FIELDS ARRANGED BY PURITY

Sociology is just applied psychology.
Psychology is just applied biology.
Biology is just applied chemistry.
Which is just applied physics. It's nice to be on top.
Oh, hey, I didn't see you guys all the way over there.

Sociologists  Psychologists  Biologists  Chemists  Physicists  Mathematicians
Is Psychological Science a STEM Discipline?

Field Attributes

and

Researcher Characteristics
Introduction

• The recognized importance of the STEM disciplines (NSF/NRC):
  – Science
  – Technology
  – Engineering
  – Mathematics
Introduction

• Where does psychology fit in?
• Is psychology a science?
• If so, what kind of science?
• How can we address these questions?
• Can we provide scientific answers?
Introduction

• Two approaches to a scientific answer:
  – Use objective and quantified variables to compare the *field* of psychology with other fields both scientific and non-scientific
  – Use objective and quantified variables to compare the *researchers* in the field of psychology with the researchers in other fields both scientific and non-scientific

• I start with the first approach …
Field Attributes

• Raw scores from the following data sources:
  – Cole (1983): disciplinary consensus and citation immediacy (5 measures)
  – McDowell (1982): obsolescence rate
  – Suls & Fletcher (1983): consultation rate
  – Smith et al. (2000): graph prominence
  – Schachter et al. (1991): lecture disfluency
  – Smith et al. (2000): rated “hardness”
  – Ashar & Shapiro (1990): paradigmatic development

• Transformed into $z$ scores ($M = 0$, $SD = 1$)
Consensus on Evaluating Scientists (Cole, 1983):

- Physics: 1.5
- Chemistry: 0.3
- Biochemistry: -0.1
- Psychology: -0.7
- Sociology: -1.0

Note: Higher score indicates higher peer-evaluation consensus; here and throughout red arrows indicate gaps ≥ 0.5 SD
Consensus on Which Scientists Have Contributed the Most in Past Two Decades (Cole, 1983):

- Physics • 1.5
- Biochemistry • 0.5
- Sociology! • -0.3
- Chemistry • -0.7
- Psychology • -1.0

Note: Higher scores indicate higher peer-evaluation consensus
Concentration of Citations to Research Articles (Cole, 1983):

- Physics
- **Psychology**!
- Chemistry!
- Mathematics!
- Sociology

- 0.9
- 0.4
- 0.2
- -1.1

Note: Higher scores indicate higher citation concentration; here and throughout **red brackets** indicate gaps ≤ 0.1 SD
Citation Immediacy Effects (Cole, 1983):

- Biochemistry
- Chemistry
- **Psychology!**
- Geology
- Physics
- Mathematics!

- 1.4
- 0.5
- 0.3
- -0.2
- -0.6
- -1.5

*Note: Higher scores indicate greater citation immediacy*
Proportion of Scientists under 35 Whose Work Received More than the Mean Number of Citations for their Field (Cole, 1983):

- Geology: 1.5
- Chemistry: 0.6
- Physics: 0.2
- Psychology: 0.1
- Sociology: -1.0
- Mathematics: -1.2

Note: Higher scores indicate that younger scientists are cited more
Relative Costs of Interrupted Careers (McDowell, 1982):

- Physics • 1.5
- Chemistry • 0.8
- Sociology! • 0.2
- Psychology • 0.1
- Biology! • -0.2
- History • -1.1
- English • -1.3

Note: Higher scores indicate faster rates of knowledge obsolescence (based on 1-year disruption in productivity)
Mean Number of Acknowledgements (Suls & Fletcher, 1983):

- Chemistry
- Physics
- **Psychology**
- Sociology

- 0.8
- 0.7
- -0.2
- -1.3

Note: Higher scores indicate *lower* collegial consultation.
Graph Prominence (Cleveland, 1984; Smith et al., 2000):

- Chemistry: 1.3
- Physics: 1.1
- Biology: 0.5
- Medicine: 0.1
- **Psychology**: -0.3
- Economics: -1.0
- Sociology: -1.3

Note: Higher scores indicate higher graph prominence.
Theories-to-Laws Ratios of Textbooks (Roeckelein, 1997):

