

Diagnosing Diagnostic Hypothesis Generation in Adolescents

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Collaborators and Funding

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☐ Students

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Questions of interest

- ❑ How do people take data and generate potential explanations (i.e., hypotheses) of that data?
 - ❑ How do hypothesis generation processes influence probability judgment?
 - ❑ How does hypotheses generation affect information search or hypothesis testing?
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Overview of Talk

- A little motivation
 - Theoretical overview of HyGene
 - Detail two lines of research motivated by the development of HyGene
 - Stopping rules for terminating memory search
 - Influence of memory processes on judgment accuracy
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Why study Hypo Generation?

- Important for many real world tasks
 - Medical diagnosis, auditor's diagnosis of going concerns, mechanics diagnoses of auto failure, science
 - Any task that involves taking "data" and formulating possible explanations of that data
 - Serves as the lynchpin for hypothesis assessment and testing
 - Need to have something to assess before you can determine likelihood
 - Help organize search for information in environment (hypo testing)
 - Hypothesis generation process defines the solution space entertained by the DM
 - Allows me to ask a lot of questions about stuff I know nothing about.
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Relevance to Adolescent Decision Making

- ❑ Adolescents often faced with task of generating solutions to problems
 - Interpersonal relationships:
 - ❑ Resolving conflict with peers
 - ❑ Generating explanations of other's behaviors
 - Risk assessment and action:
 - ❑ Generating potential risks associated with engaging in a particular behavior (e.g., sex, drug use)
 - ❑ Generating menu of behavioral options
 - Generating solutions (analogies?) to problems in the classroom
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Cognitive plasticity approach to underachievement

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Paul Hanges

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☐ Collaborators

- Michael Bunting
- Jared Novick
- Scott Weems
- Paul Hanges

☐ Funding

- Pursuing ...
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Achievement gaps

☐ Mathematics

- Blacks under perform compared to whites

☐ Cognitive Ability

- Blacks score lower on measures of cognitive ability, compared to Whites

☐ Judgment

- Blacks provide higher judgments, compared to whites

☐ Which achievement gap?

- There are many!

Racial differences: Mathematics

- ❑ Blacks under perform compared to white cohort
 - 0.6 std. difference by kindergarten, 0.8 by end of 3rd grade
 - Grows to full std. by adulthood
- ❑ Not due to 'ability' (Entwisle & Alexander, 1990)
 - Black preschoolers do equally well on 'computation'
 - Reasoning skills
- ❑ School quality?
 - Not due to school quality, or instruction quality
 - Gap persists when controlling for school and teacher effects.

Racial differences: Mathematics

□ Fryer & Levitt (2006).

- “Racial gaps in educational achievement remain substantial.”
- “Prior research shows Black children entering kindergarten lagging their White counterparts, and these differences grow throughout the school years.”
- “None of the explanations we examine, including systematic differences in school quality across races, convincingly explain the divergent academic trajectory of Black students.” (N = 20,000, 100 control variables)
- “The explanation as to why Blacks are losing ground proves elusive.”

Racial differences: Cognitive ability measures

- Working memory span
 - Raven's progressive matrices (Gf)
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Race Differences: Judgment

- White male effect (Finucane, Slovic, et al.)
 - White males underestimate risk's relative to black males
 - Subadditivity (Dougherty & Hanges)
 - Black males show greater subadditivity in probability judgments compared to White males
 - Why?
 - Socio-political factors, perceived control, trust, and other factors (Finucane et al.,
 - But! Still black-white differences even after controlling for these variables
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Racial Differences: Why?

- Separate causes for different tasks?
 - Convenient.
 - Lacks parsimony
 - Lends itself to ad hoc theorizing
 - Unique interventions required for each
 - Single underlying dimension
 - Parsimonious
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Research program

