

FIELDS ARRANGED BY PURITY

→
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

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
 - Roeckelein (1997): theories/laws ratio
 - 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

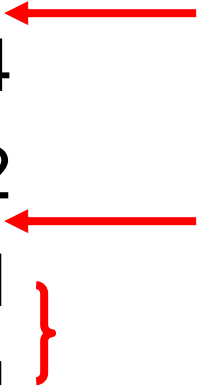
Note: Higher score indicates higher peer-evaluation consensus;
here and throughout **red arrows** indicate gaps ≥ 0.5 *SD*

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 • 0.9
 - **Psychology!** • 0.4
 - Chemistry! • 0.2
 - Mathematics! • -1.1
 - Sociology • -1.1
- 

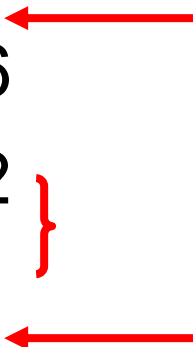
Note: Higher scores indicate higher citation concentration;
here and throughout **red brackets** indicate gaps ≤ 0.1 *SD*

Citation Immediacy Effects (Cole, 1983):

- Biochemistry • 1.4
- Chemistry • 0.5
- **Psychology!** • 0.3
- Geology • -0.2
- Physics • -0.6
- Mathematics! • -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 | • 0.8 |
| • Physics | • 0.7 |
| • Psychology | • -0.2 |
| • Sociology | • -1.3 |
- 

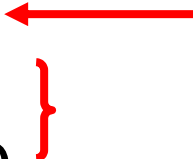

Note: Higher scores indicate *lower* collegial consultation

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 • 1.2
- Chemistry • 0.9
- Biology • 0.5
- Medicine • 0.1
- **Psychology** • -0.3
- Economics • -0.8
- Sociology • -1.6



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	• 1.7
• Physics	• 1.4
• Chemistry	• 1.30
• Biology	• 1.33
• Mathematics	• 1.2
• Psychology	• 0.8
• Economics	• 0.2
• Sociology	• -0.4
• Philosophy	• -0.8
• Anthropology	• -0.9
• Political science	• -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:

