

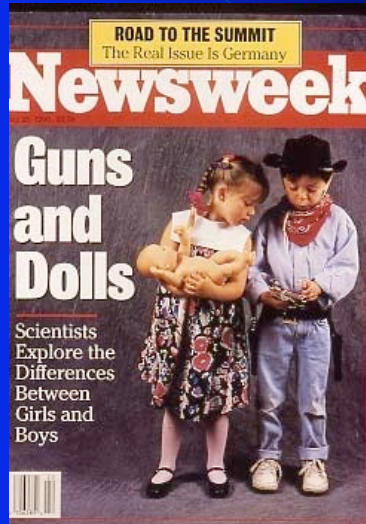
# The Gender Similarities Hypothesis: Implications for Mathematics and Science

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## Collaborators

- Verbal Ability
  - Marcia Linn
- Mathematics Performance
  - Elizabeth Fennema
- Self-Esteem
  - Kristen Kling, Carolin Showers, Brenda Buswell
- Moral Reasoning
  - Sara Jaffee
- Temperament
  - Nicole Else-Quest
- Special thanks to NSF for funding.

## The Differences Model

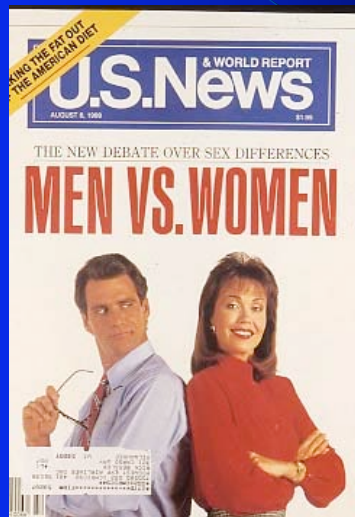


**MEN ARE  
FROM MARS,  
Women Are  
from Venus**

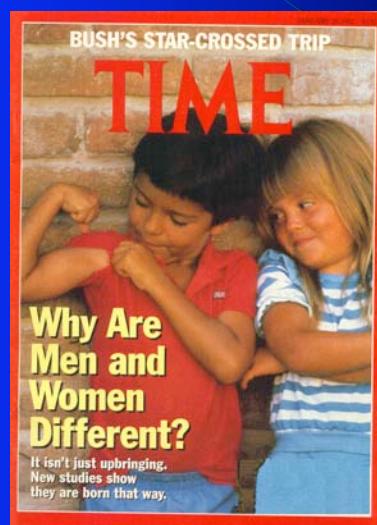
A Practical Guide for  
Improving Communication and  
Getting What You Want in Your Relationships

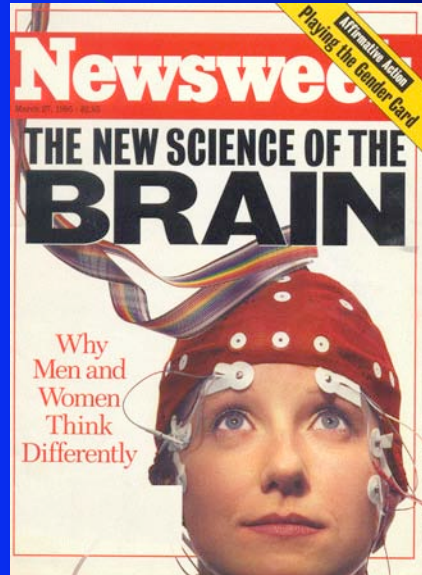
**JOHN GRAY, Ph.D.**

## The Oppositional Model

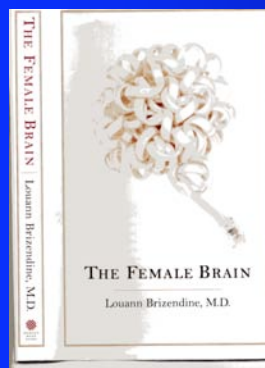


## Innate, Biological Causes





## Biological Causes



- “When you look a little deeper into the brain differences, they reveal what makes women women and men men.” (p. 2)
- “... decisions that are actually shaped by hormonal effects on the female brain compelling connection and communication.” (p. 8)

