The effects of acute aerobic exercise on memory and cognition in healthy, young adults



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Andrea Shang¹, Meredith Elman¹, Ryan Karmouta¹, Stacey DaSilva¹, Vincent Dodson¹, Jonathan Tang¹, Scott A Small², Adam M Brickman² & Wendy A Suzuki¹

¹Center for Neural Science, New York University, NY 10003 ²Department of Neurology, Columbia University Medical Center, NY 10032

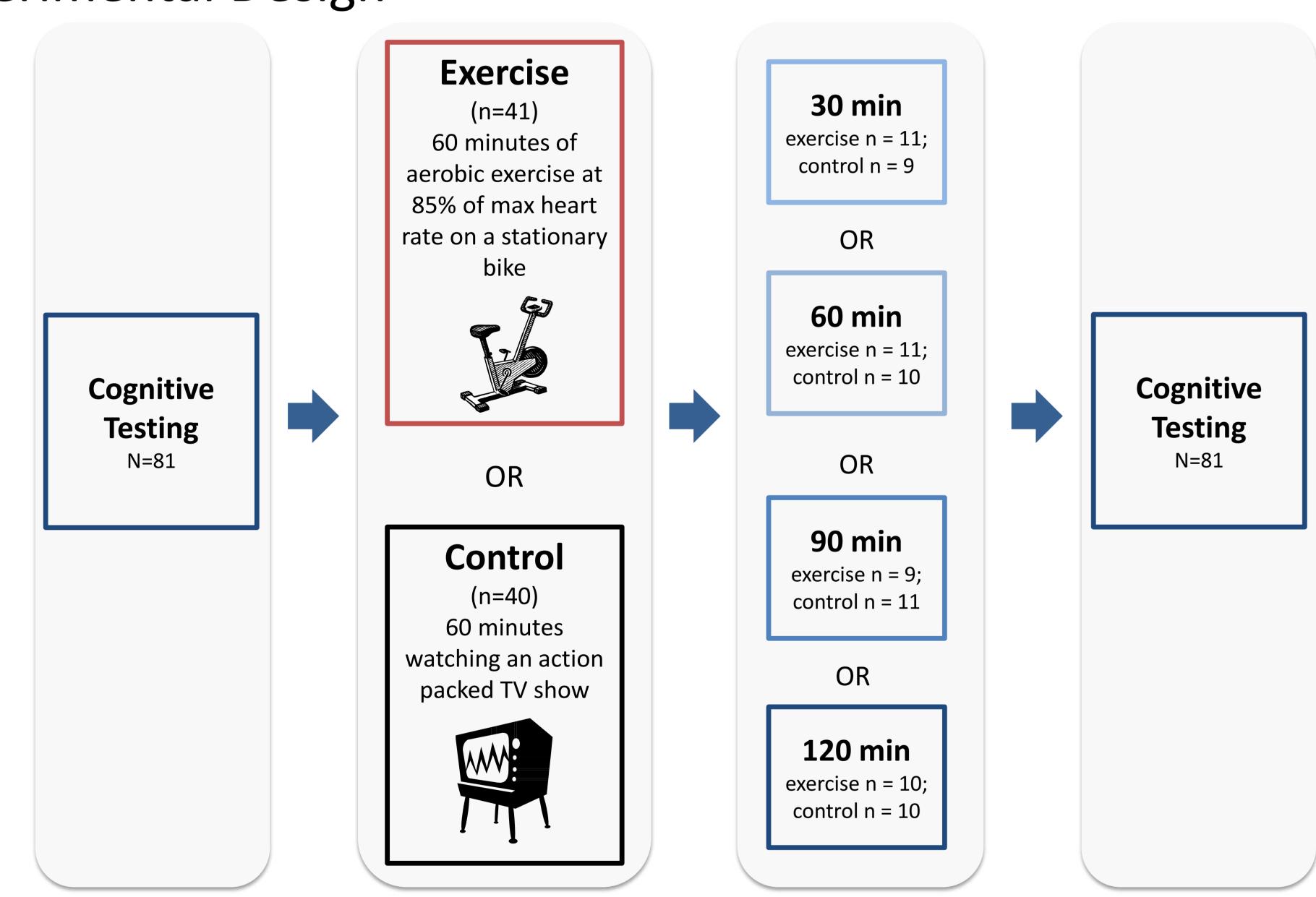


Introduction

Many previous studies have shown that higher levels of physical fitness are associated with higher levels of cognitive performance (Themanson et al., 2008; Colcombe and Kramer, 2003). While most of the exercise intervention studies have focused on chronic exercise paradigms, a growing body of work in human populations has started to explore the effects of acute exercise (typically 30 minutes to 1 hour) on cognitive functions. While the overall findings have been mixed, a recent meta-analysis by Chang et al., (2012) suggests that there is a small positive effect of acute exercise on cognition with the possibility for larger effects when specific exercise parameters are used. To try to identify the tasks that are most sensitive to an acute bout of exercise, we explored the effects of one hour of exercise on a stationary bike on a range of cognitive tasks, focusing on tasks that tap frontal lobe functions. We also asked how long the cognitive effects of acute exercise might last, examining delay intervals after exercise from 30 minutes to 2 hours. These findings are a first step in a program of work designed to identify the optimal exercise and cognitive/behavioral testing parameters that maximize the exercise effects on cognition in humans.

Methods

Experimental Design



Neuropsychological Tests

- Hopkins Verbal Learning Test
- Stroop Color and Word Test
- Symbol Digit Modalities
- Controlled Oral Word Association Test

- * Only at testing before exercise/control intervention
- Trail Making A and B
- Wechsler Test of Adult Reading*
- WAIS-III Digit Span
- Modified Benton Visual Retention Test

