Hard Evidence on Soft Skills

James J. Heckman
University of Chicago

Robert J. Lampman Memorial Lecture
Fluno Center, Howard Auditorium
UW-Madison Campus
May 16, 2012
4:00-5:30 p.m.
This draft, May 15, 2012
I. What can economists take from and contribute to personality psychology?
II. Psychological Measurement Systems
Hierarchical Scheme of General Intelligence (g) and Its Components

Gf (Fluid Intelligence)
- Sequential Reasoning
- Inductive Reasoning
- Quantitative Reasoning
- Piagetian Reasoning

Gc (Crystallized Intelligence)
- Verbal Comprehension
- Lexical Knowledge
- Reading Comprehension
- Reading Speed
- "Cloze"
- Spelling
- Phonetic Coding
- Grammatical Sensitivity
- Foreign Language
- Communication
- Listening
- Oral Production
- Oral Style
- Writing

Visual Perception
- Visualization
- Spatial Relations
- Closure Speed
- Closure Flexibility
- Serial Perceptual Integration
- Spatial Scanning
- Imagery

Closure
- Closure Speed
- Closure Flexibility

Perceptual Speed
- Number Computation
- RT and other Elementary Cognitive Tasks
- Stroop
- Clerical Speed
- Digit/Symbol

Learning and Memory
- Memory Span
- Associative Memory
- Free Recall Memory
- Meaningful Memory
- Visual Memory

Ideational Fluency
- Ideational Fluency
- Naming Facility
- Expressional Fluency
- Word Fluency
- Creativity
- Figural Fluency
- Figural Flexibility

Knowledge and Achievement
- General School Achievement
- Verbal Information and Knowledge
- Information and Knowledge, Math and Science
- Technical and Mechanical Knowledge
- Knowledge of Behavioral Content

Source: Recreated from Ackerman and Heggestad [1997], based on Carroll [1993].
Binet [1916, p. 254]

“...admits of other things than intelligence; to succeed in his studies, one must have qualities which depend on attention, will, and character; for example a certain docility, a regularity of habits, and especially continuity of effort. A child, even if intelligent, will learn little in class if he never listens, if he spends his time in playing tricks, in giggling, is playing truant.”
Jensen [1998, p. 575]

“What are the chief personality traits which, interacting with g, relate to individual differences in achievement and vocational success? The most universal personality trait is conscientiousness, that is, being responsible, dependable, caring, organized and persistent.”
Personality Psychology: A Short History
# The Big Five Domains and Their Facets: OCEAN

<table>
<thead>
<tr>
<th>Big Five Personality Factor</th>
<th>American Psychology Association Dictionary description</th>
<th>Facets (and correlated trait adjective)</th>
<th>Related Traits</th>
<th>Childhood Temperament Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness to Experience</td>
<td>“the tendency to be open to new aesthetic, cultural, or intellectual experiences”</td>
<td>Fantasy (imaginative) Aesthetic (artistic) Feelings (excitable) Actions (wide interests) Ideas (curious) Values (unconventional)</td>
<td>—</td>
<td>Sensory sensitivity Pleasure in low-intensity activities Curiosity</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>“the tendency to be organized, responsible, and hardworking”</td>
<td>Competence (efficient) Order (organized) Dutifulness (not careless) Achievement striving (ambitious) Self-discipline (not lazy) Deliberation (not impulsive)</td>
<td>Grit Perseverance Delay of gratification Impulse control Achievement striving Ambition Work ethic</td>
<td>Attention/(lack of) distractibility Effortful control Impulse control/delay of gratification Persistence Activity*</td>
</tr>
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*Activity can be considered as a facet of Conscientiousness.
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<tr>
<td><strong>Extraversion</strong></td>
<td>“an orientation of one’s interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability”</td>
<td>Warmth (friendly) Gregariousness (sociable) Assertiveness (self-confident) Activity (energetic) Excitement seeking (adventurous) Positive emotions (enthusiastic)</td>
<td>—</td>
<td>Surgency Social dominance Social vitality Sensation seeking Shyness* Activity* Positive emotionality Sociability/affiliation</td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td>“the tendency to act in a cooperative, unselfish manner”</td>
<td>Trust (forgiving) Straight-forwardness (not demanding) Altruism (warm) Compliance (not stubborn) Modesty (not show-off) Tender-mindedness (sympathetic)</td>
<td>Empathy Perspective taking Cooperation Competitiveness</td>
<td>Irritability* Aggressiveness Willfulness</td>
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# The Big Five Domains and Their Facets

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<tr>
<td>Neuroticism/Emotional Stability</td>
<td>Emotional stability is “predictability and consistency in emotional reactions, with absence of rapid mood changes.” Neuroticism is “a chronic level of emotional instability and proneness to psychological distress.”</td>
<td>Anxiety (worrying) Hostility (irritable) Depression (not contented) Self-consciousness (shy) Impulsiveness (moody) Vulnerability to stress (not self-confident)</td>
<td>Internal vs. External Locus of control Core self-evaluation Self-esteem Self-efficacy Optimism Axis I psychopathologies (mental disorders) including depression and anxiety disorders</td>
<td>Fearfulness/behavioral inhibition Shyness* Irritability* Frustration (Lack of) soothability Sadness</td>
</tr>
</tbody>
</table>

