

Cognition at Adolescence

Formal Operations

- "structured whole"
- think systematically
- "operate on operations"

Deductive Reasoning

The Scientific Method

- inspect data
- generate hypotheses
- deduce what should follow on basis of logic
- test theory

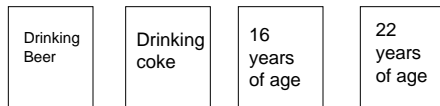
Wason problems

Supply a rule.
Show instances.
Decide if the rule is broken.

If there is a vowel on one side, then there is an even number on the other side.



Which card or cards must be turned over to see if the rule is violated?

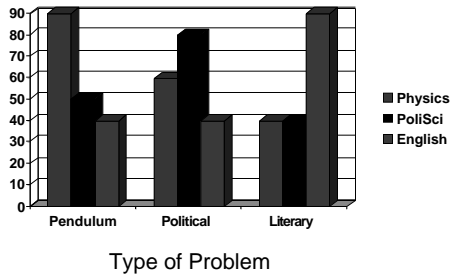


IF A PERSON IS DRINKING BEER, THEN THE PERSON MUST BE 21 OR OVER

Which card or cards must be turned over to see if the rule is violated?

- Familiarity - “human sense”

Percent Using Formal Operational Thought (De Lisi & Staudt, 1980)



- Expertise

Obstacles to FOT

- Confirmation bias
- Prior beliefs
- Failure to separate theory from evidence

Everyday Thinking

- Do not consider every possibility
 - not plausible
 - real constraints
 - short-cuts
- Different goals (Tschiri, 1980)

Gender Differences

Controversial

- great variability within gender
- increase prejudice/discrimination
- limit opportunities
- stereotype threat

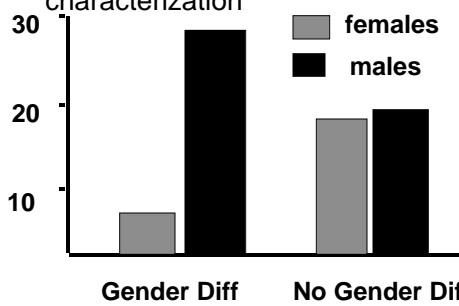
Stereotype Threat



when negative stereotypes about one's group are made salient, performance declines

Claude Steele

Mean performance on a difficult math task as a Function of Gender & Test characterization



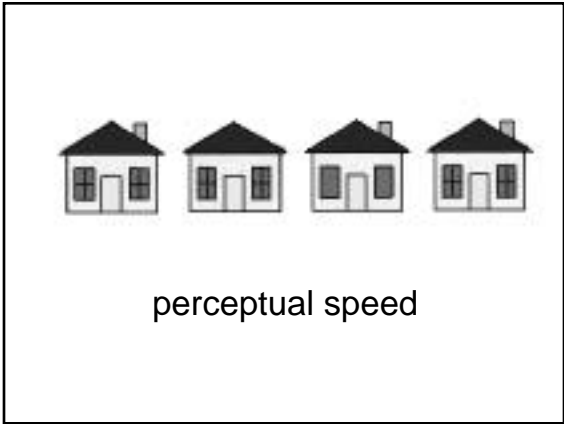
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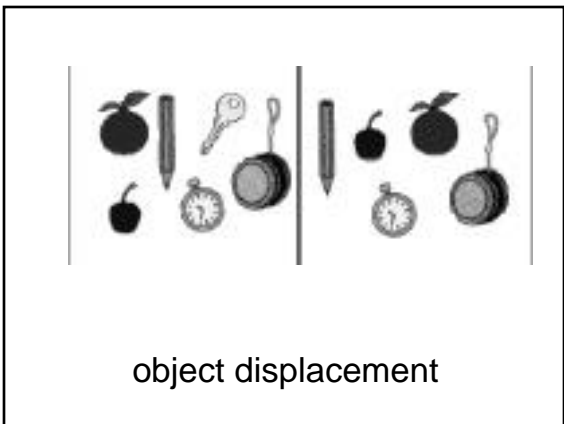
- biological and social factors that vary with gender is a legitimate focus of scientific study
- tell us what IS, not what OUGHT to be

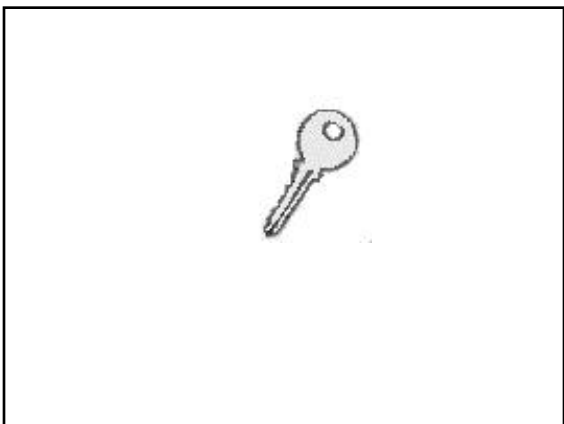
Math and Science Achievement

- elementary and middle school, no gender differences*
- *except at extremes
- by high school, males outperform females on standardized tests

tasks that favor females...







L _ _ _ _ _

Limp, Livery, Love, Laser,
Liquid, Low, Like, Lag, Live,
Lug, Light, Lift, Liver, Lime,
Leg, Load, Lap, Lucid...

