# The influence of natural environments on children's cognitive functioning


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# Outline

- Nature &
  - Stress
  - Cognition
- Attention Restoration Theory
- Influence of nature and urban walks on spatial memory, inhibition, and attention in typically developing children

# Nature and stress

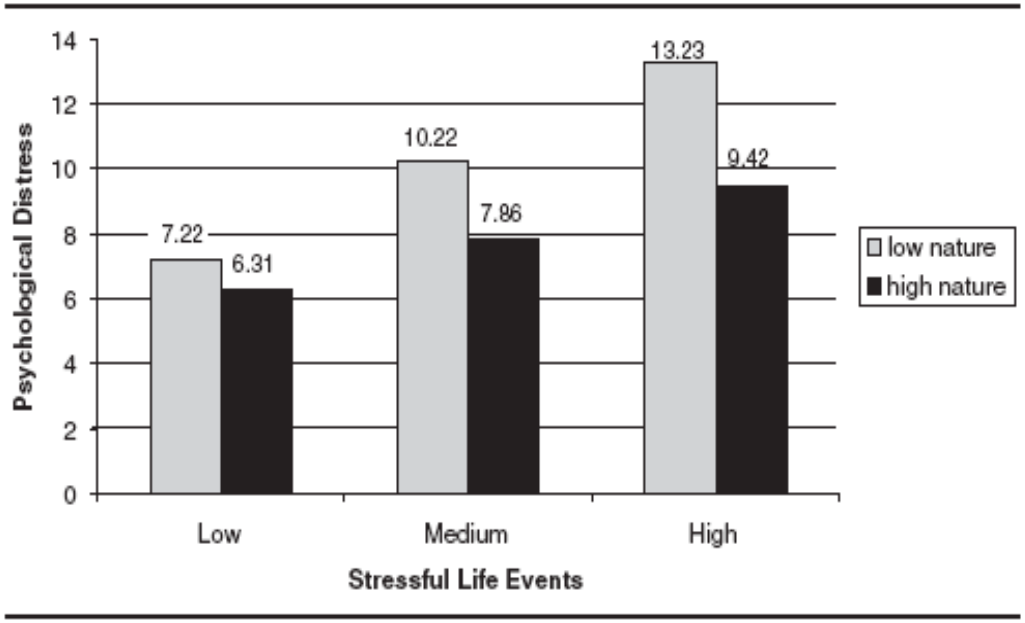



Figure 1: Nature Moderates Effects of Stressful Life Events on Psychological Distress

Wells & Evans, 2003, Figure 1

# Nature views

For girls:

naturalness of view from apartment

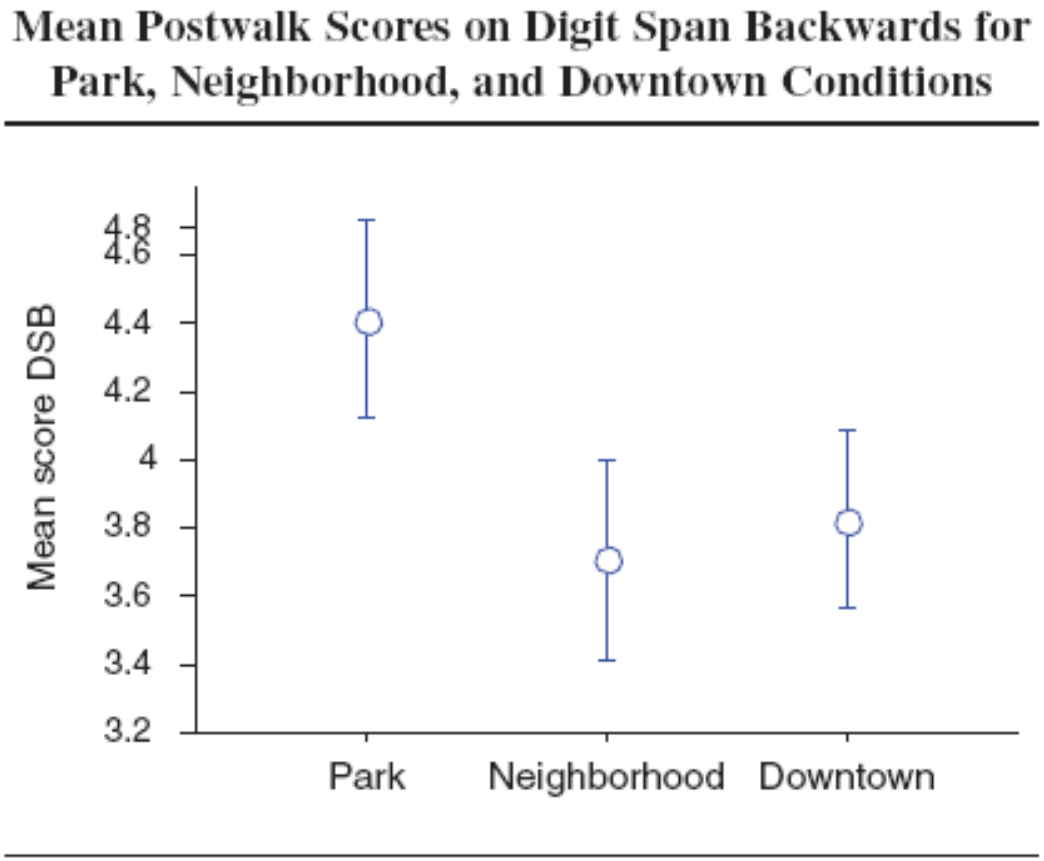
- concentration
- impulse inhibition
- delay of gratification