## The Deficit Model

- Harvard President Lawrence Summers, who claimed, in a controversial speech, that women do not have the ability to succeed in science and engineering (January, 2005)





## Meta-Analysis: A Method for Assessing Psychological Gender Differences

- A quantitative literature review
- A method for quantitatively combining the results of numerous studies on a given question

## Steps in a Meta-Analysis

- Locate all prior studies on the question
- Extract statistics from each study and compute an effect size,  $d$ , for each study
- Compute a weighted average  $d$ , averaged over all studies
- Test the set of effect sizes for homogeneity. If nonhomogeneous, conduct moderator analyses

## Effect Size

$$d = \frac{M_M - M_F}{S_w}$$

(Cohen)

## Cohen's Guidelines for Interpreting Effect Sizes

d = .20      small

d = .50      medium

d = .80      large



## Stereotypes of Gender Differences in Abilities

- Verbal
- Mathematical
- Spatial
- All are important for success in science

## Meta-Analysis of Gender Differences in Mathematics Performance

- 100 studies
- Testing of more than 3 million people

# Gender Differences in Math Performance

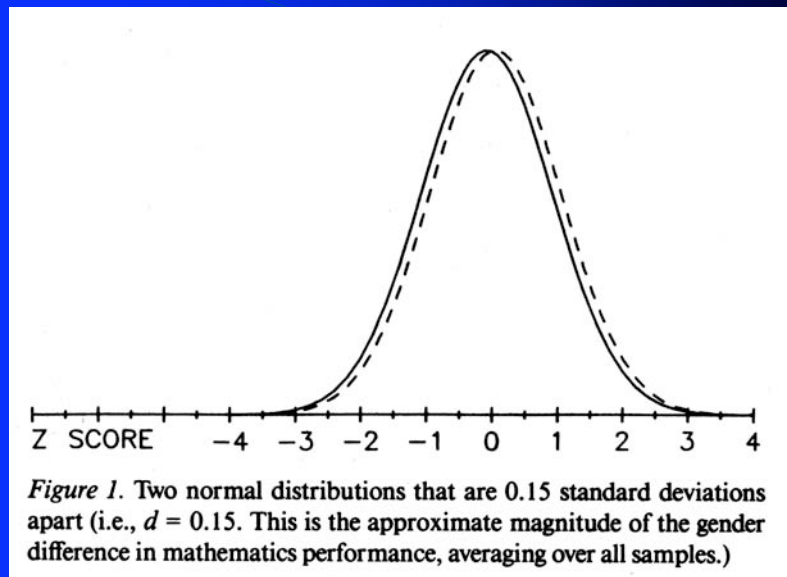
All Studies

$$d = +.15$$

Samples of the General Population

$$d = -.05$$

(Hyde, Fennema, & Lamon, *Psychological Bulletin*, 1990)



## Age x Cognitive Level

Age	Computation	Concepts	Problem Solving
5 – 10	-.20	-.02	0.00
11 – 14	-.22	-.06	-.02
15 – 18	0.0	+.07	+.29
19 - 25	NA	NA	+.32