Composite score

1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
-1.1

1 2 3 4 5

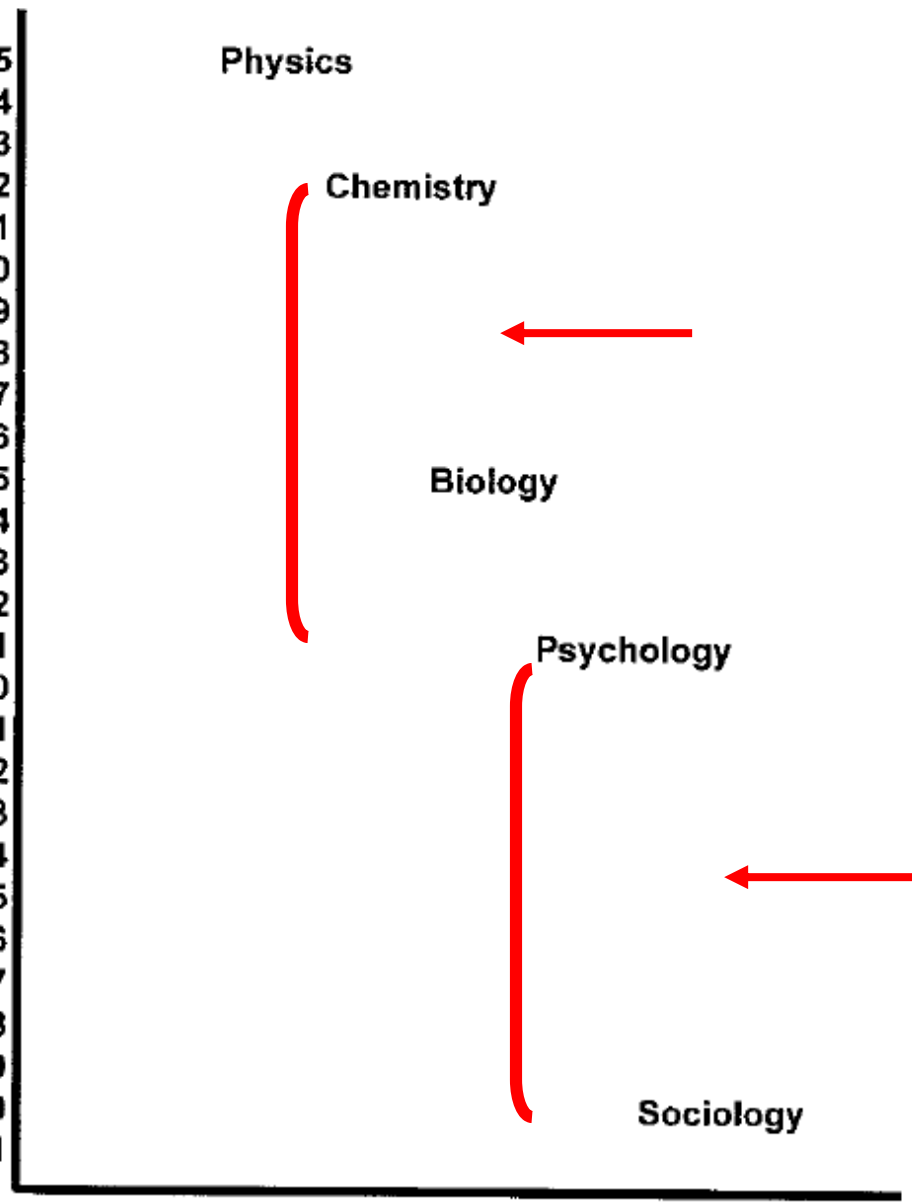
Physics

Chemistry

Biology

Psychology

Sociology



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
 - Gordon Allport, Jerome Bruner, J.P. Guilford, Harry Harlow, Ernest Hilgard, Karl Lashley, Carl Rogers, Robert Sears, B. F. Skinner, and S. S. Stevens

% Professional Fathers (Roe, 1952, 1953)

- Theoretical physicists • 84%

- Experimental physicists • 50%
- Psychologists • 50%
- Biologists • 45%
- Anthropologists • 38%

Birth order (Roe, 1953)

Position	Psych	Anthro	Phys/Chem
1	43%	62%	67%
2	21%	25%	18%
3	14%	0	2%
4	21%	0	0
5	0	0	5%
6	0	13%	2%
7	0	0	5%

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
 - Anthropologists
 - Psychologists
 - Biologists
 - Experimental physicists
- 168 (158-177)
 - 165 (150-175)
 - 163 (133-176)
 - 162 (138-176)
 - 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