Taylor, Kuo, & Sullivan, 2002

# Parental Report Studies

- children's ADHD symptoms improved following activities related to natural settings (Fabor Taylor et al. 2001; Kuo & Fabor Taylor, 2004)
- children who typically played in "greener" outdoor settings displayed milder ADHD symptoms than children who played in less green settings (Fabor Taylor et al., 2001).

# ADHD kids and time in nature




Taylor & Kuo, 2002, Figure 1

# Adult research

- Non-ADHD adults showed improvement in backwards digit span and executive portions of the attention network task following
  - a nature walk (Experiment 1)
  - viewing scenes of nature (Experiment 2)

Berman et al., 2008

# Attention Restoration Theory (ART)

- Based on work by William James
- Three basic premises
  1. two attention systems:
     - directed, effortful attention
     - involuntary, effortless attention
  2. deliberately directed attention is susceptible to fatigue and restoration
  3. different environments have different effects on attention

# Summary

- Time in nature reduces the negative influence of stress in children
- Time in nature improves attention
  - in adults
  - in children with ADHD
- Most studies in children are correlational

# Purpose of the Study

- Test influence of time in nature on cognition
  - in preschoolers
  - in typically developing children

# Sample Description

62 children:

- 15 4-year olds
- 15 5-year olds
- 16 7-year olds
- 16 8-year olds

# Research Sessions

Two sessions that included:

(1) puzzles

(2) a 20-minute walk (nature, urban)

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Two sessions that included:

(1) puzzles

(2) a 20-minute walk (nature, urban)

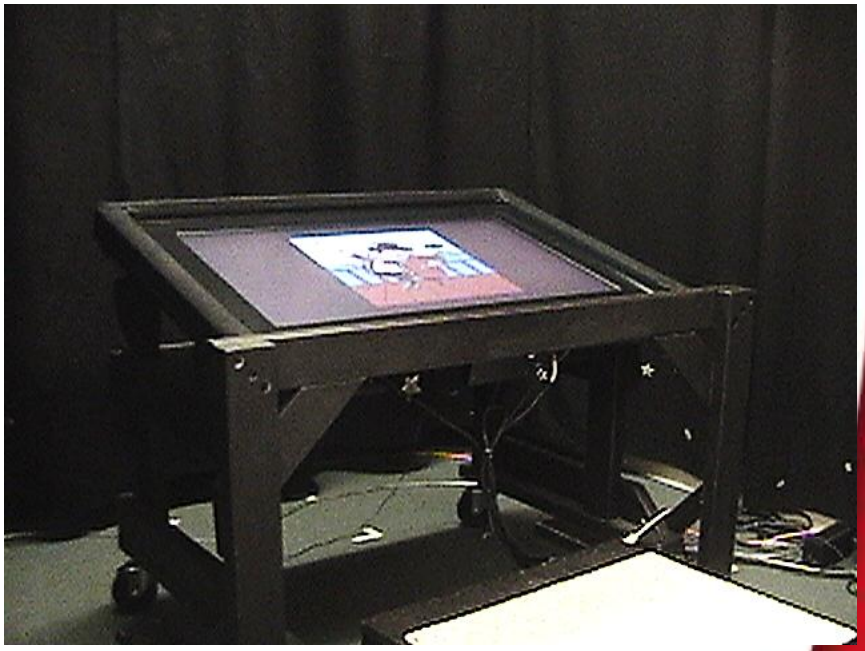
(3) cognitive tasks

- Spatial working memory
- Go-No go (inhibition)
- Continuous performance task (attention)
- Backwards digit span (7 & 8 years only)