Notes: Facets specified by the NEO-PI-R personality inventory (Costa and McCrae [1992b]). Trait adjectives in parentheses from the Adjective Check List (Gough and Heilbrun [1983]). *These temperament traits may be related to two Big Five factors. Source: Table adapted from John and Srivastava [1999].
Traits themselves may be the manifestation of underlying goals and motives that generate the traits.
III. How are psychological measurements validated?
Circular quality of most of the validation studies.
Predictive Validities of Standard IQ and Achievement Tests

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<thead>
<tr>
<th>Test</th>
<th>Domain over which it is validated</th>
<th>Estimated Validities</th>
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<tbody>
<tr>
<td>SAT</td>
<td>First year college GPA</td>
<td>0.35 to 0.53</td>
<td>Validity of the SAT for Predicting First-Year College Grade Point Average</td>
<td></td>
</tr>
<tr>
<td>ACT</td>
<td>Grades in early years of college</td>
<td>0.42</td>
<td>ACT Technical Manual</td>
<td></td>
</tr>
<tr>
<td>Stanford-Binet</td>
<td>Correlations with other intelligence tests</td>
<td>0.77 to 0.87 with WISC-R</td>
<td>Rothlisburg (1987); Greene, Sapp, Chissom (1990)</td>
<td></td>
</tr>
<tr>
<td>WISC (Wechsler</td>
<td>Correlations with academic achievement</td>
<td>WISC: 0.443 to 0.751 with WRAT tests, 0.482 to 0.788 with 1st grade grades, 0.462 to 0.794 with 2nd grade grades; WISC-R: 0.346 to 0.760 with WRAT tests, 0.358 to 0.537 with 1st grade grades, 0.420 to 0.721 with 2nd grade grades</td>
<td>Hartlage and Steele (1977) WRAT = Wide Range Achievement Test; Ranges are given because correlations vary by academic subject</td>
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<tr>
<td>WAIS (Wechsler Adult Intelligence Scale)</td>
<td>Correlations with other intelligence tests, achievement tests, and outcomes</td>
<td>0.67 (median) with verbal tests, 0.61 (median) with nonverbal tests, 0.69 with education attained, 0.32 with employability of mentally challenged, 0.38 to 0.43 with college grades, 0.62 with high school grades, 0.14 with nursing grades</td>
<td>Feingold (1982)</td>
<td></td>
</tr>
<tr>
<td>Raven's Standard Progressive Matrices</td>
<td>Correlations with other intelligence tests</td>
<td>0.74 to 0.84 with WAIS-R</td>
<td>O'Leary, Rusch, Guastello (1991)</td>
<td></td>
</tr>
<tr>
<td>GATB (General Aptitude Test Battery)</td>
<td>Supervisor rating performance in training programs and in job performance</td>
<td>0.23 to 0.65</td>
<td>Hunter (1986)</td>
<td>Large range due to variety of jobs</td>
</tr>
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Source: Almund et al. (2011).
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<tr>
<td>ASVAB (Armed Services Vocational Aptitude Battery)</td>
<td>Performance in military training programs and military attrition rates</td>
<td>0.37 to 0.78 for training (mean=0.56); -0.15 for attrition</td>
<td>Schmidt (1988) for performance in training programs; Sticht et al (1982) for attrition rates</td>
<td>Large range in training correlations due to a variety of jobs</td>
</tr>
<tr>
<td>GED (General Educational Development)</td>
<td>Test difficulty is normed against graduating HS seniors. Test scores of high school seniors and grades of high school seniors</td>
<td>0.33 to 0.49 for HS Senior GPA</td>
<td>Technical Manual: 2002 Series GED Tests</td>
<td></td>
</tr>
<tr>
<td>DAT (Differential Aptitude Tests)</td>
<td>Correlations with academic achievement</td>
<td>0.13 to 0.62 for college GPA</td>
<td>Omizo (1980)</td>
<td>Large range is due to varying validity of eight subtests of DAT</td>
</tr>
<tr>
<td>WJAT (Wechsler Individual Achievement Test)</td>
<td>Correlation with other achievement tests; teacher ratings of student achievement</td>
<td>0.80 with grade 4 CAT/2, 0.69 with grade 5 CAT/2, 0.83 with grade 6 CAT/2; 0.67 with teacher ratings</td>
<td>Michalko and Saklofske (1999)</td>
<td>CAT=California Achievement Test</td>
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Source: Almund et al. (2011).
### Validities of Personality Tests