- Assessment:
 - Are there black-white differences in problem structuring skills?
 - Do these skills mediate black-white differences in mathematics, cognitive ability, and judgment?
 - Etiology:
 - What are the causes of black-white differences in problems structuring skills?
 - Hypotheses:
 - Skills learned in early childhood.
 - Structure in the home environment
 - Structured versus free play.
 - Intervention:
 - Can we develop effective interventions to improve problem structuring skills in at-risk (or low achieving) individuals?
 - Neural plasticity:
 - Extensive problem structuring training
 - Does problem structuring training generalize to other tasks?
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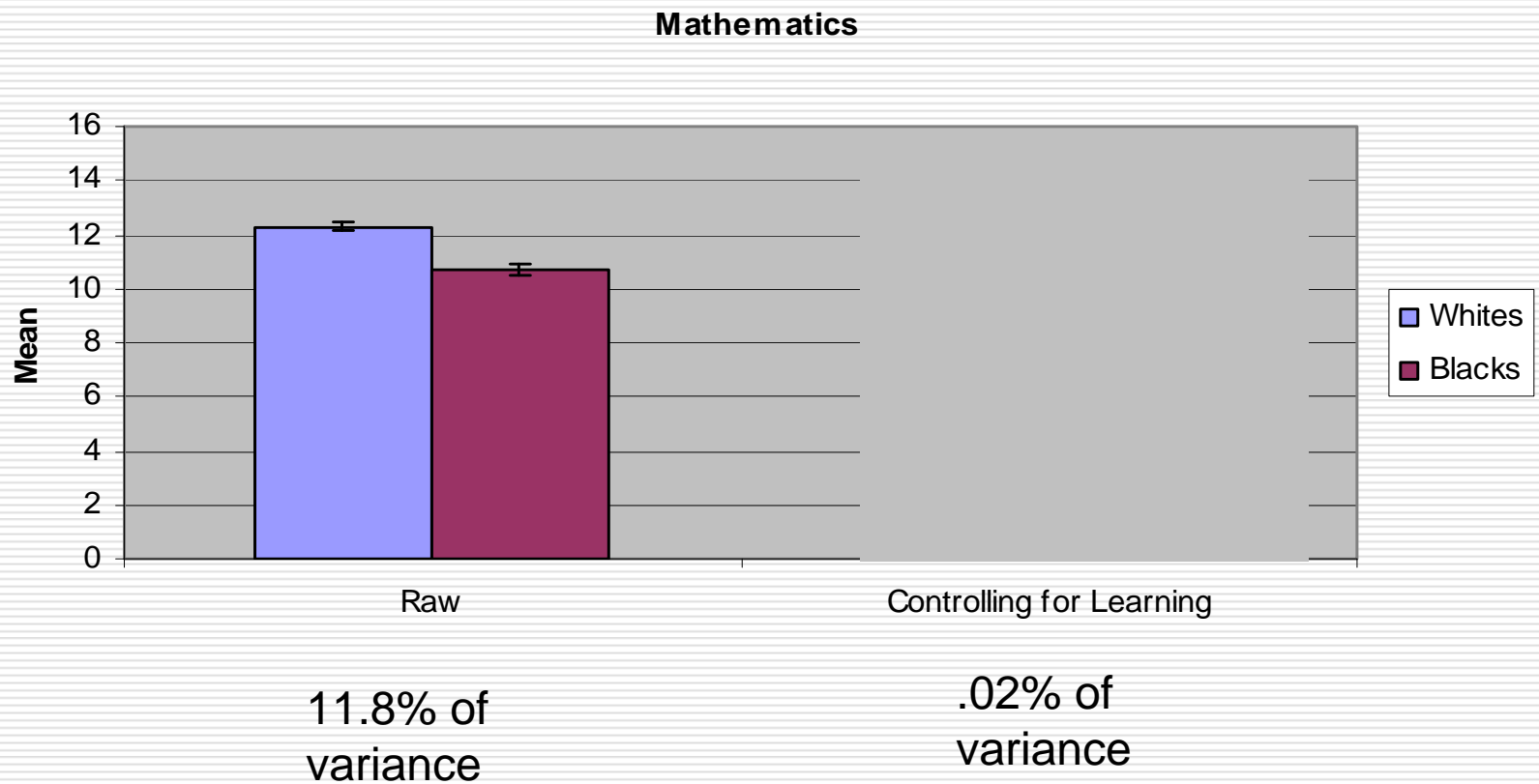
Assessment: Existing data

- ❑ 311 subjects (Enrolled in firefighter academy in Alabama)
 - N = ## Black Participants
 - N = ## White Participants
 - ❑ Study designed to examine personnel selection procedures
 - Reading ability
 - ❑ Standard test of reading ability (not included in present study)
 - Mathematics ability
 - ❑ N word problems drawn from SAT-like corpus
 - Working memory capacity
 - ❑ Modified version of 'counting span' task
 - Judgment task
 - ❑ 9 probability judgment questions
 - ❑ "Of all deaths in XX county in the next year, what proportion of deaths will be due to *Drowning*?"
 - 'Learning task'
 - ❑ Involves problem structuring
 - ❑ But, not designed as a process pure measure
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Assessment: Mathematics