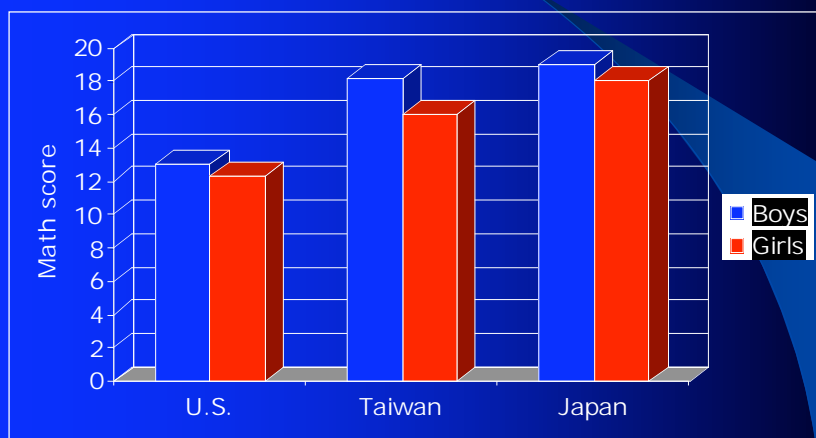
## Possible Reasons for the Gender Gap in High School

- Course choice (Eccles)
  - Mathematics
  - Science
- Stereotype threat (Steele)

## Ethnicity

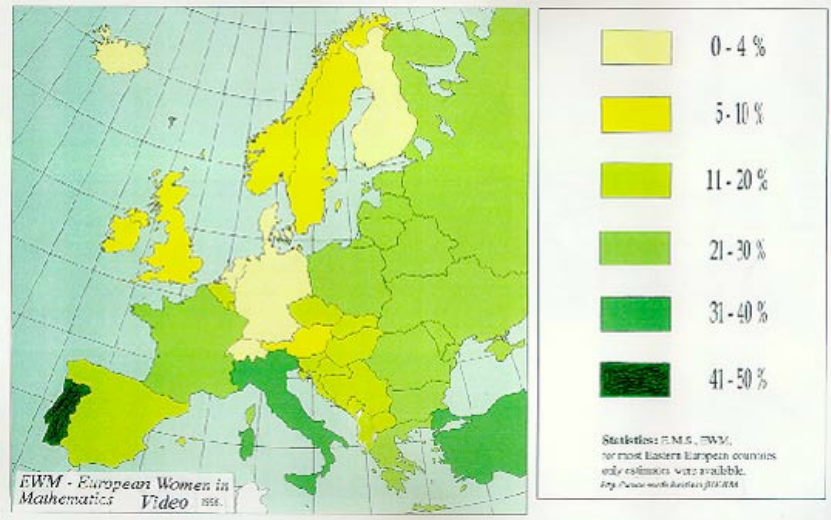
	d	No. of studies
African Americans	-.02	21
Hispanics	0.00	20
Asian Americans	-.09	4
Whites	+.13	13
Australians	+.11	7
Canadians	+.09	5
Mixed or unreported	+.15	184

## Cross-national Trends in Mathematics Performance



Lummis & Stevenson, 1990 5<sup>th</sup> graders, word problems

PERCENTAGE OF WOMEN AMONG TENURED MATHEMATICIANS AT UNIVERSITY LEVEL

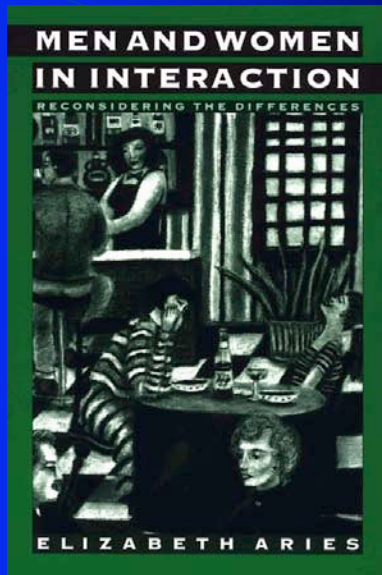
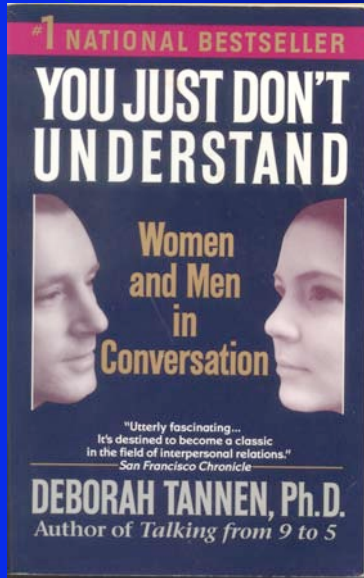