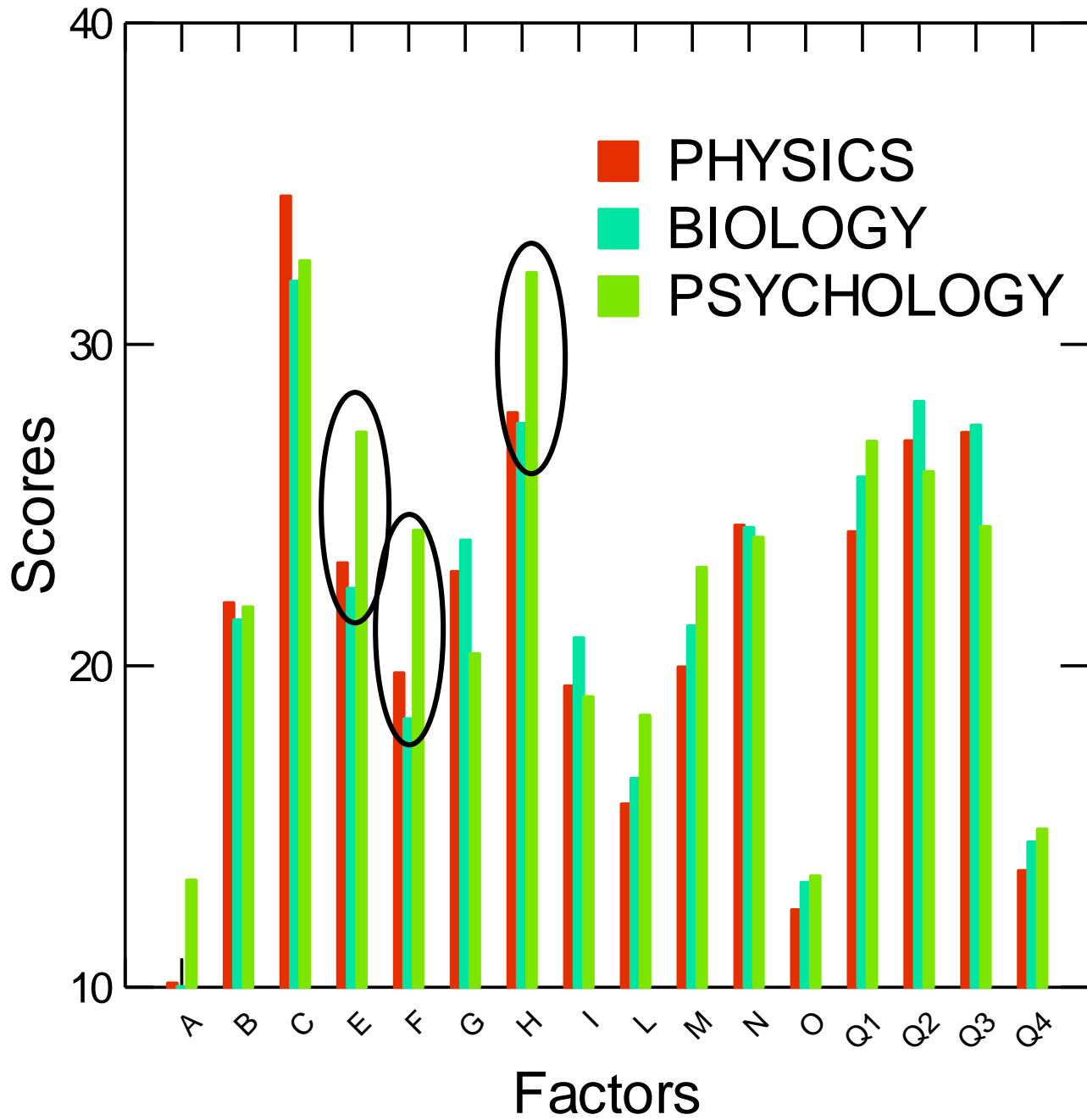
Cattell & Devdahl (1955): 144 Eminent Scientists

- Sample: Eminent researchers
 - 46 Physicists
 - 46 Biologists
 - 52 Psychologists
- Measure: 16 PF

TABLE I

Mean 16 Personality Factor Profile of Eminent Researchers ($N = 140$)
in Physics, Biology, and Psychology

