Gender Bias in Scientific Review

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NIH Director’s Pioneer Awards

• First NIH Roadmap initiative to be rolled out
• Intended to accelerate innovative research unsupported through traditional NIH funding mechanisms
• $500,000/yr for 5 years
• Drew from all institutes
• New protocol for submission and review
• None of 9 awarded first round were women
• 6/14 second round (43%); 4/13 third round (31%) were women
Potential Pool of Women Applicants

Women earn:

- 45% PhD’s in biological sciences
- 20% HHMI awards
- 50% MacArthur genius awards
- 25% of R01 applicants
- 23% of all NIH grants
Qx: Is it statistically likely that all 9 would go to male scientists?

Binomial probability test

Pool of potential applicants = 23% ♀

Phase 1 (N=1300) = 20% ♀, $P < .001$

Phase 2 (N=240) = 13% ♀, $P < .01$

Finalists (N=21) = 10% ♀, NS

Awardees (N=9) = 0 ♀, NS

Ans: Probably not
If nine people are selected from a population of equally eligible individuals in which 25% are female what is the probability of 0, 1, 2, 3, 4 or more women being chosen?

Number of women selected out of nine

% probability

0 5 10 15 20 25 30

0 1 2 3 4 or more

75%

% probability
## NIH Director’s Pioneer Awards

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%♀</td>
<td>N</td>
</tr>
<tr>
<td>Phase 1</td>
<td>1300</td>
<td>20</td>
<td>840</td>
</tr>
<tr>
<td>Phase 2</td>
<td>240</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Interview</td>
<td>21</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Final selection</td>
<td>9</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

**Probability of occurring in a population of 25% women**

- 2004: 7%
- 2005: 7%
- 2006: 21%
Questions

1. Were there any differences in the solicitation and review processes between the two rounds?

2. If so,
   - Would research on gender and evaluation predict a preferential bias toward the selection of men in 2004?
   - Would the changes made in 2005 and beyond be predicted to mitigate this bias?
“Are you just pissing and moaning, or can you verify what you’re saying with data?”
Research on Gender and Evaluation Relevant to Process

- Time pressure and high cognitive demand
- Impact of face-to-face review committee meeting
- Semantic priming
- Focus on intrinsic leadership abilities combined with ambiguous performance criteria
- Proportion of women in applicant pool
- Proportion of women on the review panel
- Social tuning
Background: Gender and Behavior

DESCRIPTIVE: How men and women actually behave
PRESCRIPTIVE: Subconscious assumptions about the way men and women in the abstract “ought” to behave:

- **Women**: Nurturing, communal, nice, supportive, helpful, sympathetic
- **Men**: Decisive, inventive, strong, forceful, independent, “willing to take risks”

RELEVANT POINTS:

- **Leaders (also scientists and pioneers)**: Decisive, inventive, strong, independent
- **Social penalties** for violating prescriptive gender assumptions
- **Unconscious gender stereotypes** are easily and automatically activated
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• Social tuning
Time pressure and high cognitive load enhance activation of automatic gender stereotypes

- 202 undergrads (77 male, 125 female)
- Subjects randomly assigned to 1 of 8 experimental conditions (2x2x2 factorial):
  - Male or female version of police officer’s performance
  - Hi or low attentional demands (concurrent task demand and time pressure)
  - Hi or low memory demand

Ratings:
- Competence, job performance, potential for advancement, likely future success → work performance scale
- Adjective scales of gender-related attributes (e.g. dominant-submissive, strong-weak) → composite score

• No effect of evaluator sex
• No impact of memory demand on evaluation
• Low attentional demand:
  – Men and women comparable
• High attentional demand:
  – Work performance
    • Men higher than women
    • Women same
    • Men higher than men under low attentional demand
  – Gender-related characteristics
    • Men more stereotypically masculine
    • Women same

Conclusions

• When multi-tasking and pressed for time, evaluation defaults to prescriptive gender assumptions

• In evaluation for a male assumed job, these cognitive “short cuts” increase the likelihood that
  – Men’s evaluations will be inaccurately better

• Removing such pressures increases the likelihood that all applicants will receive a fair evaluation of the actual work performed

Corollary: Increasing the fairness of such a process, will decrease the current advantage afforded men
Was there a difference in time pressure and cognitive load between 2004 and subsequent rounds?

