Pink Brain, Blue Brain?

Neurobehavioral sex differences and implications for developing talent in STEM

May 23, 2013
1:00 pm (Eastern)
WEPAN 2012-2013 Webinar Series

- **Host: Diane Matt**, Executive Director, WEPAN, Women in Engineering ProActive Network

- **Speaker: Lise Eliot**, Associate Professor Neuroscience, Chicago Medical School of Rosalind Franklin University

- **Moderator: Shawna Fletcher**, Interim Director, Women in Engineering Program, The Ohio State University and WEPAN Professional Development Committee Chair
General Info and Q&A

• The webinar uses Voice Over Internet. If your sound quality is not good, a teleconference line is available:
  • Phone: +1 (951) 266-6131, Access Code: 701-934-490
  • Audio Pin: Check your screen once you dial in.

• Participant microphones are muted for quality.

• Undock, expand “Questions” pane in control panel.

• We will stop for questions at the end of the webinar. Presenter will stay on the line for an additional 10 minutes after the webinar. Please post your questions during the webinar.

• Stay with us if we are temporarily disconnected.

• Download PowerPoint and link to recorded webinar at www.wepan.org > Webinars.
WEPAN’s Core Purpose

• To propel higher education to increase the number and advance the prominence of diverse communities of women in engineering.
About WEPAN  www.wepan.org

• Core Values:
  Knowledge, Collaboration, Inclusion and Leadership

• 880 members from 200 engineering schools, corporations, government and non-profits

• Support WEPAN’s work! Join and make a donation at  www.wepan.org
Goal: Increase the number, scope and effectiveness of initiatives to advance women in engineering.

- **Catalogued and fully cited resources - 1,300+**
  Research, reports, data and statistics, agenda papers, bibliographies, best practices,
- **Online Professional Community**
  Network, collaborate, identify experts, share information
Engage Everyone: Building an Inclusive Climate for Diverse Communities for Women in STEM
June 19-22, 2013
Hyatt Regency Atlanta, Georgia

Join us for the ONLY national forum entirely focused on advancing diverse communities of women in engineering higher education.

Top 5 Reasons to Attend the WEPAN Conference

1. Meet other change agents and get inspired.
   Make new friends, identify potential partners and kick back and relax at the Newcomers and Showcase Receptions.

2. Learn strategies that translate directly to your work.
   Attend conference sessions, including panels, paper presentations, and workshops highlighting best practices and explore new programs, research and findings.

3. Empower yourself.
   Expand your skills at our Pre-Conference Workshops on Gender Competence and Creativity.

4. Share your challenges.
   Enjoy thematic Dinner Discussions at local restaurant favorites.

5. Get the latest on building gender-inclusive cultures with practical, research-based strategies.
   Joint Women in Engineering Division of the American Society for Engineering Education and WEPAN Symposium on Saturday, June 22nd

Register online by May 31st to save! Visit www.wepan.org
Pink Brain, Blue Brain?

Neurobehavioral sex differences and implications for developing talent in STEM

May 23, 2013
1:00 pm (Eastern)
The popular zeitgeist...
Bad neuroscience on CBS Early Show

The Gender Similarities Hypothesis

Janet Shibley Hyde
University of Wisconsin—Madison

September 2005 • American Psychologist
Copyright 2005 by the American Psychological Association 0003-066X/05/$12.00
Vol. 60, No. 6, 581–592 DOI: 10.1037/0003-066X.60.6.581

Height

“Empathy”

# of cases

# of cases

\[ d = 2.6 \]

\[ d = 0.35 \]
Sex differences in behavior are real, but much subtler than Mars/Venus stereotypes and largely acquired through learning.

There is no such thing as a “male brain,” or a “female brain.” Brain sex differences are small and statistical, not large & categorical.

A better understanding of how sex differences develop is crucial for helping raise both boys’ and girls’ achievement.
SEX DIFFERENCES (AND SIMILARITIES) IN THE BRAIN
Sex differences in the brain

- Psychological differences tell us there must be differences in brain structure or function.
- But small magnitude of behavioral differences makes it hard to identify reliable brain differences in humans.
- In rodents, differences are most dramatic in areas of the brain involved in reproduction itself.
Hypothalamus

- The preoptic area (POA) is important in reproduction.
- In rats, perinatal testosterone expands the male SDN-POA by 5X.
- The human homologue, INAH-3, is 2X larger in men.
Prenatal T (organizational phase) affects toy preference, sexual orientation, activity level. By contrast, post-pubertal hormones (activational phase) have negligible effects on cognition or emotion (menstrual fluctuations; WHI; transsexuals; delayed puberty)
Females’ brains are smaller and finish growing earlier

But sex differences in specific structures are “minute” when corrected for overall brain size.
“Men tend to use only one brain hemisphere at a time, but women employ ‘whole brain’ thinking.”

www.girlslearndifferently.com
Wrong: Both men and women are left dominant

(Study of resting brain activity, Liu et al., n =300)


- Found a “weak population-level sex difference in hemispheric specialization” for auditory, visual, tactile & dual-task assays, accounting for 1-2 percent of variance.