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<tr>
<td>Hogan Personality Inventory</td>
<td>Correlations with delinquency criterion; Factor correlations with outcomes</td>
<td>0.00 to 0.67 with School Success, 0.68 to 0.73 with Avoids Trouble, 0.22 to 0.33 with Non-experience Seeking, -0.44 to 0.01 with Enjoys Crowds, -0.42 to 0.09 with Exhibitionist, 0.25 to 0.43 with Easy to Live With, 0.36 to 0.44 with Good Sense of Attachment, 0.10 to 0.43 with Not Depressed, 0.26 to 0.54 with No Guilt; Delinquency factor correlates: 0.91 with chargeable accidents, 0.80 with warning letters, 0.44 with suspensions; Absenteeism factor correlates: 0.62 with grievances, 0.61 with absences, 0.55 with medical absences, 0.44 with workers compensation claims; Negative Sanctions factor correlates: 0.68 with suspension letters, 0.67 with discharges; No Fault factor correlates: 0.71 with nonchargeable accidents; Supervisor’s Ratings factor: 0.60 with supervisor’s ratings, -0.38 with health history</td>
<td>Hogan &amp; Hogan (1989)</td>
<td></td>
</tr>
<tr>
<td>Myers-Briggs Type Indicator</td>
<td>Correlations with other personality tests; agreement between reported personality type and best-fit personality type</td>
<td>Correlation with Big Five based on Adjective Check List: -0.70 (E-I to Extraversion), 0.44 (S-Thompson (2009) N to Openness), 0.47 (T-F to Agreeableness), -0.54 (J-P to Conscientiousness); 72.9% report same four preferences as best-fit type, 18.2% report same three out of four preferences as best-fit type</td>
<td>Schaubhut, Herk.</td>
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## Validities of Personality Tests

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<tr>
<td>NEO PI-R (Revised NEO Personality Inventory)</td>
<td>Correlations with other personality tests</td>
<td>Correlation with Positive Presentation Management Scale: -0.60 (N), 0.48 (E), 0.04 (O), 0.25 (A), 0.41 (C); correlations with Negative Presentation Management Scale: 0.39 (N), -0.46 (E), -0.31 (O), -0.38 (A), -0.54 (C); correlations with Big Five Index: 0.76 (E), 0.66 (A), 0.70 (C), -0.66 (N), 0.68 (O); correlations with Ten Item Personality Inventory: 0.65 (E), 0.59 (A), 0.68 (C), -0.66 (N), 0.56 (O)</td>
<td>Yang, Bagby, Ryder (2000); Gosling, Rentfrow, Swann (2003)</td>
<td>N=neuroticism, E=extraversion, O=openness, A=agreeableness, C=conscientiousness</td>
</tr>
<tr>
<td>NEO-FFI (NEO Five Factor Inventory)</td>
<td>Correlations with other personality tests</td>
<td>0.73 overall with BFI (Big-Five Index)</td>
<td>Gosling, Rentfrow, Swann (2003)</td>
<td>Note: This is a shorter version of the NEO PI-R</td>
</tr>
<tr>
<td>Rotter Locus of Control</td>
<td>Correlation with high school GPA</td>
<td>Correlation with high school GPA is 0.09 in suburban schools, 0.26 in inner-city schools</td>
<td>Stipek &amp; Weisz (1981)</td>
<td></td>
</tr>
<tr>
<td>Rosenberg Self-Esteem Scale</td>
<td>Correlations with other self-esteem scales</td>
<td>0.73 to 0.80 with Single Item Self-Esteem Scale; 0.15 to 0.76 with Harter’s Self-Perception Profile for Adolescents</td>
<td>Robins, Hendin, Trzeniewski (2001); Hagborg (1993)</td>
<td>Correlations with Harter’s done on an item by item basis</td>
</tr>
<tr>
<td>Short GRIT Scale</td>
<td>Item-level correlations with outcomes</td>
<td>0.03 to 0.13 for West Point 2008 Retention, 0.00 to 0.11 for West Point 2010 Retention, 0.05 to 0.17 for Spelling Bee success, 0.03 to 0.32 for Ivy League GPA</td>
<td>Duckworth &amp; Quinn (2009)</td>
<td>Large ranges due to variety of items</td>
</tr>
</tbody>
</table>

Source: Almlund et al. 2011
IV. Validating Psychological Measures On Outcomes That Matter
Difficulties:

- Measures of personality and cognition differ among studies.
- Different studies use different notions of predictive power of the measures.
- Few studies address the question of causality, i.e., does the measured trait cause (rather than just predict) the outcome?
Main Findings from Correlational Analyses
Conscientiousness is the most predictive Big Five trait across a variety of outcomes.
Correlations of the Big Five and Intelligence with College Course Grades (First Year)

Source: Poropat [2009].
Association of the Big Five and Intelligence with Years of Schooling in GSOEP

Source: German Socio-Economic Panel (GSOEP), waves 2004-2008, own calculations.
Probability of Graduating from High School - By Cognitive and Noncognitive Skill Decile

The Probability of Educational Decisions, by Endowment Levels, Dropping from Secondary School vs. Graduating


Heckman

Hard Evidence on Soft Skills
The Effect of Cognitive and Socio-emotional endowments on Probability of White-collar occupation (age 30)

Correlations of Mortality with Personality, IQ, and Socioeconomic Status (SES)

Source: Roberts, Kuncel, Shiner et al. [2007]
Participated in 2006 Election

The Effect of Cognitive and Socio-emotional endowments on Trusting People (2008)

The Effect of Cognitive and Socio-emotional endowments, Daily Smoking

The Effect of Cognitive and Socio-emotional endowments on Physical Health at age 40 (PCS-12)

The Effect of Cognitive and Socio-emotional endowments on Mental Health at age 40 (MCS-12)


Ever been in jail by age 30, by ability (males)