Personality Dimension Label at Lower Pole	Mean Stens	Plotted Mean Sten Scores										Personality Dimension Label at Upper Pole	
		1	2	3	4	5	6	7	8	9	10		
A- Schizothymia	3.36	.	.	.	.	.	.	.	.	.	.	Cyclothymia	A+
B- Low intelligence	7.64	.	.	.	.	.	.	.	.	.	.	High intelligence	B+
C- Low ego strength	5.44	.	.	.	.	.	.	.	.	.	.	High ego strength	C+
E- Low dominance	6.62	.	.	.	.	.	.	.	.	.	.	High dominance	E+
F- Desurgency	3.15	.	.	.	.	.	.	.	.	.	.	Surgency	F+
G- Low group superego	4.10	.	.	.	.	.	.	.	.	.	.	High group superego	G+
H- Threctia	6.01	.	.	.	.	.	.	.	.	.	.	Parmia	H+
I- Harria	7.05	.	.	.	.	.	.	.	.	.	.	Premsia	I+
L- Low protension	5.36	.	.	.	.	.	.	.	.	.	.	High protension	L+
M- Praxernia	5.36	.	.	.	.	.	.	.	.	.	.	Autia	M+
N- Simplicity	5.50	.	.	.	.	.	.	.	.	.	.	Shrewdness	N+
O- Low guilt proneness	4.38	.	.	.	.	.	.	.	.	.	.	High guilt proneness	O+
Q ₁ - Conservatism	7.00	.	.	.	.	.	.	.	.	.	.	Radicalism	Q ₁ +
Q ₂ - Low self-sufficiency	7.52	.	.	.	.	.	.	.	.	.	.	High self-sufficiency	Q ₂ +
Q ₃ - Low self-sentiment	6.44	.	.	.	.	.	.	.	.	.	.	High self-sentiment	Q ₃ +
Q ₄ - Low ergic tension	4.91	.	.	.	.	.	.	.	.	.	.	High ergic tension	Q ₄ +



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

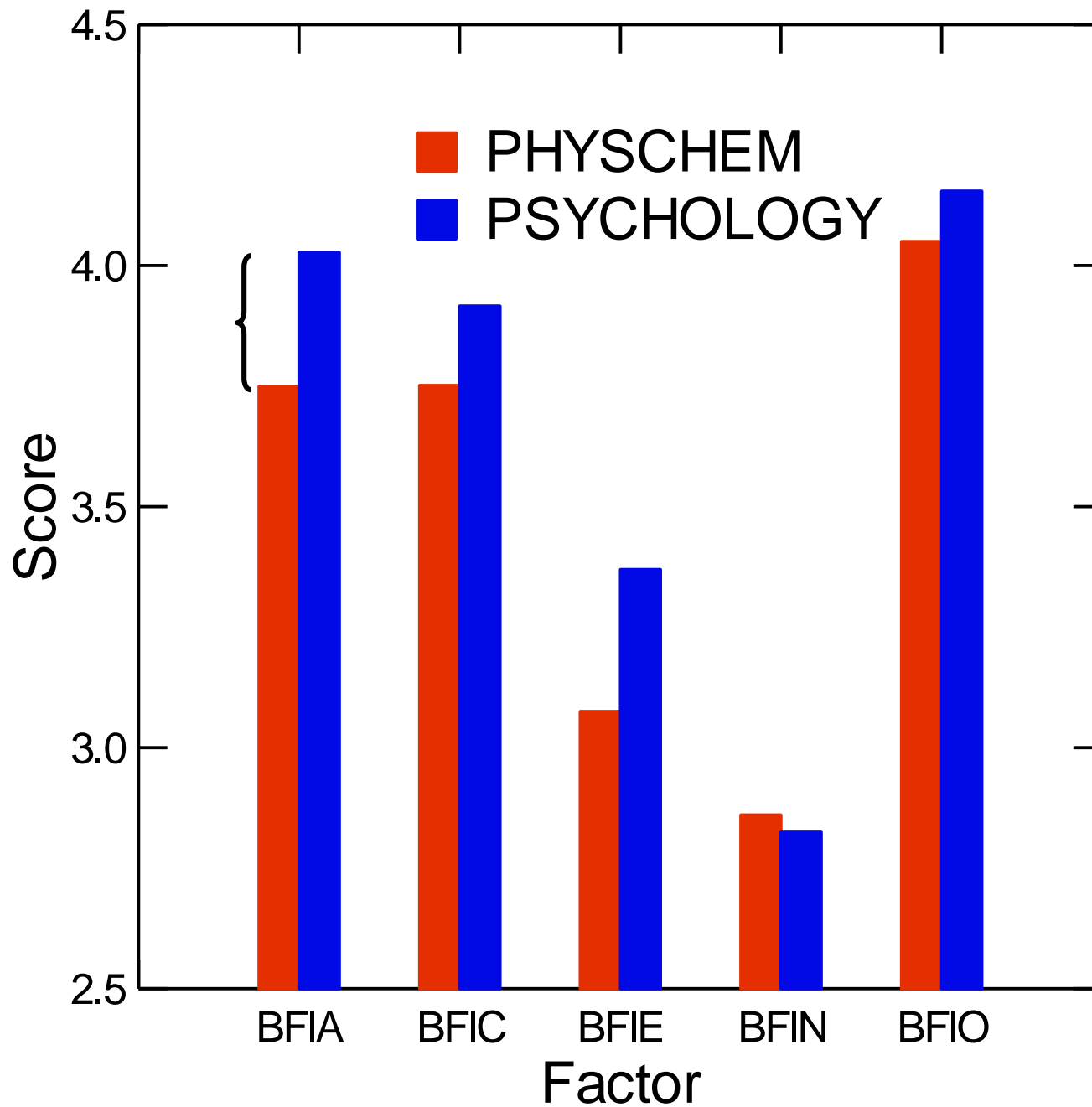
- Measures
 - Cattell 16 PF Questionnaire:
 - E: Dominance versus Submission
 - F: Enthusiasm and Cheerfulness versus Seriousness and Introspectiveness)
 - H (Adventurousness versus Timidity)
 - M (Creativity versus Conventional Outlook)
 - Q₂ (Self-Sufficiency versus Group Dependency)
 - Initiative measure, Ghiseli's Self-Description Inventory
 - Security-Insecurity Inventory
 - Biographical Inventory