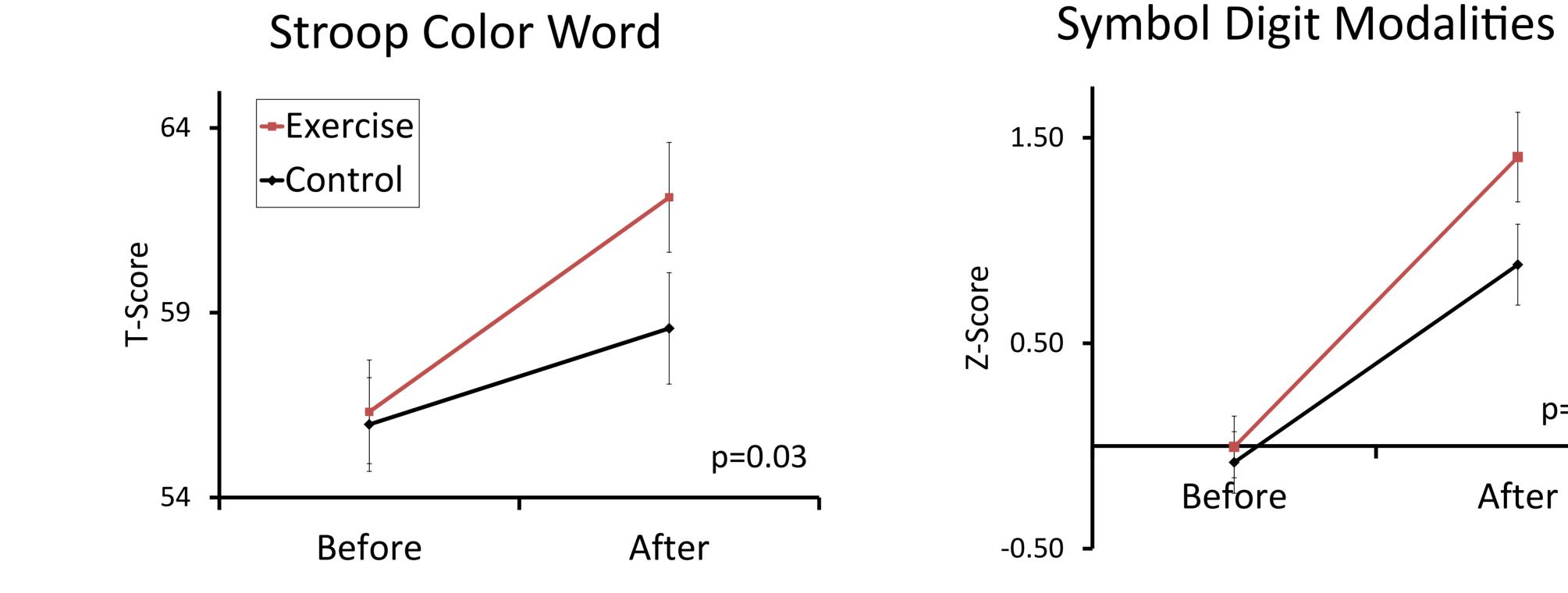
Participant Demographic Information

	AII (N=81)	Exercise (N=41)	Control (N=40)
Gender	48 female	20 female	28 female
Age (years)	22.37 (SD=4.20)	22.17 (SD=3.76)	22.57 (SD= 4.65)
Education (years)	12.98 (SD=1.92)	15.15 (SD=1.96)	14.80 (SD=1.88)

Results

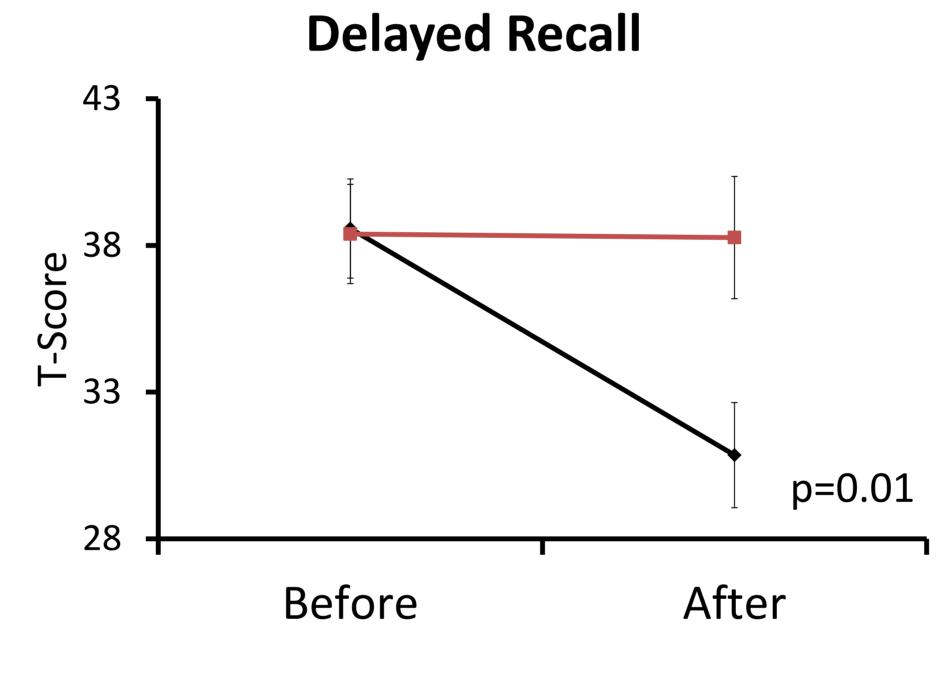
Performance on Cognitive Tasks Before vs. After Intervention