- Similar findings in meta-analysis by Voyer (1996): 0.1% of variance.
Is language processing more lateralized in men?
“NO” according to meta-analysis

No difference in planum temporale asymmetry
Sommer et al. (2008)
Also, no difference in corpus callosum

Small difference in adult connectivity

(Biswal et al.)

- Resting fMRI activity from 1,414 participants, 35 sites.
- However, a similar study of 238 adolescents found no sex difference in functional connectivity (Dosenbach et al., Science, 329:1358-61, 2010).
**Brain Fallacy**

- Just because a sex difference in the brain is “biological” does not mean it is “hardwired.”

- Consider this experiment: Brain activation in two different subjects while performing the same self-judgment task.

- Gender learning is at least as potent as other cultural experience in shaping brain function.

Mental rotation

- Stronger in males, from infancy onward, but difference widens through childhood.
- The one imaging study of children found no difference between boys and girls, using same MR task that revealed a difference between adults: Kucian et al. (2007) *J. Neural Transmission*, 114: 675-686.
THE NURTURE SIDE
How the brain grows up

- **Nature** (genes & hormones) and **Nurture** (environment & experience) inextricably interwoven from the first cell division.

- Neuroscientists use the term “**plasticity**” to describe the Nurture effect. Works according to 2 “**activity-dependent**” rules:
  - “Cells that fire together, wire together.”
  - “Use it or lose it.”

- **Synaptic plasticity** is far more potent in childhood than later life.
Girl culture, boy culture & plasticity

- The different ways in which boys and girls are socialized and spend their time wires up their brains differently.

- “Boy play” promotes risk-taking and visual-spatial skills, while “girl play” promotes relational and literacy skills.
Social gender learning

- Family, peers, teachers & larger culture shape children’s gender aspirations
- Such influences have been linked to:
  - Toy preference
  - Mental rotation
  - Math performance
  - Verbal ability
  - Risk-taking
  - Physical aggression
  - Emotional expression
Cards from a British designer
**Parental expectations**

- Mothers of girls underestimated the slope their infants would crawl down, but mothers of boys were accurate.
- There was no difference in the actual slope boys and girls descended.
Toys ‘R Us
In 1981, LEGOs were for girls too
but today’s girls get “girly” LEGOs
Gendered crayons
Pink crappy science toys
Teacher bias

- Teachers’ expectations shape student outcomes, known as the “Pygmalion effect” and their implicit biases about gender are the same as everyone’s.

- Girls are especially vulnerable to female teacher’s math anxiety (Beilock et al., PNAS, 107:1860-63, 2010).

- “Boys learn differently. They need hands-on activities and motor breaks” (6th grade teacher quote, Portland Press Herald, 9/9/11)

- “Girls generally work well with others and talking about a concept with a peer can help them understand it... Social skills seem to come naturally to them.” (3rd grade teacher, Daytona Beach News Journal, 9/15/11)
“Women’s current underrepresentation in math-intensive fields is not caused by discrimination in these domains, but rather to sex differences in resources, abilities, and choices (whether free or constrained). Thus, current initiatives direct energy toward solving past problems rather than current ones.”
Most of us are biased

Let’s move beyond denial, own up to our prejudices against women and retrain our brains to overcome them, says Jennifer Raymond.
Implicit Association Test

In the next task, you will be presented with a set of words or images to classify into groups. This task requires that you classify items as quickly as you can while making as few mistakes as possible. Going too slow or making too many mistakes will result in an uninterpretable score. This part of the study will take about 5 minutes. The following is a list of category labels and the items that belong to each of those categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Man, Boy, Father, Male, Grandpa, Husband, Son, Uncle</td>
</tr>
<tr>
<td>Female</td>
<td>Girl, Female, Aunt, Daughter, Wife, Woman, Mother, Grandma</td>
</tr>
<tr>
<td>Science</td>
<td>Biology, Physics, Chemistry, Math, Geology, Astronomy, Engineering</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>Philosophy, Humanities, Arts, Literature, English, Music, History</td>
</tr>
</tbody>
</table>

Keep in mind

- Keep your index fingers on the 'e' and 'i' keys to enable rapid response.
- Two labels at the top will tell you which words or images go with each key.
- Each word or image has a correct classification. Most of these are easy.
- Sort items by their category membership. Words in green should be categorized with the green labels. Words in white should be categorized with the white labels.
- The test gives no results if you go slow -- Please try to go as fast as possible.
- Expect to make a few mistakes because of going fast. That's OK.
- For best results, make sure that your monitor is set to maximum brightness and avoid distractions.