Note: This figure plots the probability of a given behavior associated with moving up in one ability distribution for someone after integrating out the other distribution. For example, the lines with markers show the effect of increasing noncognitive ability after integrating the cognitive ability.
The graph illustrates the probability of being teenage and single with children (females) as a function of percentile for both cognitive and noncognitive abilities. The line with markers shows the effect of increasing noncognitive ability after integrating the cognitive ability. The graph is sourced from Heckman, Stixrud, and Urzua (2006).
Predictive Power of SAT versus Conscientiousness
The Relative Predictive Power of Conscientiousness and SAT Scores for College GPA

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample</th>
<th>Timing of Measurement and Outcome</th>
<th>Controls</th>
<th>Metric</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conard [2005]</td>
<td>University students in the US (N=186)</td>
<td>College GPA and SAT were both self-reported during college. Personality was measured in college.</td>
<td>Class Attendance</td>
<td>Standardized Regression Coefficient ($\beta$)</td>
<td>SAT Total Conscientiousness 0.27 0.30</td>
</tr>
<tr>
<td>Noftle and Robins [2007]</td>
<td>University students in the US (N=10,497)</td>
<td>College GPA and SAT were both self-reported during college. Personality was measured in college.</td>
<td>Gender, Other Big Five Traits</td>
<td>Standardized Regression Coefficient ($\beta$)</td>
<td>SAT Verbal SAT Math Conscientiousness 0.19 0.16 0.24</td>
</tr>
<tr>
<td>Wolfe and Johnson [1995]</td>
<td>University students in the US (N=201)</td>
<td>GPA and SAT were provided by the Colleges’ Record Office. Personality was measured in college.</td>
<td>High School GPA</td>
<td>Standardized Regression Coefficient ($\beta$)</td>
<td>SAT Total Conscientiousness 0.23 0.31</td>
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### Predictive Validities in Outcomes that Matter (Adjusted R-Squared)

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<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings at Age 35</td>
<td>0.07</td>
<td>0.17</td>
<td>0.09</td>
</tr>
<tr>
<td>Hourly Wage at Age 35</td>
<td>0.07</td>
<td>0.13</td>
<td>0.08</td>
</tr>
<tr>
<td>Hours Worked at Age 35</td>
<td>0.01</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Jail by Age 35</td>
<td>0.03</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Welfare at Age 35</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Married at Age 35</td>
<td>0.01</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>BA Degree by Age 35</td>
<td>0.12</td>
<td>0.19</td>
<td>0.16</td>
</tr>
<tr>
<td>Depression in 1992</td>
<td>0.01</td>
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**Females**

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<tr>
<td>Hours Worked at Age 35</td>
<td>-0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Jail by Age 35</td>
<td>-0.00</td>
<td>0.01</td>
<td>0.02</td>
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**Adj, $R^2$ Cog, Personality**

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<td><strong>Females</strong></td>
<td>0.10</td>
<td>0.15</td>
<td>0.10</td>
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**Source:** National Longitudinal Survey of Youth 1979.
V. Conceptualizing the Correlations: An Economic Framework for Defining and Measuring Traits.
All measurement systems in psychology are based on performance on sets of tasks.
In personality psychology, measurements are **equated** with traits.
Roberts [2009, p. 140]

“Personality traits are the relatively enduring patterns of thoughts, feelings, and behaviors that reflect the tendency to respond in certain ways under certain circumstances.”
For conceptual clarity, it is important to distinguish traits from measurements of traits.
Simple Economic Models of Personality and Their Implications for Measuring Personality and Preference Traits
Personality As One Determinant of Comparative Advantage in Multiple Tasks
- Generalized Roy Framework
- Agents perform $J$ tasks with productivity $P_j$, $j \in \{1, \ldots, J\}$.
The productivity in task $j$.

Depends on the traits of agents, $\theta$.

“Effort” they expend on the task, $e_j$:

$$ P_j = \phi_j(\theta, e_j), \quad j \in J = \{1, \ldots, J\}, \quad e_j \in \mathcal{E}, \quad \theta \in \Theta. $$  \hfill (1)

Effort $e_j$: divisible and fixed in supply.
- $\phi_j(\theta, e_j)$ concave and increasing in $e_j$.
- $R_j$ is reward per unit task.
- The agent maximizes

$$
\sum_{j=1}^{J} R_j \phi_j(\theta, e_j) \quad (2)
$$

subject to

$$
\sum_{j=1}^{J} e_j = \bar{e}.
$$

- $R = (R_1, \ldots, R_J)$

$$
e = \tau_\phi(\theta, R)
$$
\[ P_j = \phi_j(\theta, \tau_{\phi_j}(\theta, R)) \]
Concept of productivity is broadened in personality psychology
Actions: \((a)\)

\[ a = \tau(\theta, e, B) \]

Additional Constraints and Context
The concept of traits $\theta$ can be broadened.
i Standard preference parameters, e.g., risk aversion, ambiguity aversion, time preference

ii The fashion in which persons process and generate information (e.g. Niederle et al.)
Agent: Max $E[U(a, X | \theta)]$ \hspace{1cm} (3)
- Personality is a response function.
- The behaviors that constitute personality are defined as patterns of actions in response to the constraints, endowments, and incentives facing agents given their goals and preferences.
Change the incentives and constraints, you change the measure.
Basic Identification Problem: Recovering Traits from Measurement of Traits
Grades, Achievement Test Scores, Productivity on Task

IQ ("g_f")