# Research Sessions

Spatial working memory (SWM)

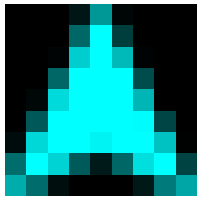
- ADHD – deficits in SWM
- Attention has been proposed as a rehearsal mechanism for SWM



# Research Sesions

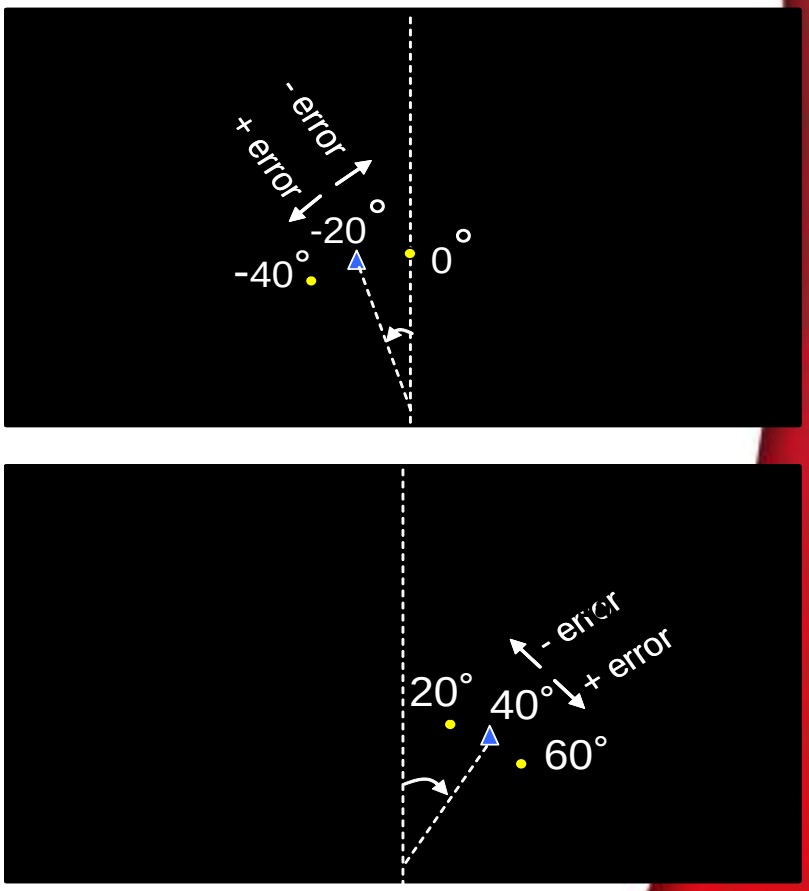
- SWM tasks
  - Spaceship search
  - Treasure find
  - Bubble burst