- ☐ Can we eliminate black-white differences by controlling for problem structuring skills?
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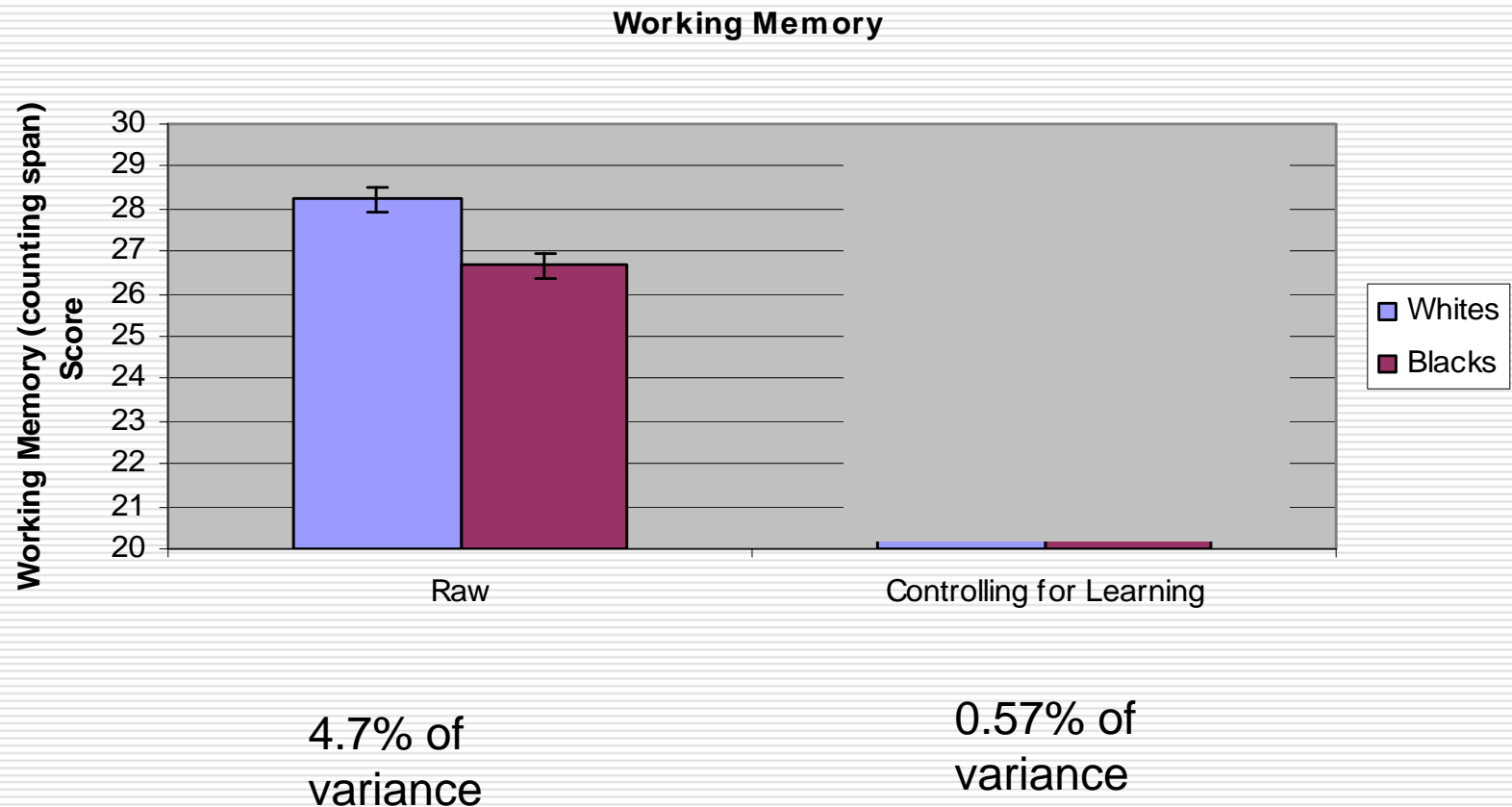
Mathematics