Acquired Knowledge ("g_c")

Personality

Incentives

P: Grades, Achievement Test Scores, Productivity on Task
\[ P = \phi(\theta, e) \]

(inverting from observed task performance to traits)

i. Need to standardize for effort \((e)\)

ii. Multiple traits \((\theta)\)

iii. Functions \(\phi\) unknown
Construct Validity
Exploratory Factor Analysis
Convergent Validity: Measures in a construct cluster highly correlated.
Discriminant Validity: Measures across clusters not highly correlated.
Effort and incentives matter.
## Incentives and Performance on Intelligence Tests

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample and Study Design</th>
<th>Experimental Group</th>
<th>Effect size of incentive (in standard deviations)</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edlund [1972]</td>
<td>Between subjects study. 11 matched pairs of low SES children; children were about one standard deviation below average in IQ at baseline</td>
<td>M&amp;M candies given for each right answer</td>
<td>Experimental group scored 12 points higher than control group during a second testing on an alternative form of the Stanford Binet (about 0.8 standard deviations)</td>
<td>“…a carefully chosen consequence, candy, given contingent on each occurrence of correct responses to an IQ test, can result in a significantly higher IQ score.” (p. 319)</td>
</tr>
<tr>
<td>Breuning and Zella [1978]</td>
<td>Within and between subjects study of 485 special education high school students all took IQ tests, then were randomly assigned to control or incentive groups to retake tests. Subjects were below-average in IQ.</td>
<td>Incentives such as record albums, radios (&lt;$25) given for improvement in test performance</td>
<td>Scores increased by about 17 points. Results were consistent across the Otis-Lennon, WISC-R, and Lorge-Thorndike tests.</td>
<td>“In summary, the promise of individualized incentives contingent on an increase in IQ test performance (as compared with pretest performance) resulted in an approximate 17-point increase in IQ test scores. These increases were equally spread across subtests... The incentive condition effects were much less pronounced for students having pretest IQs between 98 and 120 and did not occur for students having pretest IQs between 121 and 140.” (p. 225)</td>
</tr>
</tbody>
</table>
What traits do grades and achievement tests capture?
Decomposing Achievement Tests and Grades into IQ and Personality [NLSY79]

Source: Borghans et al. (2011).
Decomposing Achievement Tests and Grades into IQ and Personality

[Stella Maris]

Source: Borghans et al. (2011).
VI. Causality
Difficulties in Establishing Causality
Grades, Achievement Test Scores, Productivity on Task

IQ ("g_f")

Acquired Knowledge ("g_c")

Personality

Incentives

P:
Grades, Achievement Test Scores, Productivity on Task
Causal Evidence

- GED Testing Program
- Evidence from a Social Experiment (Perry Preschool Program)
VII. Causality Study 1: The GED as a case study of the power of soft skills and the costs of neglecting them
GEDs are as smart as HSGs who do not go on to college.
Terminal GEDs perform at levels very close to those of dropouts.
Cognitive ability by educational status

Source: Heckman, Humphries, Urzua, and Veramendi (2010)
Risky Behaviors (Males)

(a) Sex and Smoking

(b) Minor Crime and Drinking

(c) Major Crimes

(d) Violent Behaviors

Distribution of Non-Cognitive Skills by Education Group

Females: Noncognitive Density

- GED, no college
- HS Dropout
- HS Grad., no college

College Graduation (NLSY79) - All Races

(a) Fraction Obtaining BA, Males

(b) Fraction Obtaining BA, Females

GED HSG S.E.

Sources: National Longitudinal Survey of Youth 1979. Notes: The graph represents post-secondary educational attainment of dropouts, GED recipients and high school graduates. “BA” also includes people with higher education: M.A. Ph.D and professional degrees.
GEDs earn at the rate of dropouts and perform at rate of dropouts in earnings, employment, labor force participation, and hours worked.
Avoiding Pretest Bias Or “Cherry Picking” of Results
Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Annual Earnings Across Models for Males

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Hourly Wage Across Models for Males

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Employment Across Models for Males

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Hours Worked Across Models for Males

**Sources:** National Longitudinal Survey of Youth 1979.
Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Labor Force Participation Given Labor Force Participation for Males

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Unemployment Given Labor Force Participation for Males

Evidence From Murnane Group
Women
Controlling for ability and baseline characteristics, there appear to be GED effects (compared to dropouts) for certain groups of females.
Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Annual Earnings Across Models for Females

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Hourly Wage Across Models for Females

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Employment Across Models for Females

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Hours Worked Across Models for Females

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Labor Force Participation Given Labor Force Participation for Females

Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Unemployment Given Labor Force Participation for Females

Differential Characteristics of Male and Female GEDs
Two Groups of Women Benefit from GED Certification

(I) 40%

- Girls who get pregnant, drop out, and reenter after their children are sufficiently old to place in childcare.
- Their baseline noncognitive characteristics are relatively good, and they have experienced a shock.