- Delay: no delay, 1 s, 5 s, or a 10 s

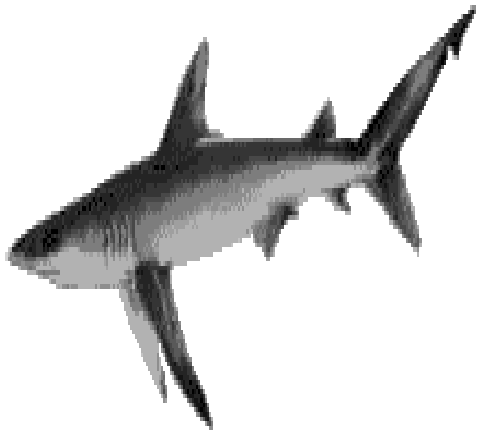
# SWM Task

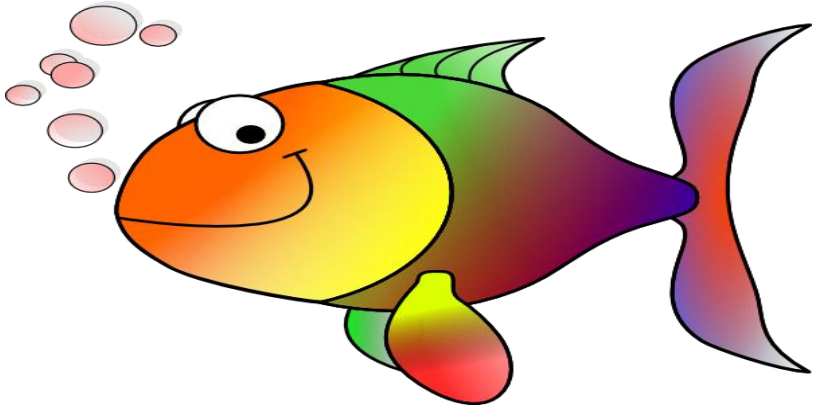
- Targets: -20º or 40º degrees from midline
- Distractor: half of the 5 and 10 s delay trials
  - 20º toward midline (inner)
  - 40º away from midline (outer)