Assessment: Cognitive ability

- ☐ Can we eliminate black-white differences in cognitive ability by controlling for problem structuring?
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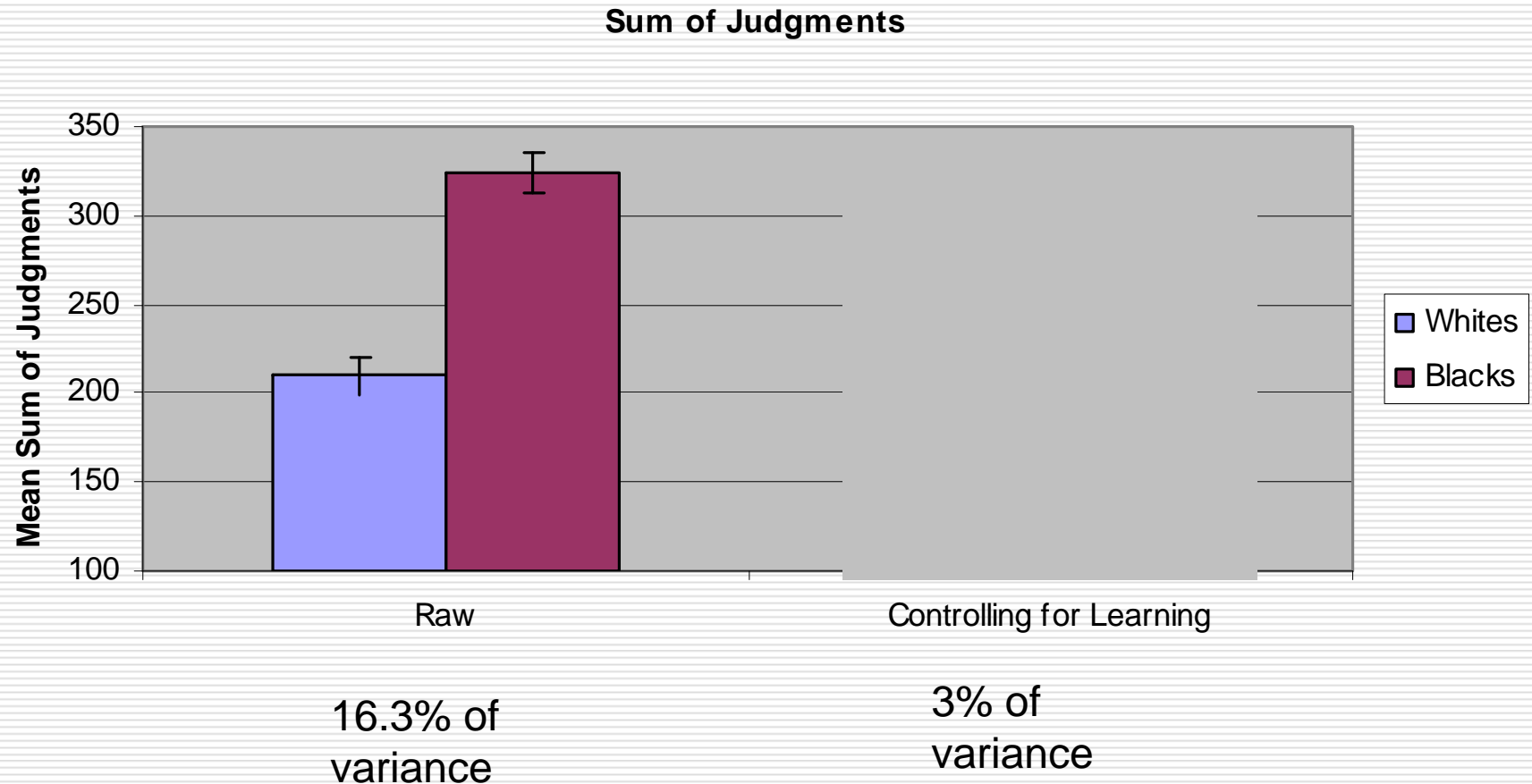
Working Memory



Assessment: Judgment

- ☐ Can we eliminate black-white differences in judgment by controlling for problem structuring?
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Judgment



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Intervention

- ☐ Is it reasonable to think gains can be made in cognitive functioning?
 - Yes
 - Brain plasticity-based training program (Mahncke et al., 2006)
 - ☐ Elderly adults show improved cognitive performance following intervention (Even in Alzheimer patients)
 - ☐ $\frac{1}{4}$ stdev increase even on untrained tasks.
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Other relevant research

- Developing measures of cognitive ability that are
 - Language independent
 - Don't require mathematics
 - Cognitive plasticity
 - Influence of threat on measures of attitude and cognitive ability.
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