- Physics: 1.1
- Chemistry: 0.9
- Biology: 0.1
- Anthropology: 0.0
- **Psychology**: -0.4
- Sociology: -1.7

Note: Higher scores indicate *lower* ratio of theories to laws.
Uhs per Minute During Lectures (Schachter et al., 1991):

- Biology: 1.0
- Mathematics: 0.9
- Chemistry: 0.73
- Philosophy: 0.72
- **Psychology**: 0.6
- Economics: 0.3
- Sociology: -0.3
- Political science: -1.1
- Art history: -1.3
- English: -1.6

Note: Higher score indicates lower speech disfluency
Rated Disciplinary Hardness (Smith et al., 2000)

- Physics  
- Chemistry  
- Biology  
- Medicine  
- **Psychology**  
- Economics  
- Sociology

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>1.2</td>
</tr>
<tr>
<td>Chemistry</td>
<td>0.9</td>
</tr>
<tr>
<td>Biology</td>
<td>0.5</td>
</tr>
<tr>
<td>Medicine</td>
<td>0.1</td>
</tr>
<tr>
<td>Psychology</td>
<td>-0.3</td>
</tr>
<tr>
<td>Economics</td>
<td>-0.8</td>
</tr>
<tr>
<td>Sociology</td>
<td>-1.6</td>
</tr>
</tbody>
</table>

Note: Higher scores indicate higher rated hardness
Ashar & Shapiro (1990)

• Indicators of paradigm development:
  – “(1) The average length in words of dissertation abstracts in each field, computed from a random sample of twenty-five dissertation abstracts per field”
  – “(2) The average length in pages of dissertations in each field, computed from a random sample of twenty-five dissertations per field”
  – “(3) the length of chain of prerequisite courses in each field taken from the University Catalogue” (UoW)
• First two are inverse indicators (reverse scored)
Score on Paradigm Development (Ashar & Shapiro, 1990):

- Astronomy
- Physics
- Chemistry
- Biology
- Mathematics
- **Psychology**
- Economics
- Sociology
- Philosophy
- Anthropology
- Political science

- 1.7
- 1.4
- 1.30
- 1.33
- 1.2
- 0.8
- 0.2
- -0.4
- -0.8
- -0.9
- -1.2

**Notes:** Higher scores indicate higher paradigm development
Field Attributes:
Conclusions

• Psychology’s exact placement varies according to the criterion applied
• Yet psychology generally seems closer to the natural sciences than to the human sciences
• This proximity was indicated earlier by Simonton (2004) using a 7-composite indicator derived from a subset of the previous measures:
Researcher Characteristics

- Development
- Disposition
Researcher Characteristics

Development
Developmental Variables

- Father’s occupation
- Birth order
- Education
Roe (1952, 1953): 64 Eminent Scientists

• Sample
  – Three categories:
    • 22 physicists (theoretical and experimental)
    • 20 biologists
    • 22 social scientists:
      – 8 anthropologists
      – 14 psychologists: The latter include
% Professional Fathers (Roe, 1952, 1953)

<table>
<thead>
<tr>
<th>Field</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical physicists</td>
<td>84%</td>
</tr>
<tr>
<td>Experimental physicists</td>
<td>50%</td>
</tr>
<tr>
<td>Psychologists</td>
<td>50%</td>
</tr>
<tr>
<td>Biologists</td>
<td>45%</td>
</tr>
<tr>
<td>Anthropologists</td>
<td>38%</td>
</tr>
</tbody>
</table>
Birth order  
(Roe, 1953)

<table>
<thead>
<tr>
<th>Position</th>
<th>Psych</th>
<th>Anthro</th>
<th>Phys/Chem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43%</td>
<td>62%</td>
<td>67%</td>
</tr>
<tr>
<td>2</td>
<td>21%</td>
<td>25%</td>
<td>18%</td>
</tr>
<tr>
<td>3</td>
<td>14%</td>
<td>0</td>
<td>2%</td>
</tr>
<tr>
<td>4</td>
<td>21%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>13%</td>
<td>2%</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>5%</td>
</tr>
</tbody>
</table>
See also …