(II) 28%

- Girls who do not get pregnant, are smart but have low levels of baseline skills.
- They seem to change (mature).
- They go to college.
- They benefit.
Annual Earnings by Type of GED Recipient - (All Races)

(a) Unadjusted

Sources: National Longitudinal Survey of Youth 1979, Nationally Representative Sample. Controls: Mother’s highest grade completed, urban status at age 14, family income in 1979, broken family status, living in the south at age 14, AFQT, and factors based on adolescent behavioral measures, crime and school performance. Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. All regressions allow for heteroskedastic errors and when appropriate clustering at the individual level.
Annual Earnings by Type of GED Recipient - (All Races)

(b) Background and Ability Adjusted

Sources: National Longitudinal Survey of Youth 1979, Nationally Representative Sample. Controls: Mother’s highest grade completed, urban status at age 14, family income in 1979, broken family status, living in the south at age 14, AFQT, and factors based on adolescent behavioral measures, crime and school performance. Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. All regressions allow for heteroskedastic errors and when appropriate clustering at the individual level.
Attributes of Female GED Recipients who Drop Out due to Pregnancy Compared to Other Female GED Recipients

Source: The National Longitudinal Survey of Youth 1979 (NLSY79). Variable Definitions: AFQT scores are adjusted for years of schooling at the time of test. Days of Absence - The number of days that the student was absent during 9th grade in the NLSY79 and the number of days that the student was absent during fall semester of 1997 in the NLSY97. GPA was calculate based on credits and grades earned in 9th grade. Credits Grade 9 - Cumulative number of credits obtained in 9th grade. Highest Grade Completed - Highest grade the respondent completed in elementary and secondary school. Drinks By 15 - Whether the respondent used to drink on regular basis - at least once or twice per month by age 15. Sex By 15 - Whether the respondent had sexual intercourse by age 15. Smokes by 15 - Whether the respondent smoked more then 100 cigarettes in his life and smoked daily by age 15. Minor Crime - Whether the respondent was involved at least once in one of the following: vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods. Major Crime - Whether the respondent was involved at least once in one of the following: auto theft, breaking/entering private property, and grand theft. Violent Crime - Whether the respondent was involved at least once in one of the following: fighting at work or school, assault and battery, and aggravated assault.
Motivated females take the GED. This is not necessarily a “causal effect” of the GED.
What Women Benefit?
Attributes of Female GED Recipients by College and Pregnancy Status

(a) Cognitive Ability, Personality, and School Behavior

Source: The National Longitudinal Survey of Youth 1979 (NLSY79). “No Coll” indicates the group that does not attend college. “Coll” indicates the group that does attend college. “Preg GED” indicates that the respondent was pregnant before dropping out of high school. “Oth GED” indicates that the respondent was not pregnant before dropping out of high school.

Variable Definitions: Days of Absence - The number of days that the student was absent during 9th grade. GPA was calculate based on credits and grades earned in 9th grade. Credits Grade 9 - Cumulative number of credits obtained in 9th grade. Compl. Gr.10 - Whether the respondent completed 10th grade. Drinks By 15 - Whether the respondent used to drink on regular basis - at least once or twice per month by age 15. Sex By 15 - Whether the respondent had sexual intercourse by age 15. Smokes by 15 - Whether the respondent smoked more then 100 cigarettes in his life and smoked daily by age 15. Minor Crime - Whether the respondent was involved at least once in one of the following: vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods. Major Crime - Whether the respondent was involved at least once in one of the following: auto theft, breaking/entering private property, and grand theft.
Attributes of Female GED Recipients by College and Pregnancy Status

(b) Risky and Criminal Behavior

Source: The National Longitudinal Survey of Youth 1979 (NLSY79). “No Coll” indicates the group that does not attend college. “Coll” indicates the group that does attend college. “Preg GED” indicates that the respondent was pregnant before dropping out of high school. “Oth GED” indicates that the respondent was not pregnant before dropping out of high school.

Variable Definitions:
- Days of Absence - The number of days that the student was absent during 9th grade. GPA was calculate based on credits and grades earned in 9th grade.
- Credits Grade 9 - Cumulative number of credits obtained in 9th grade.
- Completes Gr.10 - Whether the respondent completed 10th grade.
- Drinks By 15 - Whether the respondent used to drink on regular basis - at least once or twice per month by age 15.
- Sex By 15 - Whether the respondent had sexual intercourse by age 15.
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- Minor Crime - Whether the respondent was involved at least once in one of the following: vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods.
- Major Crime - Whether the respondent was involved at least once in one of the following: auto theft, breaking/entering private property, and grand theft.
VIII. Situational Specificity Hypothesis
“...with the possible exception of intelligence, highly generalized behavioral consistencies have not been demonstrated, and the concept of personality traits as broad dispositions is thus untenable”

-Mischel (1968, p. 146)
“The great contribution to psychology by Walter Mischel [...] is to show that there is no such thing as a stable personality trait.”

- Thaler (2008)
The stability of traits and behaviors before and after GED certification argues against preference change, at least for most GEDs.
Survival Rate in Employment (All Races, All Levels of Post-Secondary Education)

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.