Ideational fluency



precision tasks involving fine
motor coordination

$$14 \times 3 - 17 + 52$$

$$2(15 + 3) + 12 - 15/3$$

mathematical calculation

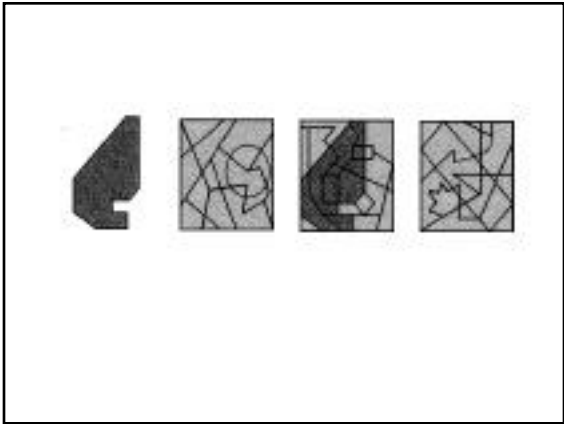
tasks that favor males...



target-directed motor skills

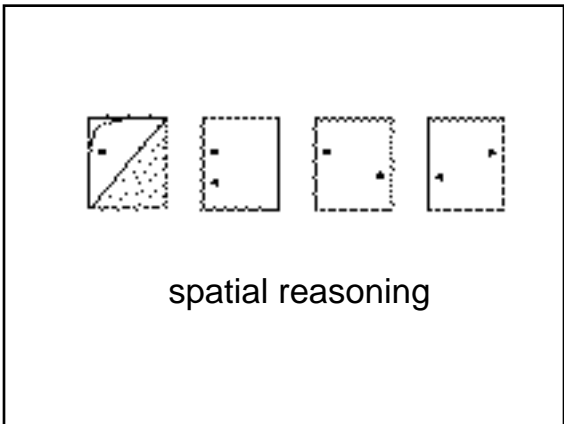


disembedding tasks

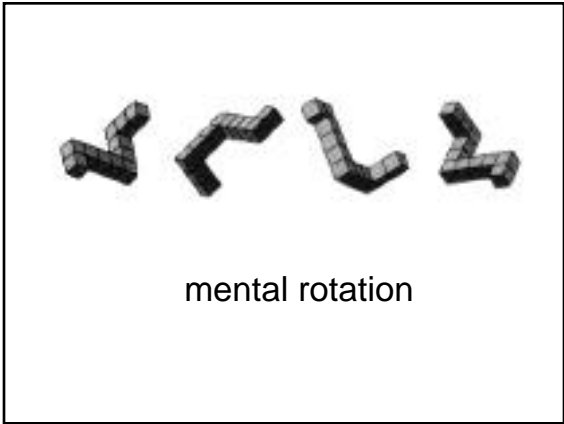


If only 60 percent of seedlings will survive, how many must be planted to obtain 660 trees?

mathematical reasoning



spatial reasoning



Explanations


- evolutionary psychology
- socialization
- genes, hormones, brains

Toys

“Math class is tough”

“I love dressing up”

“Do you want to braid my hair?”



Games

- baseball, football, etc.

Activities

- boys roam farther from home
- money

Values

- Burkam, et al, 1997
- 8th through 10th graders

"I have always associated chemistry and physics with boys, and I have always associated biology with girls. So when I thought of chemistry, I thought, well, boys mostly, so I just scored it out.

I don't see why a girl shouldn't be able to do chemistry and physics. I'd like to have carried on with them, but, as I said before, boys' subjects so I just dropped them".

(Burkam, et al, 1997, p. 303)

"I chose biology because it seemed to cover more areas of life, whereas chemistry and physics seems to be only pouring liquids, powders, and gases into test tubes which didn't really appeal to me. Biology, I thought...could be of help to me in the future...But I could not understand much reason to know whether one liquid was heavier than the other."

(Burkam, et al, 1997, p. 303)

Attributions

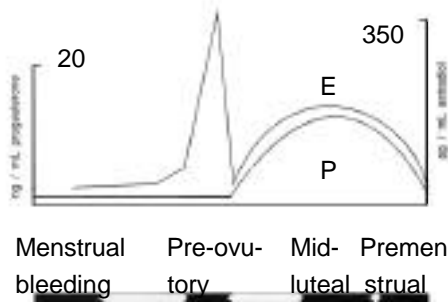
- Stipek & Gralinski, 1991
- 8- and 13-year-olds
- regularly scheduled math test

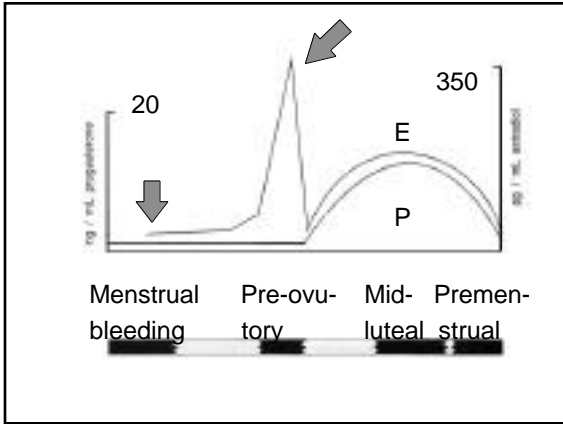
Attributions

- Girls
 - rated ability lower
 - expected to do less well
 - less likely to attribute success to ability
 - more likely to attribute failure to ability
 - more shame, less pride

Hormones

- Kimura & Hampson





Hormones

- when Estrogen high, females performed better on “female” tasks, less well on “spatial” (i.e, male)
- when Estrogen low, reverse

Hormones

- male undergrads with below ave testosterone perform better on spatial tasks than other males
- in northern hem., testosterone levels for males higher in fall. Therefore:
 - males should do better on spatial tasks in the spring

Conclusions

- as always, development involves an interaction between biology and environment