I am ready to begin
IAT: Results

Percent of web respondents with each score:

- Strong automatic association of Male with Career and Female with Family: 24%
- Moderate automatic association of Male with Career and Female with Family: 32%
- Slight automatic association of Male with Career and Female with Family: 20%
- Little to no automatic preference between gender and family or career: 17%
- Slight automatic association of Male with Family and Female with Career: 4%
- Moderate automatic association of Male with Family and Female with Career: 2%
- Strong automatic association of Male with Family and Female with Career: 0.3%

Click for detailed summary.
National differences in gender–science stereotypes predict national sex differences in science and math achievement

“The math–gender stereotype is acquired early and influences emerging math self-concepts prior to ages at which there are actual differences in math achievement.”

Are Leader Stereotypes Masculine?  
A Meta-Analysis of Three Research Paradigms

Anne M. Koenig  
University of San Diego

Abigail A. Mitchell  
Nebraska Wesleyan University

Alice H. Eagly  
Northwestern University

Tiina Ristikari  
University of Tampere

This meta-analysis examined the extent to which stereotypes of leaders are culturally masculine. The primary studies fit into 1 of 3 paradigms: (a) In Schein’s (1973) think manager–think male paradigm, 40 studies with 51 effect sizes compared the similarity of male and leader stereotypes and the similarity of female and leader stereotypes; (b) in Powell and Butterfield’s (1979) agency–communion paradigm, 22 studies with 47 effect sizes compared stereotypes of leaders’ agency and communion; and (c) in Shinar’s (1975) masculinity–femininity paradigm, 7 studies with 101 effect sizes represented stereotypes of leadership-related occupations on a single masculinity–femininity dimension. Analyses implemented appropriate random and mixed effects models. All 3 paradigms demonstrated overall masculinity of leader stereotypes: (a) In the think manager–think male paradigm, intraclass correlation = .25 for the women–leaders similarity and intraclass correlation = .62 for the men–leaders similarity; (b) in the agency–communion paradigm, \( g = 1.55 \), indicating greater agency than communion; and (c) in the masculinity–femininity paradigm, \( g = 0.92 \), indicating greater masculinity than the androgynous scale midpoint. Subgroup and meta-regression analyses indicated that this masculine construal of leadership has decreased over time and was greater for male than female research participants. In addition, stereotypes portrayed leaders as less masculine in educational organizations than in other domains and in moderate- than in high-status leader roles. This article considers the relation of these findings to Eagly and Karau’s (2002) role congruity theory, which proposed contextual influences on the incongruity between stereotypes of women and leaders. The implications for prejudice against women leaders are also considered.
What to do

- Teach spatial skills & computer programming early.
- Train students in “Growth Mindset.”
- Foster positive risk-taking & competition.
- Evaluate teachers for gender bias.
- Discourage gender segregation and encourage gender interaction in classroom settings: respect, collaboration & mutual leadership.
- Teach “Math = Money” and salary negotiation: Kate Farrar, 23-Apr-13 WEPAN webinar
Teach spatial skills (from pre-K to college)!!

Table 11. Engineering retention rates for subjects

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th></th>
<th></th>
<th>Males</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EG1</td>
<td>CG1</td>
<td>EG1</td>
<td>CG1</td>
<td>EG2</td>
<td>CG2</td>
</tr>
<tr>
<td>Enrolled</td>
<td>13</td>
<td>40</td>
<td>11</td>
<td>32</td>
<td>85</td>
<td>200</td>
</tr>
<tr>
<td>Retained in Engineering</td>
<td>9</td>
<td>25</td>
<td>7</td>
<td>17</td>
<td>52</td>
<td>104</td>
</tr>
<tr>
<td>Engineering retention rate (%)</td>
<td>69.2</td>
<td>62.5</td>
<td>63.6</td>
<td>53.1</td>
<td>61.2</td>
<td>52.0</td>
</tr>
</tbody>
</table>

randomized sample

Asking Questions and Discussion

- Participant microphones are muted for webinar quality.
- Undock and expand the “Questions” pane in the webinar control panel and type in your question.
- If time permits, “live” questions may be asked at end of webinar.
Questions & Discussion

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Thank You for Attending
We Hope You Enjoyed the Webinar!

• Links to the PowerPoint and recorded webinar will be posted at [www.wepan.org](http://www.wepan.org) > Webinars

• Share with your colleagues!

• Survey following the webinar—please respond!

• Support WEPAN—make a donation at [www.wepan.org](http://www.wepan.org) > Donate

• Pay a personal tribute to someone who has made a difference to women in engineering

• Thank you for attending today!