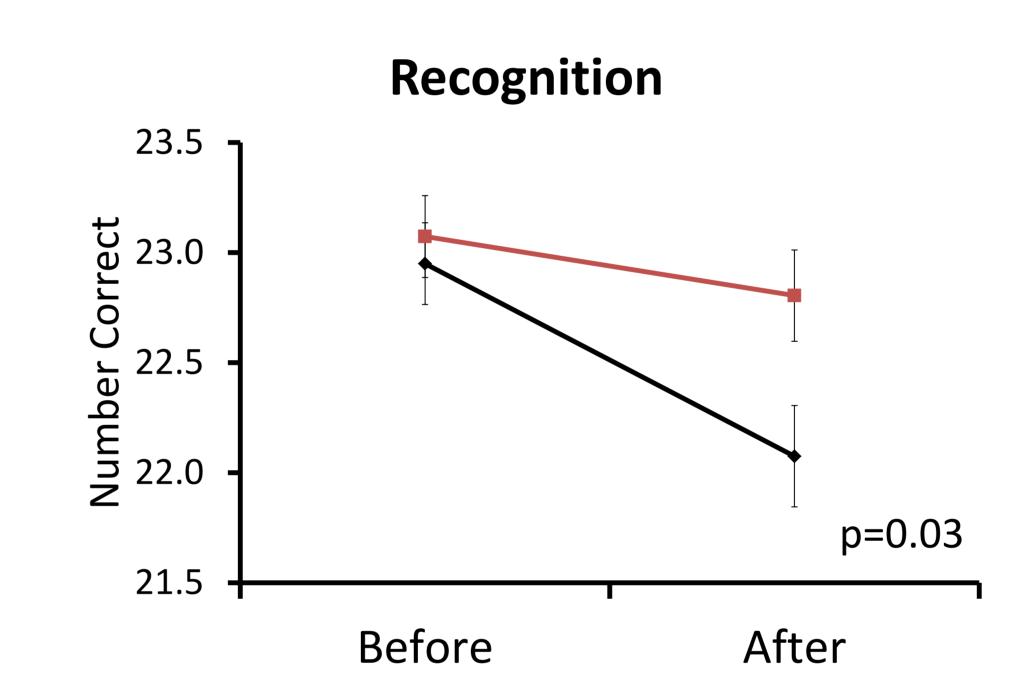
. All Delays Combined



Hopkins Verbal Learning Test



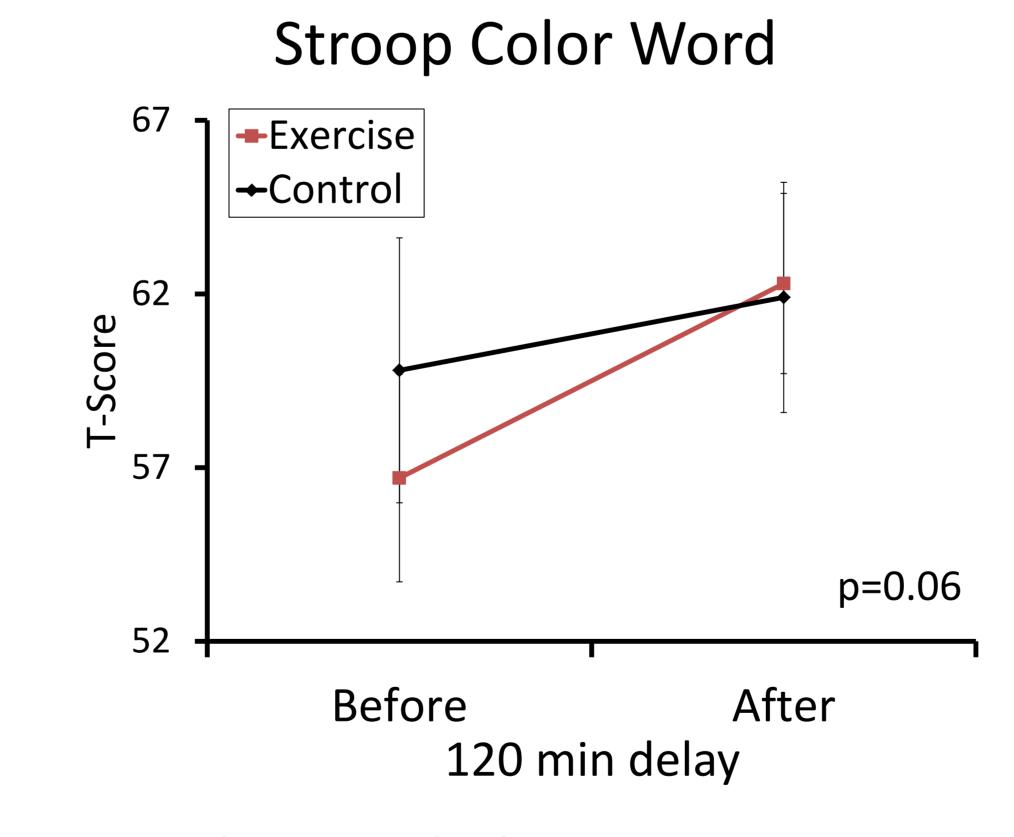




p=0.02

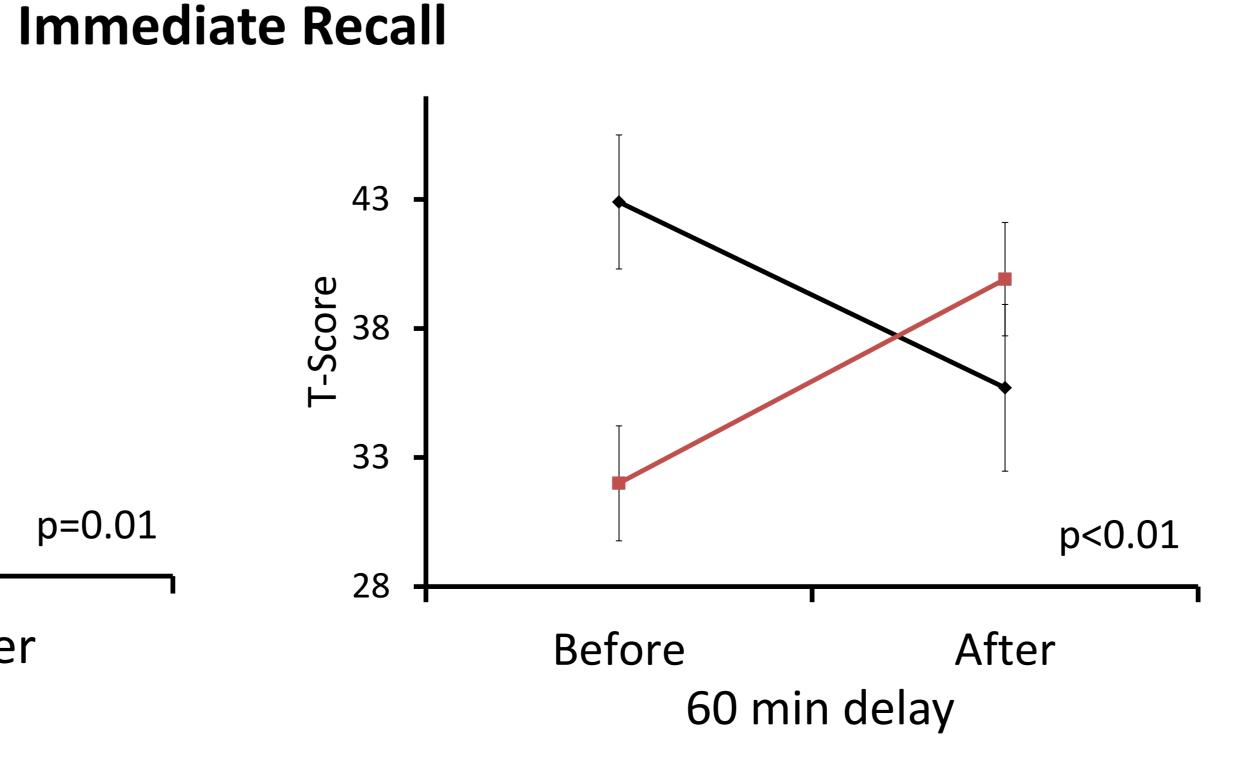
After

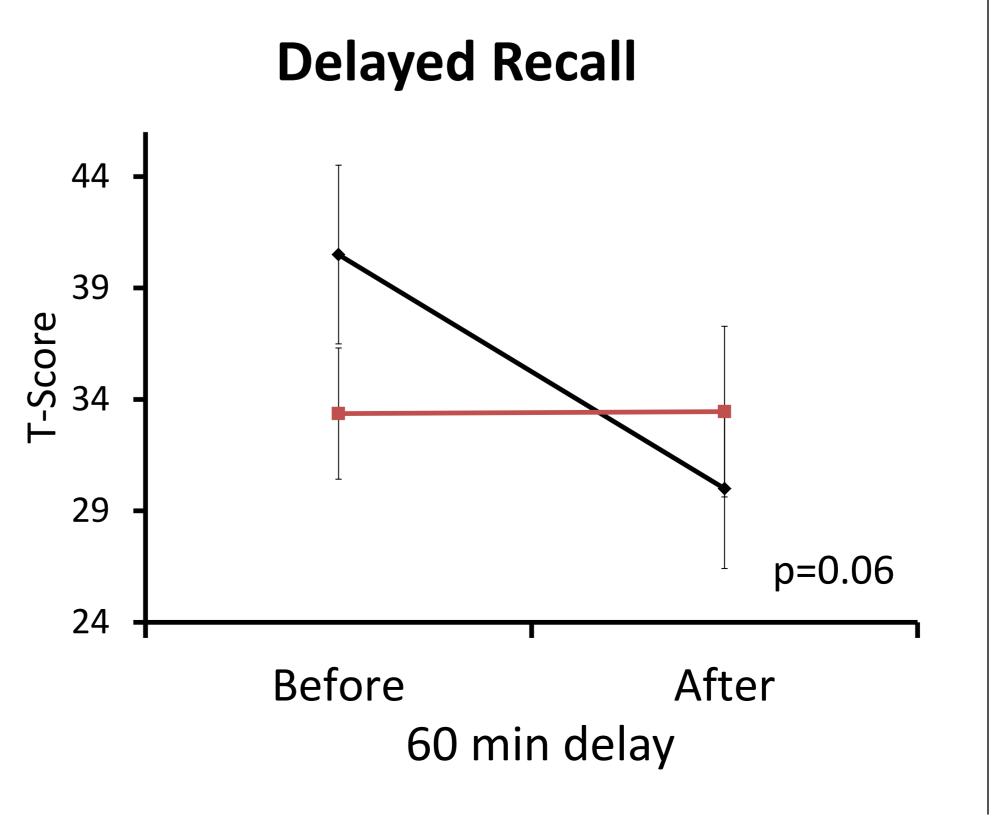
II. Individual Delays



Hopkins Verbal Learning Test

p=0.01Before After 30 min delay





Summary & Conclusion

- A single bout of aerobic exercise results in significant improvement on frontal lobe dependent tasks in healthy, young adults.
- These improvements may last for up to 120 minutes after the bout of exercise.
- The controls' decline in performance on the HVLT after the intervention suggest that TV watching may have a detrimental effect on performance on this task.

Frontal lobe dependent tasks are highly sensitive to the effects of just an hour of aerobic exercise.

Future Directions

We are currently exploring the EEG signals associated with these cognitive effects of acute exercise.

References

Chang YK, Laban JD, Gapin JI, Etnier JL (2012) The effects of acute exercise on cognitive performance: a meta-analysis. Brain Res 1458:87–101.

Colcombe S & Kramer AF (2003) Fitness effects on the cognitive function of older adults: a meta-analytic study. Psychol Sci 14(2): 125-130.

Themanson JR, Pontifex MB, Hillman CH (2008) Fitness and action monitoring: evidence for improved cognitive flexibility in young adults. Neuroscience 157: 319-328.

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Please contact ashang@cns.nyu.edu for further details