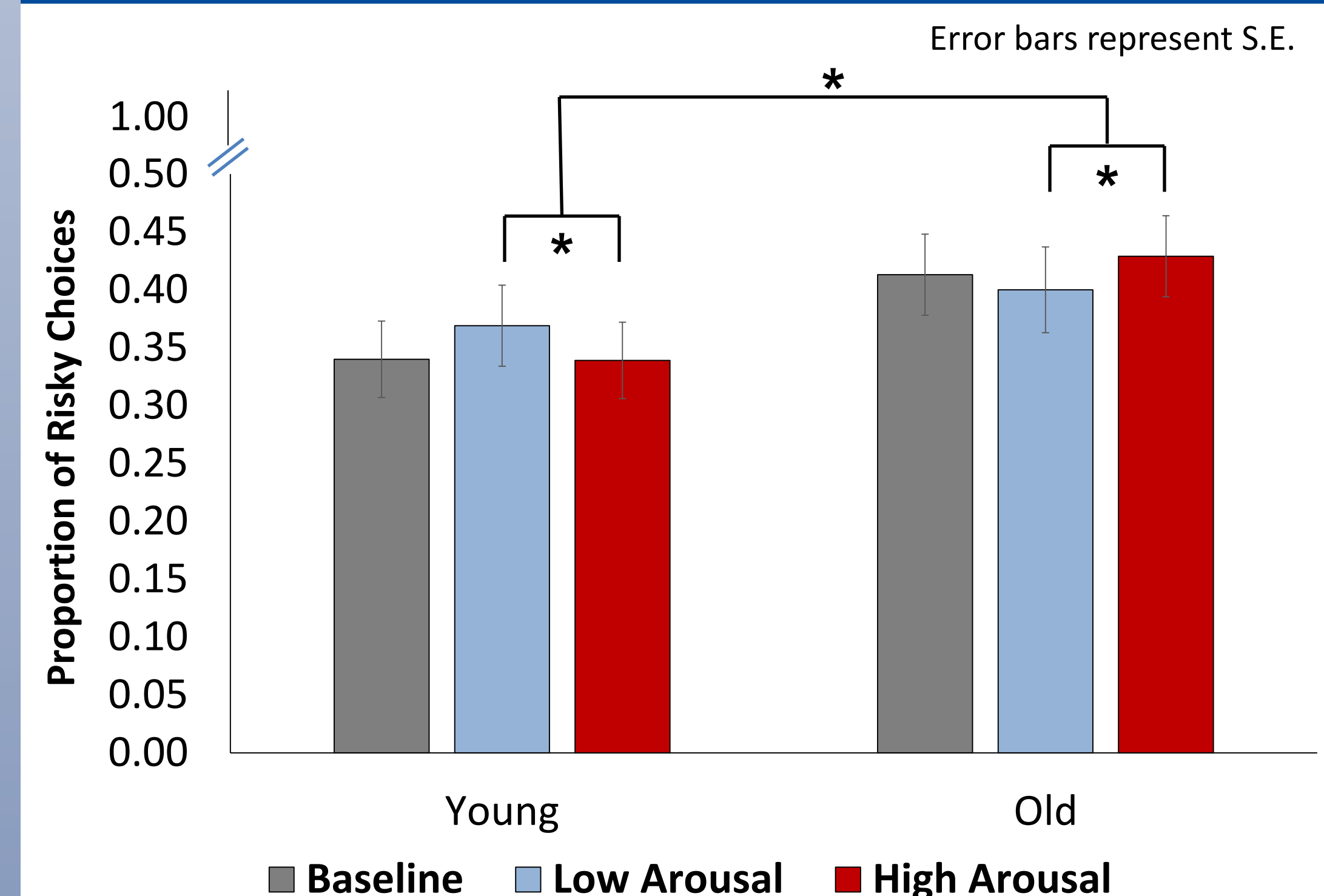
Arousal Speeds up Responses More for Younger Adults than Older Adults



- A multilevel linear regression (random intercept only) was estimated with trials nested within subjects regressing RT onto age and condition.

Fixed Effects	b	SE	t	p
Intercept	2134.53	119.48	17.87	< 0.01
Age (Young = 0, Old = 1)	825.89	175.09	4.72	< 0.01
D1: High Arousal (0) vs Baseline (1)	331.30	29.21	11.34	< 0.01
D2: High Arousal (0) vs Low Arousal (1)	90.62	29.17	3.11	< 0.01
Age x D1	-137.09	42.95	-3.19	< 0.01
Age x D2	-49.29	42.83	-1.15	0.25