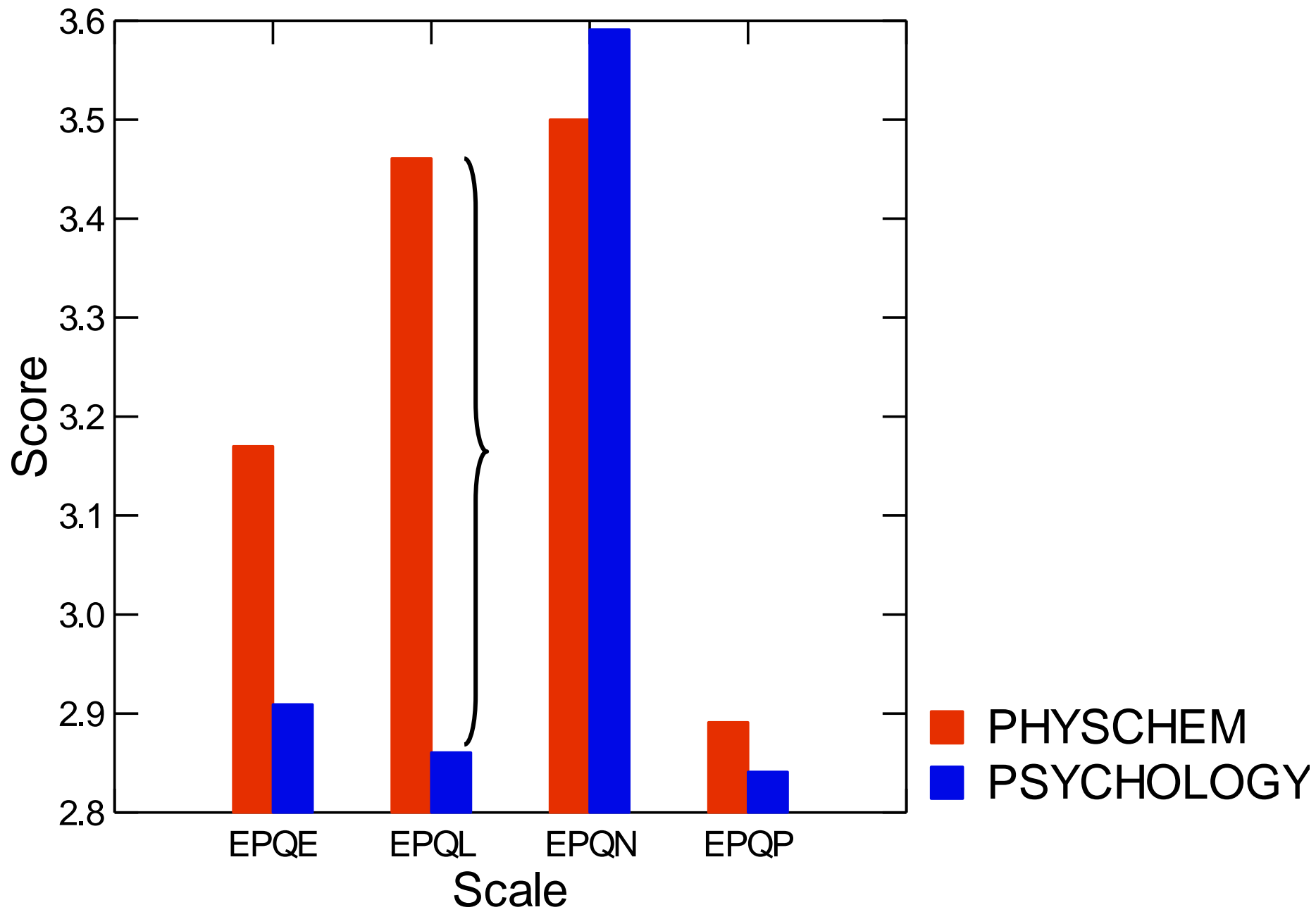
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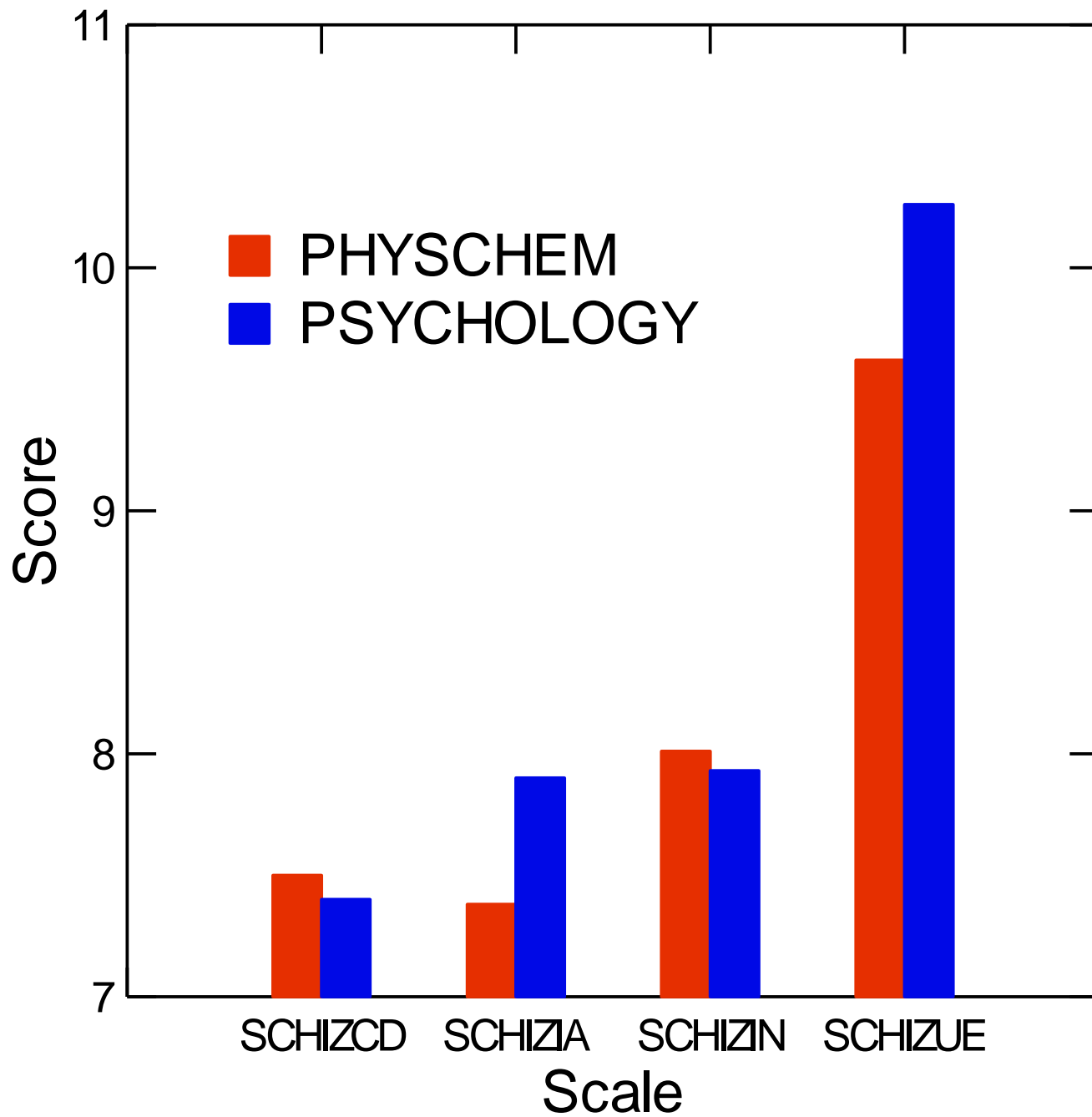
- Results:
 - Mostly non-significant differences
 - Exceptions:
 - “Psychologists more Bohemian, introverted, unconventional, imaginative and creative in thinking and behavior” (M)
 - “Psychologists more socially oriented”
 - “Psychologists more rebellious against parents”
 - Moreover, highly eminent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