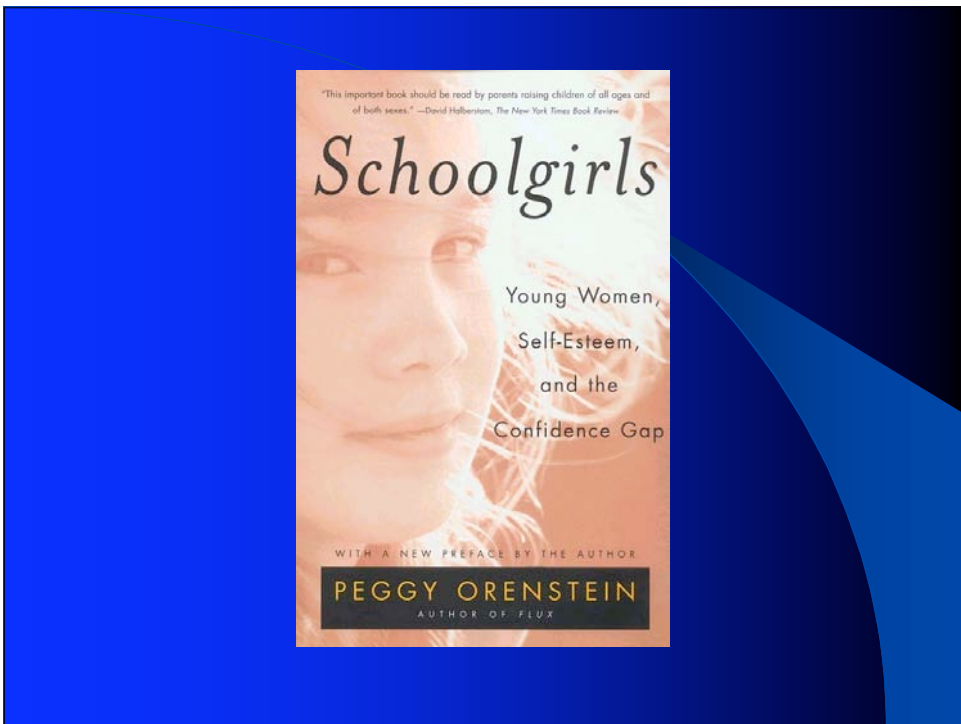
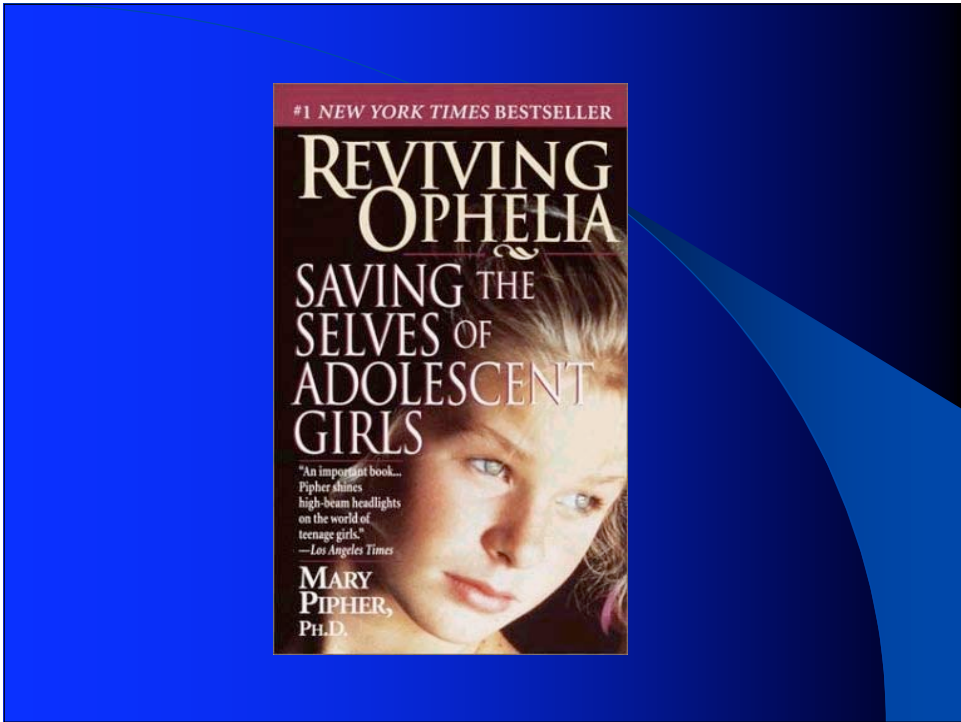
Source: [www.awis.org/resource/statistics/euromath.jpg](http://www.awis.org/resource/statistics/euromath.jpg)  
 Western Europe circa 1996