Very likely; especially in the first level of winnowing
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Swedish Postdoc study

• 114 applications for prestigious research postdocs to Swedish MRC (52 women)
• Reviewers’ scores vs standardized metric from publication record = impact points
• Women consistently reviewed lower, especially in “competence”
• Women had to be 2.5x as productive as men to get the same score
• To even the score, women needed equivalent of 3 extra papers in a prestigious journal like Science or Nature
“Friendship bonus”

- Multivariate models to test contribution of the following on competency ratings:
  - Gender
  - Productivity
  - Nationality (Swedish vs non-Swedish)
  - Field of education (e.g. Medicine, Nursing)
  - Scientific field
  - University affiliation
  - Committee to which application was assigned
  - Postdoc abroad
  - Presence of a letter of recommendation
  - Affiliation with a member of the committee (who themselves could not score) (12-13% for men and women)

- Three had influence: gender, productivity, affiliation
  - Being male worth 64 (CI: 35-93) impact points
  - Committee member affiliation worth 67 (CI: 29-105) impact points

- Being female and not knowing someone on the committee – needed 131 additional impact points

Was there a difference in face to face meeting between 2004 and subsequent rounds?

No, does not appear to have been different
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Semantic priming activates unconscious gender stereotypes

• Unrelated exercise: unjumble sentences where actions reflect dependent, aggressive or neutral behaviors; e.g.:
  – P alone cannot manage a
  – M at shouts others of
  – R read book by the

• “Reading comprehension” experiment with Donna or Donald engaging in dependent or aggressive behaviors

• Rated target on series of traits (Likert, 1-10)

Gender of target determined influence of semantic priming:
- Neutral primes – Donna and Donald same
- Dependent primes – only Donna more dependent
- Aggressive primes – only Donald more aggressive
<table>
<thead>
<tr>
<th>2004</th>
<th>2005, 06</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristics of target scientist and research</strong></td>
<td><strong>Emphasis on risk removed:</strong></td>
</tr>
<tr>
<td><strong>Risk-taking emphasized:</strong></td>
<td><strong>Emphasis on risk removed:</strong></td>
</tr>
<tr>
<td>• “exceptional minds willing and able to explore ideas that were considered risky”</td>
<td>• “pioneering approaches”</td>
</tr>
<tr>
<td>• “take…risks”</td>
<td>• “potential to produce an unusually high impact”</td>
</tr>
<tr>
<td>• “aggressive risk-taking”</td>
<td>• “ideas that have the potential for high impact”</td>
</tr>
<tr>
<td>• “high risk/high impact research”</td>
<td>• “highly innovative”</td>
</tr>
<tr>
<td>• “take intellectual risks”</td>
<td>• URL no longer includes “risk”</td>
</tr>
<tr>
<td>• URL includes “highrisk”</td>
<td></td>
</tr>
<tr>
<td><strong>Description of recommendations from outside consultants</strong></td>
<td><strong>Mention of technological breakthroughs removed; human health added:</strong></td>
</tr>
<tr>
<td><strong>Technological advances highlighted as desirable:</strong></td>
<td>• “encourage highly innovative biomedical research with great potential to lead to significant advances in human health.”</td>
</tr>
<tr>
<td>• “support the people and projects that will produce tomorrow’s conceptual and technological breakthroughs”</td>
<td></td>
</tr>
</tbody>
</table>
Was there a difference in semantic priming between 2004 and later rounds?

Yes
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Unconscious bias in review: Evaluation of Leadership/Competence

Prescriptive Gender Norms

• Men
  – Strong
  – Decisive
  – Assertive
  – Tough
  – Authoritative
  – Independent

“Leader”

• Women
  – Nurturing
  – Communal
  – Nice
  – Supportive
  – Helpful
  – Sympathetic
Ambiguous performance criteria in traditionally male jobs favors evaluation of men: “glass escalator”

- 48 subjects (20 men)
- Job description: Assist VP; products made suggested male (e.g. engine parts, fuel tanks). Male and female rated in two conditions:
  - Performance clear
  - Performance ambiguous

Achievement-related Characteristics:
- Unambitious - ambitious
- Passive - active
- Indecisive - decisive
- Weak - strong
- Gentle - tough
- Timid - bold
- Unassertive - assertive

Interpersonal Hostility:
- Abrasive - not abrasive
- Conniving - not conniving
- Manipulative - not manipulative
- Not trustworthy - trustworthy
- Selfish - not selfish
- Pushy - accommodating

Competence Score:
- Competent - incompetent
- Productive - unproductive
- Effective - ineffective

Likeability:
- Likeable - not likeable
  How much do you think you would like to work with this person?
  Very much - not at all

