Intelligence and Aging

Figures from:
Forms of intelligence

- Sternberg (1985)
  - Problem-solving (Analytic)
    - Logical, reasoning
  - Verbal (also called Creative)
    - Vocabulary, novel tasks
  - Social competence (Practical)
    - “Street smarts”
Psychometric approach

- **Factor analysis**: Examine correlations between tests
- Spearman (1904)
  - “g” and “s”
- If high correlations
  - “g” or general intelligence
- If low correlations
  - “s” or specific intelligences
- Thurstone (1938)
  - 7 independent “primary mental abilities”
  - Verbal meaning, word fluency, numerical ability, spatial ability, verbal memory, perceptual speed, and reasoning
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S = Sample; T = Time of Measurement
Schaie (1994)
Seattle Longitudinal Study

• Core battery: Thurstone’s (1938) primary mental abilities
  – Verbal meaning
  – Space
  – Reasoning
  – Number
  – Word fluency

• First, whether intelligence changes uniformly through adulthood or whether there were different life-course ability patterns.
• Second, at what age reliably detectable age decrements in ability occurred and to determine the magnitude of that decrement.
• Third, investigate patterns of generational (cohort) differences in intellectual abilities as well as their magnitude.
• Fourth, stability of the factor structure of the psychometric abilities across the adult life course.
• Fifth, what accounts for the vast individual differences in age-related change in adulthood.
• And, whether intellectual decline with increasing age can be reversed by educational interventions.

<table>
<thead>
<tr>
<th>Primary ability</th>
<th>Test</th>
<th>Source</th>
<th>Test–retest correlation</th>
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<td>Inductive Reasoning</td>
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<td>Thurstone &amp; Thurstone, 1949</td>
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<td>Object Rotation</td>
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<td>ETS Cube Comparisons</td>
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<td>ETS Subtraction &amp; Multiplication (N-3)</td>
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<td>Verbal Comprehension</td>
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<td>Perceptual Speed</td>
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<td>ETS Finding As</td>
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<td>ETS Number Comparison</td>
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<td>Zelinski et al., 1993</td>
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<td>PMA Word Fluency</td>
<td>Thurstone &amp; Thurstone, 1949</td>
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</table>

*Note. PMA = Primary Mental Abilities test; ADEPT = Adult Development and Enrichment Project; ETS = Educational Testing Service.*

http://geron.psu.edu/sls/researchers/measures.html
Differences in Life-Course Ability Patterns

Figure 2. **Cross-Sectional** Mean T Scores for Single Markers of the Primary Mental Abilities
Figure 3. **Longitudinal Estimates** of Mean T Scores for Single Markers of the Primary Mental Abilities
Figure 5. Cross-Sectional Mean Factor Scores for the Latent Ability Constructs
Figure 6. Longitudinal Estimates of Mean Factor Scores for the Latent Ability Constructs
Figure 7. Cohort Gradients for the Single Markers of the Primary Mental Abilities
Flynn effect

- Intelligence test performance has been rising.
Schaie (1994)
The variables identified to reduce the risk of cognitive decline in old age include the following:

- The absence of cardiovascular and other chronic diseases.
- Living in favorable environmental circumstances as would be the case for those persons characterized by high SES.
- Substantial involvement in activities such as: reading, travel, attendance at cultural events, pursuit of continuing education activities, and participation in clubs and professional associations
- Individual's self-report of a flexible personality style at midlife as well as flexible performance on objective measures of motor–cognitive perseveration tasks
- Being married to a spouse with high cognitive status.
- The maintenance of high levels of perceptual processing speed into old age
- Rating one's self as being satisfied with one's life's accomplishment in midlife or early old age.
Forms of intelligence

- Cattell & Horn (1966)
  - Crystalized intelligence
  - Fluid intelligence

- Raven’s progressive matrices
Crystalized vs fluid intelligence

**Basic information processing**

- **Mechanics**
  - Content-poor
  - Universal, biological
  - Genetically predisposed

- **Pragmatics**
  - Content-rich
  - Culture-dependent
  - Experience-based

**Performance**

- Pragmatics (crystallized)
- Mechanics (fluid)

**Life course**

- Intelligence as cultural knowledge
- Intelligence as basic information processing

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Vocabulary test

- **Connect:**
  Accident  lace  flint  join  bean  field

- **Provide:**
  Harmonize  hurt  annoy  commit  supply  divide

- **Dwindle:**
  Swindle  diminish  linger  pander  wheeze  compare

- **Bombastic:**
  Democratic  bickering  destructive  pompous  cautious  anxious

- **Recumbent:**
  Fugitive  unwieldy  reclining  cumbersome  repelling  penitent

- **Glower:**
  Extinguish  disguise  aerate  shine  gloat  scowl
IQ tests: Visual reasoning

**Question**
Choose the next sequence:

[Image of three diagrams]

**Choose Your Answer**

1) [Image of a diagram]
2) [Image of a diagram]
3) [Image of a diagram]
Stanford-Binet Test: IQ