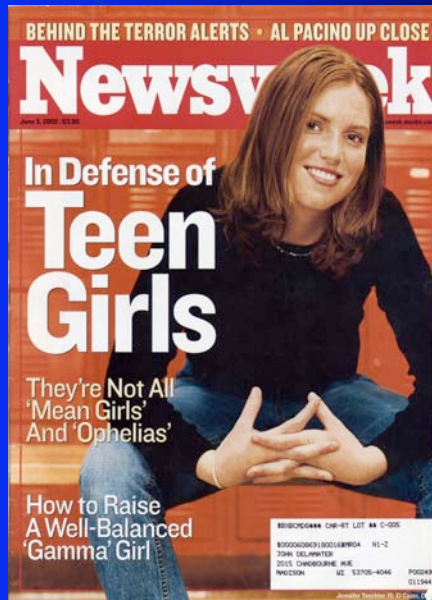
## Selectivity of Sample

Sample	d	Number of studies
General	-.05	184
Moderately selective	+.33	24
Highly selective	+.54	18
Precocious	+.41	15

Greater Male Variability Hypothesis  
 (Hedges & Nowell, *Science*, 1995)







## Gender Differences in Self-Esteem

$d = +.21$   
(from meta-analysis)

$d = +.04$  to  $+0.24$   
(from NCES data)

(Kling, Hyde, et al., *Psychological Bulletin*, 1999)



## Gender Differences in Self-Esteem

Age group	d	No. of studies
7-10	+.16	22
11-14	+.23	53
15-18	+.33	44
19-22	+.18	72
23-59	+.10	16
60 or older	-.03	6

## Gender Differences in Self-Esteem

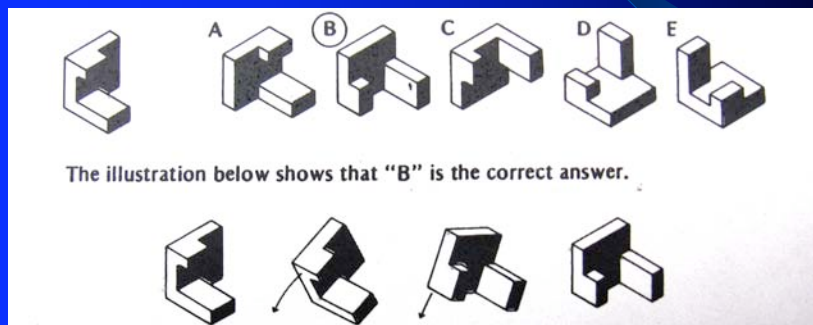
Ethnic Group	d	No. of Studies
Whites	+.20	52
Blacks	-.04	11