- Eminent scientists more likely firstborns (Chambers, 1964; Clark & Rice, 1984; Eiduson, 1962; Galton, 1874; cf. Feist, 1993),
- Eminent literary creators more likely laterborns (Bliss, 1970; Clark & Rice, 1984; cf. Schubert, Wagner, & Schubert, 1977)
- Eminent psychologists are more likely firstborns (Gupta, Gilbert & Pierce, 1983; Helmreich et al., 1980; Simonton, 2008; Terry, 1989), and the
- Preponderance increases with eminence and with gender (Chambers, 1964; Helson & Crutchfield, 1970; Simonton, 2008)
Education (Roe, 1952, 1953): Age at Bachelors / Doctorate

- Physical scientists: 20.9 / 24.6
- Psychologists: 21.4 / 25.8
- Biologists: 21.8 / 26.0
- Anthropologists: 22.1 / 28.6
Researcher Characteristics

Disposition
Disposition

- Intelligence
- Personality
Roe (1952, 1953): 64 Eminent Scientists

• Measures
  – Intelligence: verbal, spatial, and mathematical
    • devised by Educational Testing Service
    • converted to IQs in Simonton (2002, Table 6.3)
Roe (1952): 64 Eminent Scientists
- Verbal Intelligence

- Theoretical physicists: 168 (158-177)
- Anthropologists: 165 (150-175)
- Psychologists: 163 (133-176)
- Biologists: 162 (138-176)
- Experimental physicists: 154 (121-174)
Roe (1952): 64 Eminent Scientists - Spatial Intelligence

- Theoretical physicists • 149 (149-161)
- Psychologists • 141 (127-161)
- Experimental physicists • 141 (123-161)
- Biologists • 137 (123-164)
- Anthropologists • 135 (123-151)
Roe (1952): 64 Eminent Scientists  
- Mathematical Intelligence

- Biologists
- Psychologists
- Anthropologists

165 (133-194)  
162 (139-194)  
142 (128-154)

N.B.: Theoretical and experimental physicists did not take test
Cattell & Devdahl (1955): 144 Eminent Scientists

- Sample: Eminent researchers
  - 46 Physicists
  - 46 Biologists
  - 52 Psychologists

- Measure: 16 PF
<table>
<thead>
<tr>
<th>Personality Dimension Label at Lower Pole</th>
<th>Mean Sten</th>
<th>Plotted Mean Sten Scores</th>
<th>Personality Dimension Label at Upper Pole</th>
</tr>
</thead>
<tbody>
<tr>
<td>A – Schizothymia</td>
<td>3.36</td>
<td></td>
<td>Cyclothymia</td>
</tr>
<tr>
<td>B – Low intelligence</td>
<td>7.64</td>
<td></td>
<td>High intelligence</td>
</tr>
<tr>
<td>C – Low ego strength</td>
<td>5.44</td>
<td></td>
<td>High ego strength</td>
</tr>
<tr>
<td>E – Low dominance</td>
<td>6.62</td>
<td></td>
<td>High dominance</td>
</tr>
<tr>
<td>F – Desurgency</td>
<td>3.15</td>
<td></td>
<td>Surgency</td>
</tr>
<tr>
<td>G – Low group superego</td>
<td>4.10</td>
<td></td>
<td>High group superego</td>
</tr>
<tr>
<td>H – Threctia</td>
<td>6.01</td>
<td></td>
<td>Parmia</td>
</tr>
<tr>
<td>I – Harria</td>
<td>7.05</td>
<td></td>
<td>Premsia</td>
</tr>
<tr>
<td>L – Low protension</td>
<td>5.36</td>
<td></td>
<td>High protension</td>
</tr>
<tr>
<td>M – Praxernia</td>
<td>5.36</td>
<td></td>
<td>Autia</td>
</tr>
<tr>
<td>N – Simplicity</td>
<td>5.50</td>
<td></td>
<td>Shrewdness</td>
</tr>
<tr>
<td>O – Low guilt proneness</td>
<td>4.38</td>
<td></td>
<td>High guilt proneness</td>
</tr>
<tr>
<td>Q&lt;sub&gt;1&lt;/sub&gt; – Conservatism</td>
<td>7.00</td>
<td></td>
<td>Radicalism</td>
</tr>
<tr>
<td>Q&lt;sub&gt;2&lt;/sub&gt; – Low self-sufficiency</td>
<td>7.52</td>
<td></td>
<td>High self-sufficiency</td>
</tr>
<tr>
<td>Q&lt;sub&gt;3&lt;/sub&gt; – Low self-sentiment</td>
<td>6.44</td>
<td></td>
<td>High self-sentiment</td>
</tr>
<tr>
<td>Q&lt;sub&gt;4&lt;/sub&gt; – Low ergic tension</td>
<td>4.91</td>
<td></td>
<td>High ergic tension</td>
</tr>
</tbody>
</table>
Cattell & Devdahl (1955): 144 Eminent Scientists