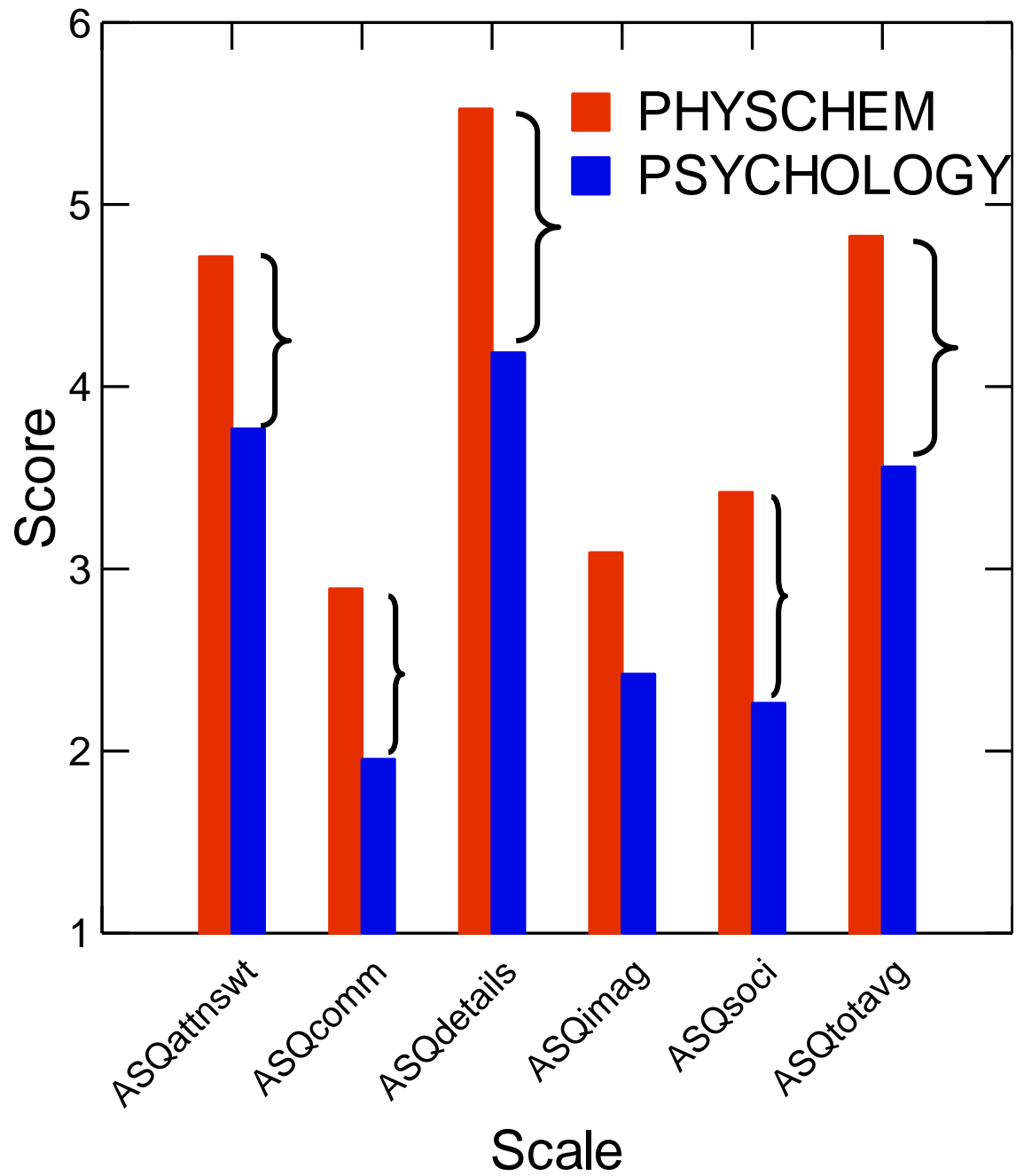
Feist et al. (in progress)