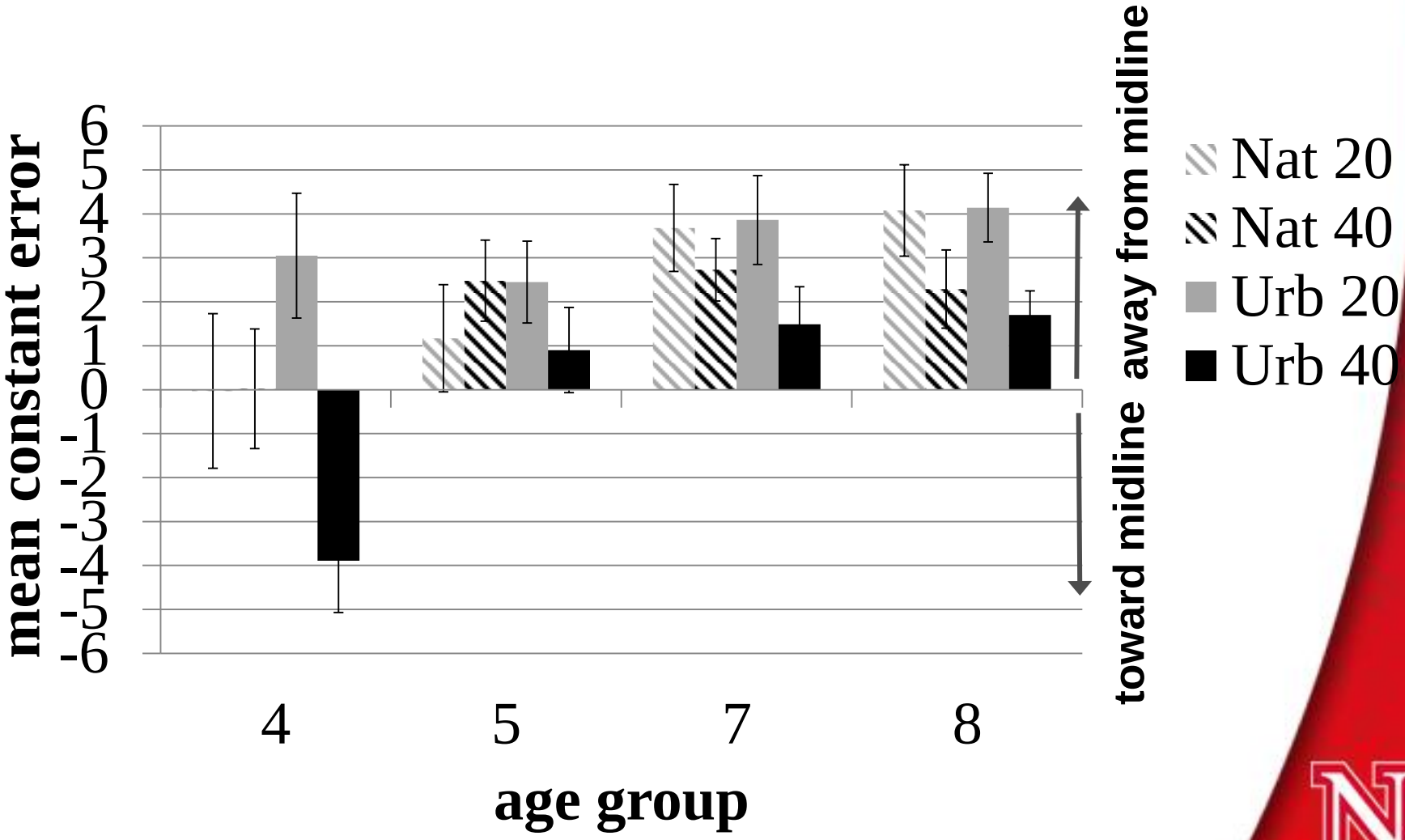
# Research Sessions

- Go-no go task  -- inhibition
- Continuous Performance Test task -- attention

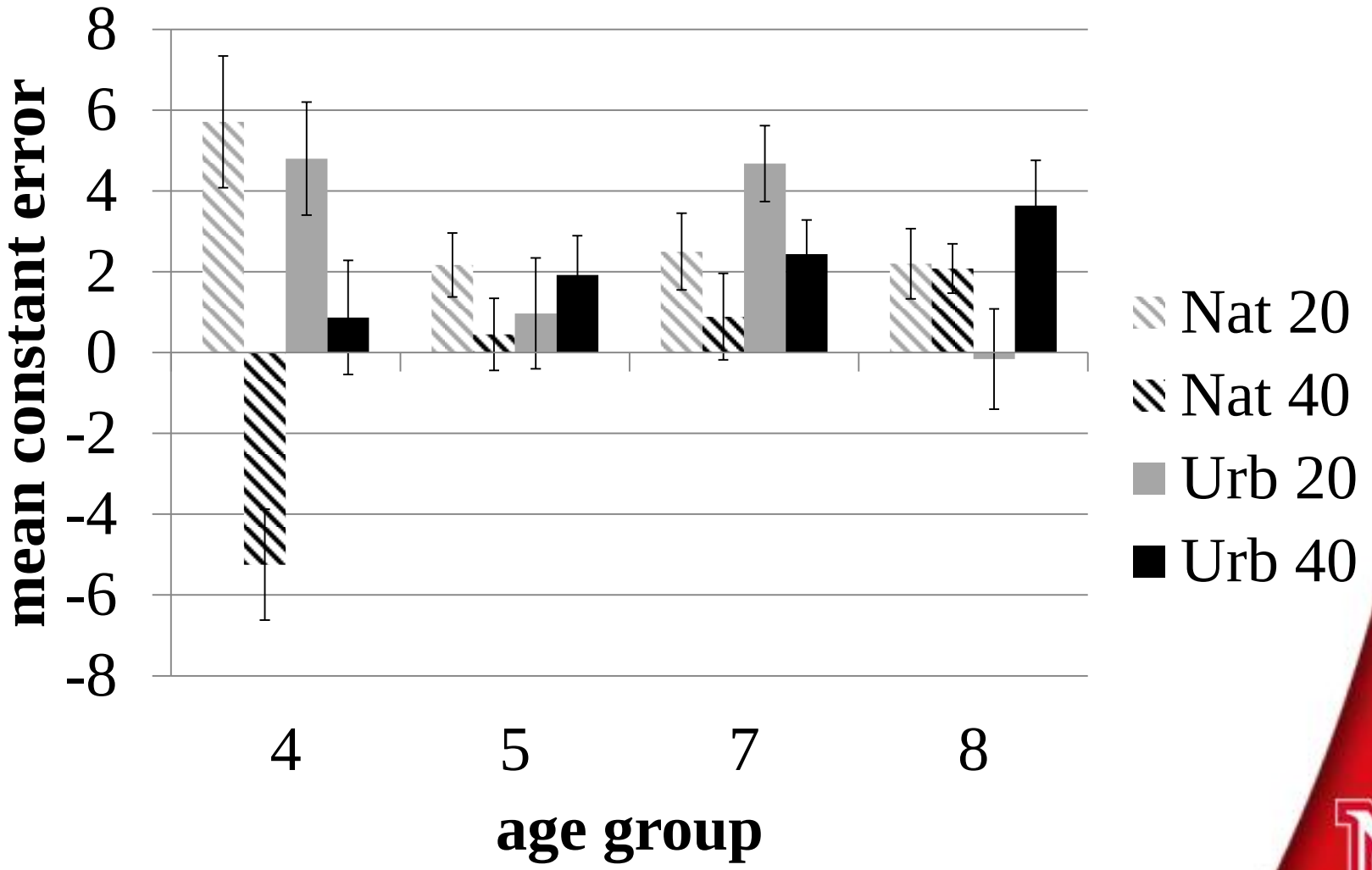




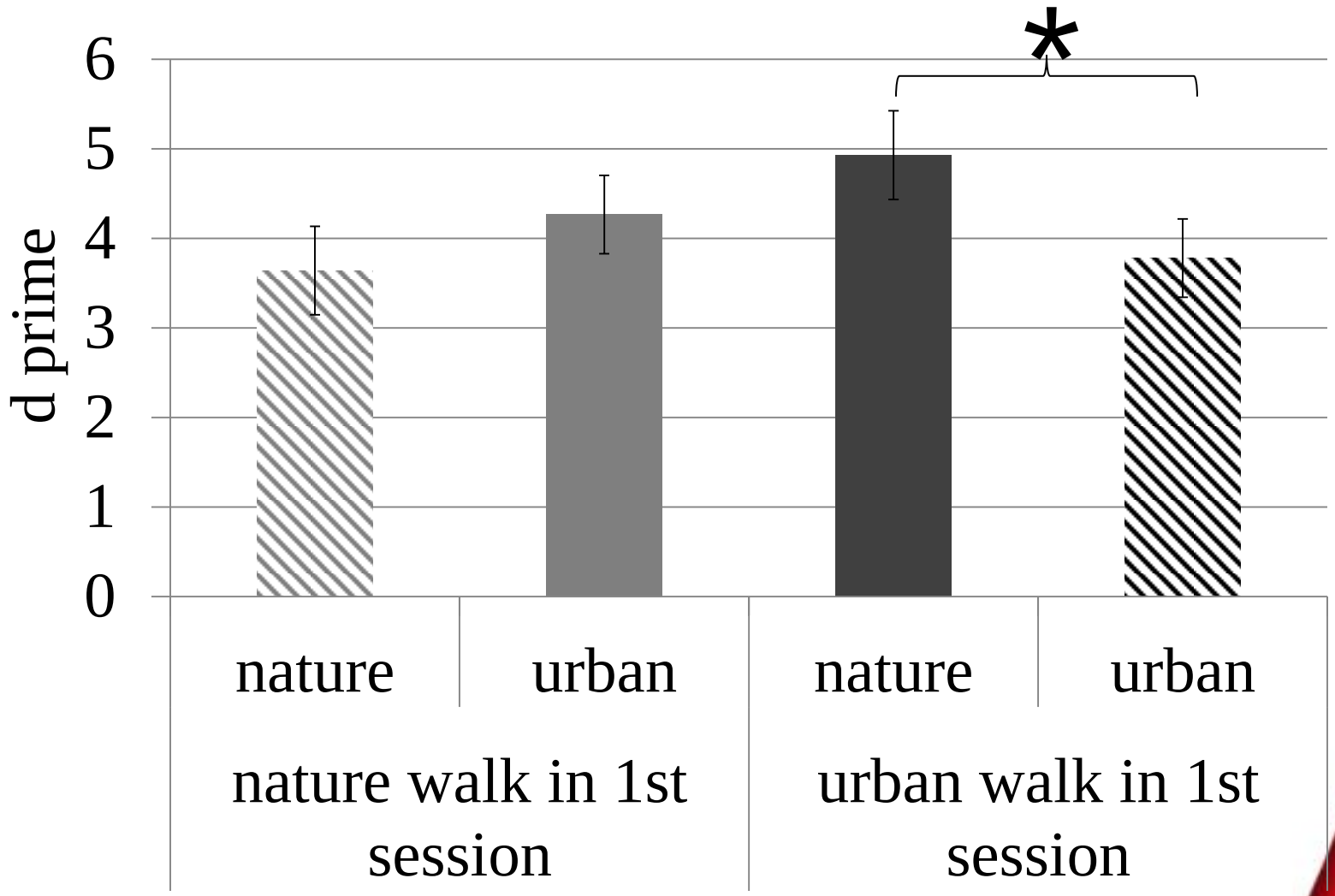
# SWM performance: Session 1



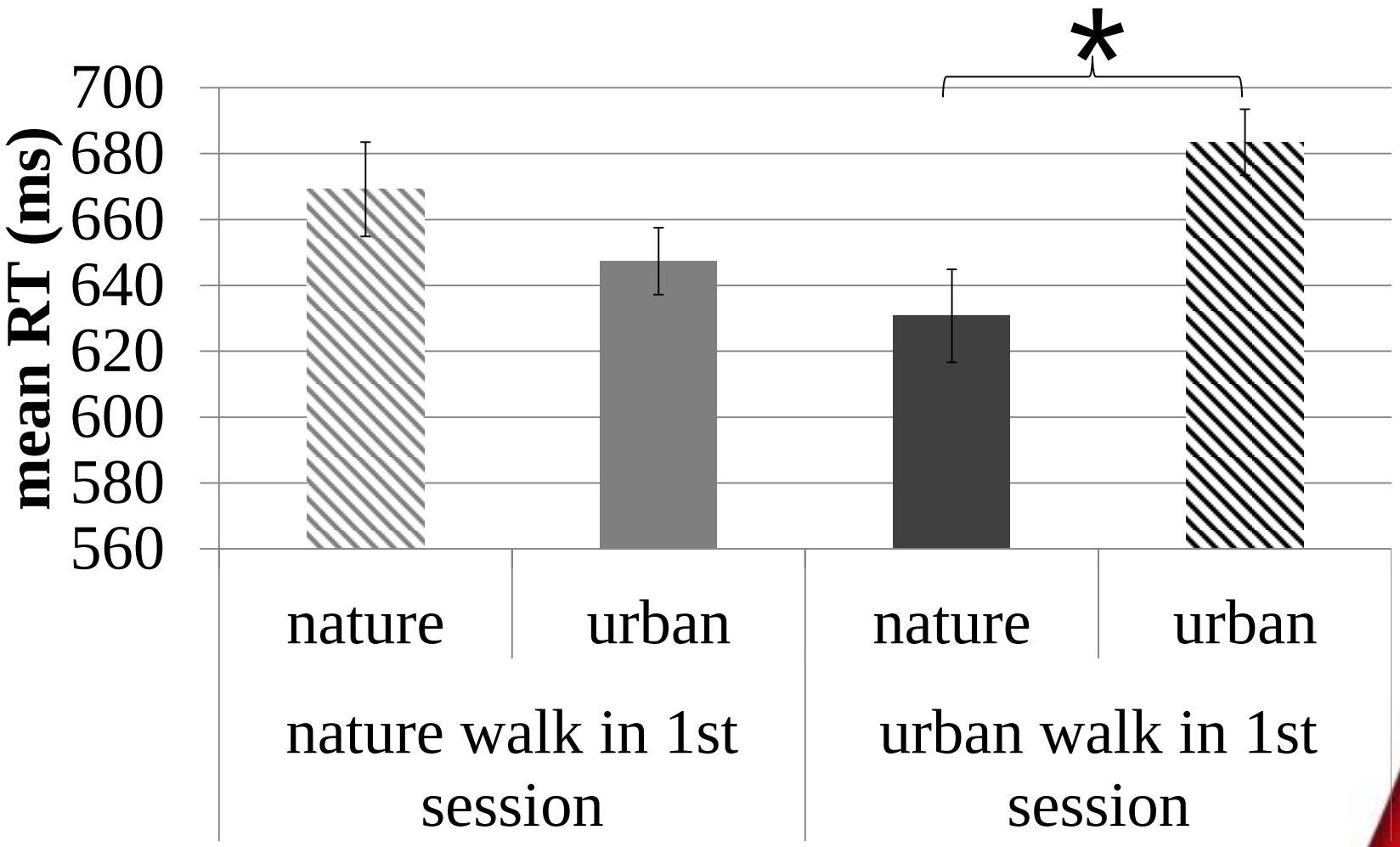
# SWM performance: Session 2



# Go/No Go Task: Inhibitory control



# Go/No Go Task: Reaction time



# Go/No Go Summary

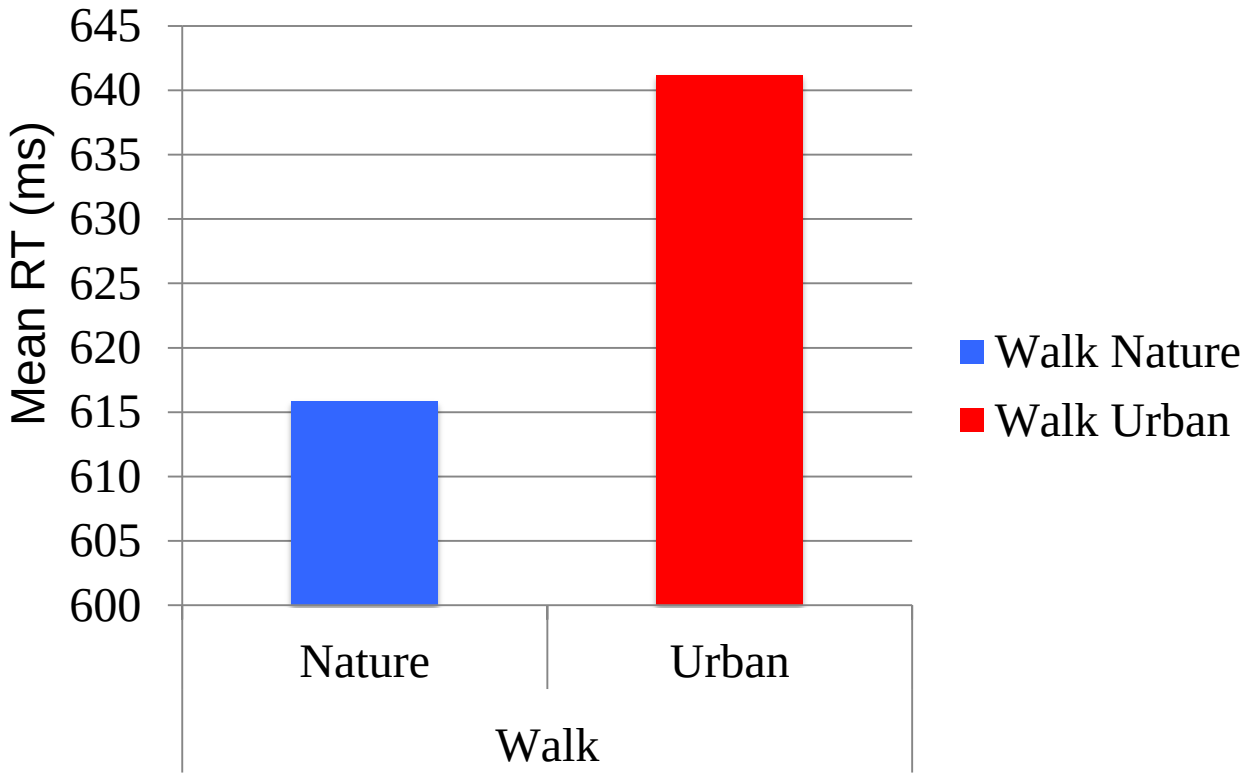
- Higher levels of accuracy and shorter reaction times in second session following nature walk

# Continuous Performance Task (CPT): Attention

- 4- and 5-year-olds: no significant effects of walk

# CPT: 7 and 8 Year Olds

- Overall accurate performance
- Reaction time: Walk main effect



# Backwards digit span

- 7- and 8-year-olds: no significant effects of walk

# Results Summary

- Spatial memory performance
  - Some interactions between walk and session
  - Influence of walk not clear
- Go-No go
  - better performance when children did nature walk in session 2
- Continuous performance task
  - 4- and 5-year-olds: no significant effects
  - 7- and 8-year-olds: nature walk significantly reduced reaction time

# Conclusion

- 4- &5-year-olds: some evidence of improved inhibitory control following nature walk
- 7- & 8-year-olds: some evidence of improved inhibitory control and attention following nature walks
- Results show promising benefits of walks in nature for children without ADHD

# Take Home Points

- Children benefit from spending time in natural environments.
- Time in natural environments improve performance on cognitive measures of attention and response inhibition.
- Time in natural environments appears to be especially beneficial to children with ADHD