- Psychologists higher in dominance (E), surgency (F), and social boldness (H; Parmia)
- Cattell’s (1963) conclusion: “the psychologists, I regret to say, [are] more dominant and less desurgent. Possibly this greater surgency accounts for the fact that on the whole psychologists have talked more and progressed less than, say, physicists!” (p. 126)
- Alternative interpretation: “things” versus “persons” orientation (cf. Galton, 1874)
Chambers (1964): 225 Chemists/213 Psychologists

- **Measures**
  - Cattell 16 PF Questionnaire:
    - E: Dominance versus Submission
    - F: Enthusiasm and Cheerfulness versus Seriousness and Introspectiveness
    - H (Adventurousness versus Timidity)
    - M (Creativity versus Conventional Outlook)
    - \( Q_2 \) (Self-Suficiency versus Group Dependency)
  - Initiative measure, Ghiseli’s Self-Description Inventory
  - Security-Insecurity Inventory
  - Biographical Inventory
Chambers (1964): 225 Chemists/213 Psychologists

• Results:
  – Mostly non-significant differences
  – Exceptions:
    • “Psychologists more Bohemian, introverted, unconventional, imaginative and creative in thinking and behavior” (M)
    • “Psychologists more socially oriented”
    • “Psychologists more rebellious against parents”
  – Moreover, highly eminent scientists in both disciplines tended to be highly similar
Feist et al. (in progress)

• Sample: US full-time tenured or tenure-track researchers at research universities
  – $\leq 44$ in Psychology
  – $\leq 104$ in Physics/Chemistry

• Measures:
  – Big Five Inventory
  – EPQ (Eysenck Personality Questionnaire)
  – O-LIFE-Schizotypy Test
  – Autism Spectrum Quotient
Factor

Score

BFIA

BFIC

BFIE

BFIN

BFIO

PHYSCHEM

PSYCHOLOGY
Two General Conclusions

• First, as a field, psychological science often compares favorably with STEM disciplines;
  – Overall, psychology’s placement is closer to the biological sciences than to the social sciences, such as sociology, political science, and even economics
  – This affinity likely reflects psychology’s genuine ties with biology, most notably, via evolutionary theory, genetics, and the neurosciences
Two General Conclusions

• Second, as *researchers*, psychologists compare favorably with scientists in STEM disciplines regarding both developmental and dispositional variables

• i.e., both are “cut from the same cloth” (with the things-vs-people proviso)

• Hence, …
Which? This? Or ... 

**STEMness**

Fields arranged by purity

Sociology is just applied psychology

Psychology is just applied biology.

Biology is just applied chemistry.

Which is just applied physics. It's nice to be on top.

Oh, hey, I didn't see you guys all the way over there.

Sociologists  Psychologists  Biologists  Chemists  Physicists  Mathematicians
STEMness

FIELDS ARRANGED BY MORE PURE

Sociology is just applied psychology.
Psychology is just applied biology.
Biology is just applied chemistry.
Which is just applied physics. It's nice to be on top.
Oh, hey, I didn't see you guys all the way over there.

Sociologists Psychologists Biologists Chemists Physicists Mathematicians