- Sample: US full-time tenured or tenure-track researchers at research universities
 - ≤ 44 in Psychology
 - ≤ 104 in Physics/Chemistry
- Measures:
 - Big Five Inventory
 - EPQ (Eysenck Personality Questionnaire)
 - O-LIFE-Schizotypy Test
 - Autism Spectrum Quotient









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 the things-vs-people proviso)
- Hence, ...

Which? This? Or ...

STEMness

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→ MORE PURE

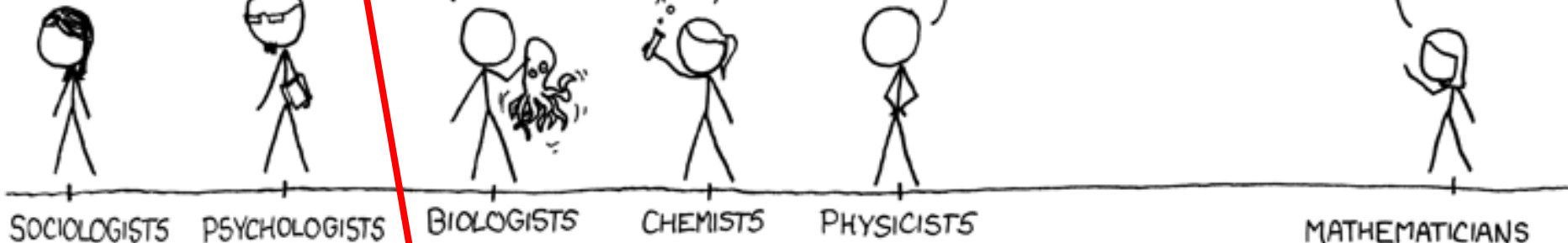
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This?

STEMness

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