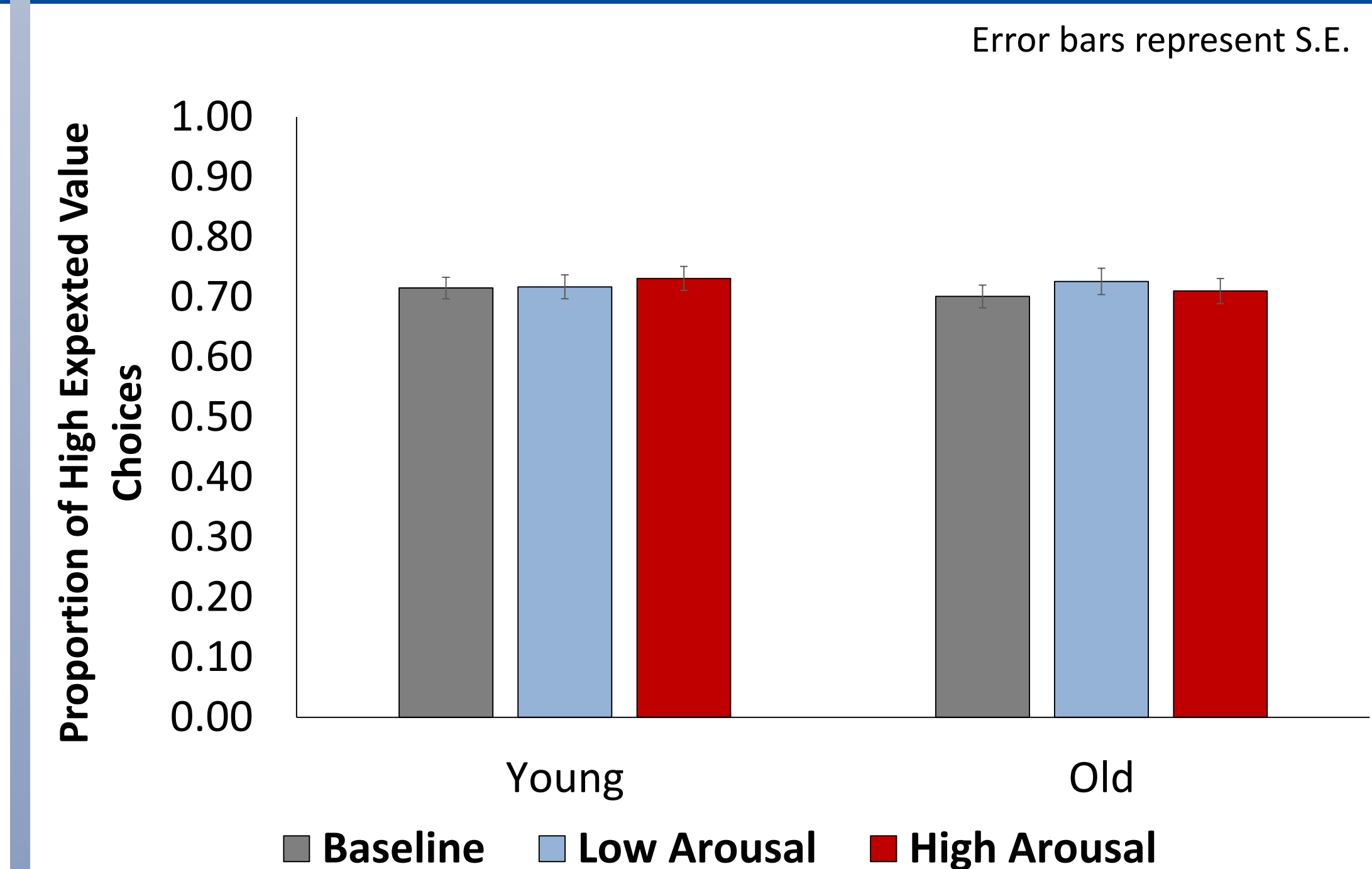
Changes in Arousal are Associated with an Age-Related Divergence in Risky Choices



- A multilevel logistic regression (random intercept only) was estimated with trials nested within subjects regressing the proportion of risky choices onto age and condition.

Fixed Effects	b	SE	z	p	Odds Ratio
Intercept	-0.82	0.20	-4.00	< 0.01	0.44
Age (Young = 0, Old = 1)	0.52	0.30	1.74	0.08	1.68
D1: High Arousal (0) vs Baseline (1)	0.002	0.08	0.03	0.98	1.00
D2: High Arousal (0) vs Low Arousal (1)	0.15	0.08	1.85	0.06	1.16
Age x D1	-0.09	0.12	-0.73	0.47	0.92
Age x D2	-0.30	0.12	-2.56	0.01	0.74

Arousal and Age Do Not Influence Decision Quality



- A multilevel logistic regression (random intercept only) was estimated with trials nested within subjects regressing the proportion of high expected value choices onto age and condition.
- There were no significant effects or interactions.

References

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Discussion and Conclusion

- Aging is associated with changes in arousal-modulated decision making:
 - Arousal speeds responses, but this effect is greater in younger adults than in older adults.
 - Arousal **decreases** risk taking in younger adults, but **increases** risk taking in older adults.
 - Arousal has no effect on decision quality in either age group*
 - *at least when normatively “good” (higher-expected value) choices are equally distributed across safe and risky options, as they were in this experiment .
- The current study is one of the first demonstrations of **age differences in arousal-based modulation of value-based decision making**, and may have implications for predicting younger vs. older adults’ real-world financial decision making in affectively laden situations.