In Employment, Males

Drop p<0.05 (GED vs.HSG)
GED p<0.05 (GED vs.Drop)
HSG p<0.05 (HSG vs.Drop)
Survival Rate in Employment (All Races, All Levels of Post-Secondary Education)

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
Survival Rate in Employment (All Races, All Levels of Post-Secondary Education)

In The Same Job, Males

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
Survival Rate in Employment (All Races, All Levels of Post-Secondary Education)

In The Same Job, Females

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
Survival Rate in Marriage (All Races, All Levels of Post-Secondary Education)

In Marriage, Males

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
Survival Rate in Marriage (All Races, All Levels of Post-Secondary Education)

**In Marriage, Females**

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
Survival Rate Not Incarcerated (All Races, All Levels of Post-Secondary Education)

Source: National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample.
IX. Are Traits Set in Stone?
Three Processes of Development

- Ontogeny (programmed developmental processes common to all persons) and sociogeny (shared socialization processes).
- Personality changes through external forces above and beyond common ontogenic and sociogenic processes that operate through alterations in normal biology, such as brain lesions and chemical interventions.
- Investment: educational interventions and parental investment.
Cumulative Mean-Level Changes in Personality Across the Life Cycle

Note: Social vitality and social dominance are aspects of Big Five Extraversion. Cumulative d values represent total lifetime change in units of standard deviations ("effect sizes").

Source: Figure taken from Roberts, Walton and Viechtbauer [2006] and Roberts and Mroczek [2008]. Reprinted with permission of the authors.
Life-Cycle Models of Investment

- \( \theta^v \): traits at age \( v \), \( v \in \{1, \ldots, V\} \in V \).
- \( IN^v \): investment at stage \( v \).
- \( h^v \) is the “situation” broadly defined.

**Technology of skill formation**
(Cunha and Heckman [2007; 2009]):

\[
\theta^{v+1} = \eta^v(\theta^v, IN^v, h^v), \quad v = 0, \ldots, V - 1
\] (4)

Productivity of investment can depend on the age at which it is made.

Complementarity of traits with investment:

\[
\frac{\partial^2 \eta^v(\theta^v, IN^v, h^v)}{\partial \theta^v \partial (IN^v)} \geq 0.
\] (5)

Functions are estimated to be nonautonomous (\( v \)-dependent).

Dynamic and static complementarity.
Critical and Sensitive Periods for Investment
A Life Cycle Framework for Organizing Studies and Integrating Evidence:
The Technology of Skill Formation

Parental Prenatal
Investment

Childhood traits
(personality, cognition,
and health)

Investment: Parenting and
Preschool

Fetal Traits

Traits

Adult Traits

Parental Environments

Parenting and
Preschool

Parenting and
School

Prenatal Parental
Environments

Perinatal Parental
Environments

Parental Environments

PRENATAL

BIRTH

EARLY
CHILDHOOD
0-3

LATER
CHILDHOOD
3-6

ADULTHOOD

Hard Evidence on Soft Skills
The Causal Effects of Schooling on Cognitive and Personality Traits
Causal Effect of Schooling on ASVAB Measures of Cognition

Notes: Effect of schooling on components of the ASVAB. The first four components are averaged to create male’s with average ability. We standardize the test scores to have within-sample mean zero, variance one. The model is estimated using the NLSY79 sample. Solid lines depict average test scores, and dashed lines, confidence intervals.
Source: Heckman, Stixrud and Urzua [2006, Figure 4].
Causal Effect of Schooling on ASVAB Measures of Cognition

Notes: Effect of schooling on components of the ASVAB. The first four components are averaged to create male’s with average ability. We standardize the test scores to have within-sample mean zero, variance one. The model is estimated using the NLSY79 sample. Solid lines depict average test scores, and dashed lines, confidence intervals.
Source: Heckman, Stixrud and Urzua [2006, Figure 4].
Causal Effect of Schooling on ASVAB Measures of Cognition

Notes: Effect of schooling on components of the ASVAB. The first four components are averaged to create male’s with average ability. We standardize the test scores to have within-sample mean zero, variance one. The model is estimated using the NLSY79 sample. Solid lines depict average test scores, and dashed lines, confidence intervals. Source: Heckman, Stixrud and Urzua [2006, Figure 4].
Causal Effect of Schooling on Two Measures of Personality

Source: Heckman, Stixrud and Urzua [2006].
Causal Effects of Education vs. Early Life Factors
Note: Conti and Heckman (2010). Author’s calculations using BCS70.
X. Study 2 of Causal Effects of Personality: Evidence from a Randomized Intervention
Perry Preschool Program: IQ, by Age and Treatment Group

Notes: IQ measured on the Stanford-Binet Intelligence Scale (Terman and Merrill, 1960). Test was administered at program entry and each of the ages indicated.
Source: Cunha, Heckman, Lochner et al. (2006) and Heckman and Masterov (2007) based on data provided by the High Scope Foundation.
Personal Behavior Index by Treatment Group

(1 is worst, 5 is best)

(a) Control

(b) Treatment

Source: Heckman, Malofeeva, Pinto, and Savelyev (2010).
Socio-Emotional Index by Treatment Group

(1 is worst, 5 is best)

(c) Control

(d) Treatment

Source: Heckman, Malofeeva, Pinto, and Savelyev (2010).
Perry Age 14 Total CAT Scores, by Treatment Group

CAT = California Achievement Test
Treatment: $N = 49$; Control: $N = 46$
Statistically Significant Effect for Males and Females (p-values 0.009, 0.021 respectively)
Source: Heckman, Malofeeva, Pinto et al. (2010).
Decomposing Treatment Effects of Perry
Decompositions of Treatment Effects on Outcomes