- Verbal reasoning
  - Vocabulary
  - Comprehension
  - Verbal relations

- Abstract/visual reasoning
  - Pattern analysis
  - Copying
  - Paper folding and cutting

- Quantitative reasoning
  - Number series
  - Equation-building

- Short-term memory
  - Bead memory
  - Memory for sentences and digits
  - Memory for objects
Training studies

• Willis & Nesselroade (1990)
• Cattell’s Culture Fair Test
  – Figure series
  – Figure classify
  – Matrices
  – Topology
• http://www.alliqtests.com/tests/7/8/
Moderators of intellectual change

- Age-related changes
- Cohort differences
- Educational level
- Change in cognition
  - Perceptual (processing) speed
  - Working memory
  - Inhibition or inability to avoid interference
- Social variables
  - Occupations
  - Socioeconomic status
  - Exposure to stimulating environments
  - Social engagement (vs lonliness)
- Personality
  - Self-efficacy; positive beliefs or attitudes
  - Neuroticism and chronic psychological distress
- Health and lifestyle
  - Cardiovascular disease, hypertension, sensory functioning
- Relevancy and appropriateness of tasks
Baltes & Lindenberger (1997)

- Visual and auditory acuity related to fluid intelligence
Willis et al. (Allaire & Marsiske, 2002)

- Examine correlations of 7 primary mental abilities
  - Traditional tasks vs everyday tasks
- Which primary abilities predict everyday performance?
  - Fluid intelligence (figural relations)

Table 1
Intercorrelations Among Everyday Cognition Battery (ECB) and Basic Ability Tests

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
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<td>1. ECB Knowledge Test</td>
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<td>2. ECB Reasoning Test</td>
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<td>3. ECB Memory Test</td>
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<td>4. Verbal Meaning Test</td>
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<td>.74</td>
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<td>5. Letter Sets Test</td>
<td>.41</td>
<td>.56</td>
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<td>6. HVLT</td>
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<td>.50</td>
<td>.53</td>
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Note. All correlations are significant at $p < .05$. HVLT = Hopkins Verbal Learning Test.
Table 1
Descriptive Statistics of Study Variables Prior to Creation of Composites

<table>
<thead>
<tr>
<th>Variable</th>
<th>65- to 75-year-olds (n = 439) Mean (SD)</th>
<th>76- to 94-year-olds (n = 259) Mean (SD)</th>
<th>Complete sample (n = 698) Mean (SD)</th>
<th>Age correlation</th>
<th>Reliability estimate</th>
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<tbody>
<tr>
<td>Age</td>
<td>70.20 (2.98)</td>
<td>80.58 (3.96)</td>
<td>74.05 (6.05)</td>
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<tr>
<td>Gender</td>
<td>75%</td>
<td>71%</td>
<td>74%</td>
<td>−.08</td>
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<td>Education</td>
<td>13.54 (2.64)</td>
<td>13.10 (2.80)</td>
<td>13.37 (2.70)</td>
<td>−.17*</td>
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<td>MMSE</td>
<td>27.50 (1.95)</td>
<td>26.88 (2.02)</td>
<td>27.27 (2.00)</td>
<td>−.17*</td>
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<td>Measures of everyday functioning</td>
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<td>Timed Instrumental Activities of Daily Living</td>
<td>.10 (.53)</td>
<td>−.24 (.73)</td>
<td>−.03 (.64)</td>
<td>−.32*</td>
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<td>Observed Tasks of Daily Living</td>
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<td>Everyday Problem Solving</td>
<td>18.31 (4.20)</td>
<td>15.82 (4.38)</td>
<td>17.38 (4.43)</td>
<td>−.30*</td>
<td>.75</td>
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<td>Self-reported difficulty with Instrumental Activities of Daily Living</td>
<td>19.14 (5.46)</td>
<td>16.72 (6.04)</td>
<td>18.25 (5.79)</td>
<td>−.22*</td>
<td>.87</td>
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<td>Neurocognitive measures</td>
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<td>Word Series</td>
<td>10.26 (4.89)</td>
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<td>9.26 (4.81)</td>
<td>−.33*</td>
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<td>Letter Series</td>
<td>10.62 (5.70)</td>
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<td>−.31*</td>
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<td>Letter Sets</td>
<td>6.14 (2.90)</td>
<td>4.90 (2.57)</td>
<td>5.69 (2.85)</td>
<td>−.24*</td>
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<td>104.34 (100.45)</td>
<td>192.15 (144.13)</td>
<td>136.90 (125.82)</td>
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<td>286.32 (125.43)</td>
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<td>AVLT</td>
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<td>47.47 (10.68)</td>
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Note. All reliability estimates come from Ball et al. (2002) except where otherwise noted.

* Lower scores reflect better performance/higher functioning.  
b Estimate comes from Morris et al. (1997).  
c Estimate is a 12-week test-retest correlation.

* Age correlation is significant at p < .01.