Comparative Judgment:
- Who is more likeable?
- Who is more competent?
Results

- Performance clear
  - Competence comparable
  - Achievement-related characteristics comparable
  - Women less liked
  - Women more hostile
- Performance ambiguous
  - Likeability and hostility comparable
  - Men more competent
  - Men more achievement-related characteristics
Prejudice favoring male leaders is strong

- Subjects: German students and faculty
- Task:
  - read short description of person;
  - shown photograph (pre-tested masculine or feminine)
  - Rate 5 leadership abilities (exper 1)
  - Confidence in remembering traits in story (exper 2)
- Masculine appearing individuals (even among men):
  - More competent leaders
  - Greater false recognition of leadership competence
  - Independent of likeability

Evaluation criteria

<table>
<thead>
<tr>
<th>2004</th>
<th>2005, 06</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrinsic qualities stressed:</strong></td>
<td><strong>Focus on intrinsic abilities removed:</strong></td>
</tr>
<tr>
<td>• “Potential for scientific leadership”</td>
<td>• “Relevance of the research and impact on the scientific field and on the NIH mission”</td>
</tr>
<tr>
<td>• “Testimony of <em>intrinsic</em> motivation, enthusiasm, and intellectual energy”</td>
<td>• “Motivation/enthusiasm/intellectual energy to pursue a challenging problem.”</td>
</tr>
<tr>
<td>• Reviewers told to look at potential for future work</td>
<td>• Reviewers encouraged to look at accomplishments as evidence</td>
</tr>
</tbody>
</table>
Were evaluators told to rate applicants on intrinsic leadership qualities in 2004 but not in subsequent rounds?

Yes

Were evaluation criteria more ambiguous in 2004 vs later rounds?

Yes
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Proportion of women in applicant pool

  - Tokens exaggerate differences and activate stereotypes

  - Focal woman applicant evaluated out of group of 8
  - When women ≤ 25% rated less qualified, less likely to hire, less potential for advancement
  - When women ≤ 25% applicant more stereotypical female traits and this accounted for lower ratings
Were there differences in the proportion of women in the applicant pools between 2004 and later?

<table>
<thead>
<tr>
<th>Year</th>
<th>Women in Pools</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>20%, 13%, 10%</td>
</tr>
<tr>
<td>2005</td>
<td>26%, 35%, 43%</td>
</tr>
<tr>
<td>2006</td>
<td>26%, 28%, 31%</td>
</tr>
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</table>
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The power of numbers in influencing hiring decisions.
Yoder et al. Gender and Society 3:269-76, 1989

• Examined hiring of academic psychologists across the country (N = 93 acad positions)
• In depts with < 25% women, men more likely to be hired
• In depts with 36-65% women, men and women equally likely to be hired
Was there a difference in the proportion of women on the review committee between 2004 and later rounds?

Yes

4/64 (6%) vs. 28/64 (44%) vs. 32/79 (40%)
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Social influence effects on automatic racial prejudice.

• Series of experiments measuring automatic prejudice
• Significant interaction of results with race of experimenter (less anti-black prejudice with black experimenter)
• When given instruction to avoid prejudice, further reduction in anti-black automatic prejudice
<table>
<thead>
<tr>
<th>2004</th>
<th>2005, 06</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Encouragement to specific groups of scientist to apply</strong></td>
<td><strong>Addition of encouragement to apply:</strong></td>
</tr>
<tr>
<td>No specific encouragement for women and members of underrepresented groups to apply.</td>
<td>“Those at early to middle stages of their careers, and women and members of groups underrepresented in biomedical research are especially encouraged to nominate themselves.”</td>
</tr>
</tbody>
</table>
Was social tuning to reduce gender bias more likely to be present in later rounds vs 2004?

Yes
<table>
<thead>
<tr>
<th>Feature of process</th>
<th>Predict preferential selection of men</th>
<th>Present in 2004</th>
<th>Present in 2005, 06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time pressure/no meeting</td>
<td>Yes</td>
<td>Yes</td>
<td>Less</td>
</tr>
<tr>
<td>Semantic priming in RFA</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Intrinsic leadership + ambiguous criteria</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Women &lt;25% applicant pool</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Women &lt; 25% of reviewers</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Social tuning</td>
<td>No</td>
<td>No</td>
<td>Likely</td>
</tr>
</tbody>
</table>

No. women/total awards (%)

|                              | 0/9 (0)                               | 6/14 (43);      | 4/13 (31)           |
Conclusions

• Even the most objective scientist is susceptible activation and application of unconscious gender stereotypes
• It appears bias in evaluation can be mitigated
• We applaud NIH for evidence-based approach
• We encourage others in similar self-study