Notes: The total treatment effect is normalized to 100%. One-sided $p$-values are shown above each component in each outcome. “(+)” and “(-)” denote positive and negative total treatment effects. “CAT total” denotes California Achievement Test total score.
XI. Personality and Preference Parameters
### Standard Preference Parameters and Conceptually Similar Measures in the Psychology Literature

<table>
<thead>
<tr>
<th>Preference parameter</th>
<th>Personality measures</th>
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<tr>
<td>Time preference</td>
<td>Conscientiousness</td>
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<tr>
<td></td>
<td>Self-control</td>
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<td></td>
<td>Affective mindfulness</td>
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<td></td>
<td>Consideration of future consequences</td>
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<tr>
<td></td>
<td>Elaboration of consequences</td>
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<tr>
<td>Risk aversion</td>
<td>Impulsive sensation seeking</td>
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<td></td>
<td>Balloon Analogue Risk Task</td>
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<tr>
<td>Leisure Preference</td>
<td>Achievement Striving</td>
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<tr>
<td></td>
<td>Endurance</td>
</tr>
<tr>
<td></td>
<td>Industriousness</td>
</tr>
<tr>
<td>Social preference</td>
<td>Warmth</td>
</tr>
<tr>
<td></td>
<td>Gregariousness</td>
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<td></td>
<td>Trust</td>
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<td></td>
<td>Altruism</td>
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<tr>
<td></td>
<td>Tender-mindedness</td>
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<tr>
<td></td>
<td>Hostility</td>
</tr>
</tbody>
</table>
Personality Parameters and Economic Preference Parameters Do Not Correspond Closely.

- Suggests new dimensions of human actions and essential human differences.
## Empirical Studies of the Links Between Preferences and Traits

<table>
<thead>
<tr>
<th>Preferences</th>
<th>Personality measure</th>
<th>Empirical study</th>
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<tbody>
<tr>
<td><strong>Time Preference</strong></td>
<td>Conscientiousness, Self-control, Affective mindfulness, Elaboration of consequences, Consideration of future consequences.</td>
<td>Daly, Delaney and Harmon [2009]</td>
</tr>
<tr>
<td>Extraversion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Preference</td>
<td></td>
<td>Dohmen, Falk, Huffman et al. [2010]</td>
</tr>
<tr>
<td><strong>Risk Aversion</strong></td>
<td>Sensation Seeking</td>
<td>Zuckerman [1994], Eckel and Grossman [2002]</td>
</tr>
<tr>
<td>Openness</td>
<td></td>
<td>Dohmen, Falk, Huffman et al. [2010]</td>
</tr>
<tr>
<td>Neuroticism, ambition, Agreeableness</td>
<td></td>
<td>Borghans, Golsteyn, Heckman et al. [2009]</td>
</tr>
<tr>
<td>Balloon Analogue Risk Task</td>
<td></td>
<td>Lejuez, Aklin, Zvolensky et al. [2003]</td>
</tr>
<tr>
<td><strong>Social Preferences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altruism</td>
<td>Neuroticism, Agreeableness</td>
<td>Ashton, Paunonen, Helmes et al. [1998], Osiński [2009], Bekkers [2006]</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>Neuroticism, Agreeableness, Conscientiousness</td>
<td>Dohmen, Falk, Huffman et al. [2008]</td>
</tr>
<tr>
<td>Trust</td>
<td>Neuroticism, Agreeableness, Openness, Conscientiousness</td>
<td>Dohmen, Falk, Huffman et al. [2008]</td>
</tr>
</tbody>
</table>

See ADHK (2011) for more complete discussion.
Summary and Conclusions
What can economists take from and contribute to personality psychology?
Measures of personality predict many behaviors sometimes with the same strength as conventional cognitive traits. (IQ and Achievement Tests)

Personality psychology considers a wider array of *actions* than are considered by economists—enlarges the economist’s way to describe and model the world.

Personality measures explain some of the variation in outcomes that produce inequality and hence contribute to the Lampman agenda.

Understanding personality helps us understand the nature of the tests used to monitor schools and societies. Motivation and effort affect these tests.

Personality traits persist across situations.

They are, however, not set in stone. They change in stable ways over the life cycle.

They are a possible avenue for intervention and policy.
Economists Are Now Contributing to Personality Psychology
Personality psychologists lack precise models. Economics provides a framework for recasting the field.

Economics is now playing a role in clarifying the concepts and empirical content of psychology.

More precise models reveal basic identification problems that plague measurement in psychology and warn economists not to use uncritically the measures developed by psychologists.

The next wave of personality measures will incorporate this research.

Personality psychologists typically report correlations not causal relationships.

Many contemporaneously measured relationships in personality psychology and its use in economics suffer from the problem of reverse causality.

Economists can apply their tools to define and estimate causal mechanisms and to understand the causes of effects.
Challenges and Research Opportunities

1. Linking the traits of psychology with the preferences, constraints and expectation mechanisms of economics.
2. Developing rigorous methods for analyzing causal relationships in both fields.
3. Developing a common language and framework to promote interdisciplinary exchange.
4. Danger in assuming that basic questions of content and identification have been answered by psychologists at the level required for rigorous economic analysis.
5. At this stage of the research, economists should question the measurement system and promote better systems of data collection that address the basic identification questions in the field.