# Gender Differences in Spatial Ability

(Linn & Petersen, 1985)

	d
Spatial Perception	+.44
Spatial Visualization	+.13
3-dimensional Mental Rotation	+.73

## 3-Dimensional Mental Rotation



## Gender Differences in Verbal Ability

$$d = -.11$$

(Hyde & Linn, *Psychological Bulletin*, 1988)

## Verbal Ability

Analogies  $d = +.16$

Speech Production  $d = -.33$

## In Conclusion: The Gender Similarities Hypothesis

- The Gender Similarities Hypothesis
  - Men and women are very similar on most (not all) psychological variables.
- Surveyed all available meta-analyses of psychological gender differences
  - 46 meta-analyses
  - 124 effect sizes

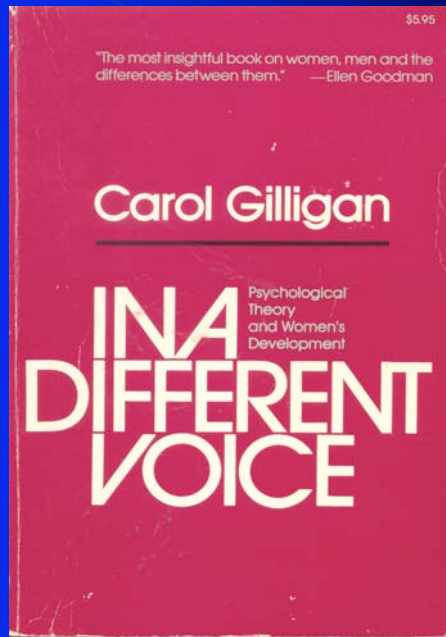
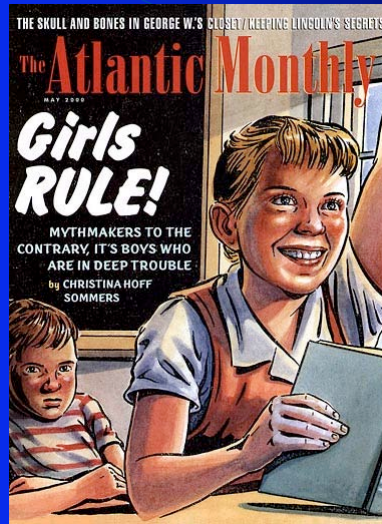
Hyde, *American Psychologist*, 2005

## Results: Synthesizing All Meta-Analyses

- 30% of d values near 0: 0 – 0.10
- 48% of d values near .20: 0.11 – 0.35
- **CONCLUSION:** Gender similarities are the rule!

## Costs to Overinflated Claims of Gender Differences

- Education
  - Single-sex classrooms or schools
- Workplace
  - How can we claim that women are vastly different from men, but can do the same jobs as men?



## Gender Differences in Moral Orientation

Care orientation:  $d = -.28$

Justice orientation:  $d = +.19$

(Jaffee & Hyde, *Psychological Bulletin*, 2000)

## Gender Differences in Temperament (Else-Quest, Hyde et al., 2006)

- What are the early, fundamental differences?
- Three different frameworks for assessing temperament

## Gender Differences in Temperament: Effortful Control

Attention	-0.23
Effortful control	-1.01
Inhibitory control	-0.41
Low intensity pleasure	-0.29
Perceptual sensitivity	-0.38

## Gender Differences in Temperament: Negative Affectivity

Emotionality	0.01
Anger	0.04
Pleasure	-0.09
Sadness	-0.10
Fear	-0.12



## Gender Differences in Temperament: Surgency

Activity	0.33
Shyness	-0.10
High intensity pleasure	0.30
Impulsivity	0.18
Smiling	0.01

## Other Cultures

- Case of Iceland
  - 15-year-old girls score ahead of boys on standardized international math test
  - The issue is effort



## Gender & Math: Trends over Time

- 1973 and earlier  $d = +.31$
- 1974 and later  $d = +.14$