

Psychology 405: Psychometric Theory

Domains of Individual Differences

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May, 2025

Outline

Early Taxonomies

19th and early 20th century taxonomies

Mid 20th century taxonomies

The lexical hypothesis

Lexical vs behavior

Additional Construct Validity studies

References

Identifying Personality Structure

1. Is it possible to reduce the broad range of individual variation in personality to a limited number of personality traits?
2. Trait: A particular feature of mind or character; a distinguishing quality; a characteristic; spec. of a culture or social group (OED)
3. The pronunciation tr ei, after mod. French , in the 19th c. considered in England the correct one, is becoming less general; in U.S. tr eit is the established one (OED)

Definition of the relevant domains

1. Individual differences in personality
2. Personality traits vs. abilities?
3. Traditional personality traits are central tendencies and preferences rather than limits
4. What do you do vs. what can you do
5. Some of us, particularly Europeans, include ability as a relevant dimension of study of individual differences

Descriptive Approaches to Personality

Derived from three approaches to taxonomy construction

1. Folk Theories: How ordinary people think about personality – constrained to types and typologies; categorical, not dimensional
2. Constructive approach: How verbal descriptions of feelings and actions covary; leading to trait dimensions – constrained by interests and ingenuity of investigators
3. Analytic approaches : How endorsements of words covary, leading to trait dimensions – constrained by the language

All seek to provide a characterization of kinds of people (a flatterer, extravert, etc.); all are only a first approximation for what a person will do (next)

Theophrastus' Folk Theory

Table: default

The talker	The anxious to please	The hostile man
The chatterer	The toady or the flatterer	The shameless man
The boaster	The coward	The distrustful man
The inventor of news	The superstitious man	The slanderer
The ironical man	The feckless	The skinflint or stingy
The boor	The tiresome man	The mean man
The arrogant man	The outcast	The avaricious man

Theophrastus (1909)

Early Theoretical Taxonomies

Plato and the requirements for leadership

" ... quick intelligence, memory, sagacity, cleverness, and similar qualities, do not often grow together, and ... persons who possess them and are at the same time high-spirited and magnanimous are not so constituted by nature as to live in an orderly and peaceful and settled manner; they are driven any way by their impulses, and all solid principle goes out of them. ... On the other hand, those stable and steadfast and, it seems, more trustworthy natures, which in a battle are impregnable to fear and immovable, are equally immovable when there is anything to be learned; they are always in a torpid state, and are apt to yawn and go to sleep over any intellectual toil." [Plato](#) (nd)

Early taxonomies

1. Galen (and Hippocrates):
2. “Blood, phlegm, yellow bile and black bile are the particular elements of the nature of man”.
3. the sanguine, bouyant type; the phlegmatic, sluggish type; the choleric, quick-tempered type; and the melancholic, dejected type

Irwin (1947); Stelmack and Stalikas (1991)

19th Century reorganization of Galen: Wundt's dimensional structure

Excitable		
Melancholic	Choleric	Changeable
Phlegmatic	Sanguine	

The Wundt organaization of the 4 temperaments

Melancholic
(NI)



Choleric
(NE)



Phlegmatic
(SI)



Sanguine
(SE)



Wundt (1904)

19th and early 20th century taxonomies

1. Freud
2. Jung
3. McDougall "Domains of personality"

Freud's taxonomy

1. Oral

- Indulgent: oral erotic – oral passive optimistic, gullible, dependent, manipulative
- Restrictive: oral sadistic, oral aggressive pessimistic, suspicious, quarrelsome

2. Anal

- Indulgent: anal retentive, anal compulsive stingy, stubborn, punctual, precise, orderly
- Restrictive: anal aggressive, anal expulsive cruel, destructive, hostile, disorderly

3. Phallic

- Indulgent: phallic-dominant vain, proud, domineering, ambitiousP, virile
- Restrictive: phallic-submissive meek, submissive, modest, timid, feminine

Jung

1. Orientations: Introverted Extraverted
2. Psychological Functioning
 - Thinking/Feeling
 - Judging/Perceiving
 - Sensing/ Intuiting
3. (current application- MBTI) [McCrae and Jr. \(1989\)](#)

McDougall

1. Intellect
2. Character
3. Temperament
4. Disposition
5. Temper

McDougall (1923)

Gerard Heymans (1857-1930)

1. Empirically based research

- 3000 (Dutch) doctors were asked to rate all members of a family on a large number of traits
- 400 responded with ratings on 2,523 subjects

2. Three dimensions

- Emotionality or Emotional Instability
- Activity or general drive
- Dominance of primary or secondary functioning

Eysenck (1992); Van der Werff (1985); van der Werff and Verster (1987)

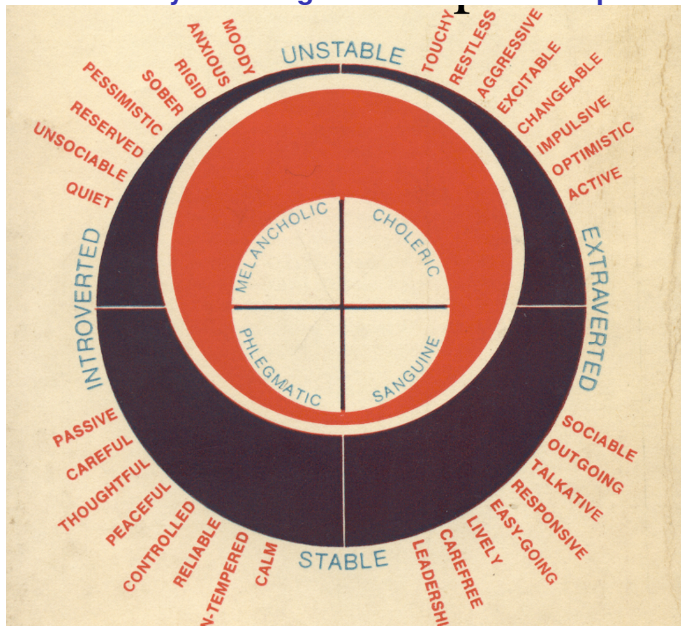
Table 2. Loadings > 0.40 in five and three rotated factors ($\delta = 0$)

1	2	3	4	5		1	2	3
76	—	—	—	—	Calm and quiet	63	—	—
66	—	—	—	—	Cold and objective	51	—	—
60	—	—	—	—	Thoughtful	55	—	—
-77	—	—	—	—	Lively and busy	-66	—	—
-69	—	—	—	—	Violent	-61	—	—
-69	—	—	—	—	Impulsive	-70	—	—
-52	—	—	—	—	Demonstrative	-56	—	—
—	64	—	—	—	Independent	—	65	—
—	63	—	—	—	Good observer	—	57	—
—	62	—	—	—	Broad-minded	—	51	—
—	62	—	—	—	Knows human nature	—	59	—
—	56	—	—	—	Brief and objective	—	51	—
—	55	—	—	—	Resolute	—	67	—
—	55	—	—	—	Practical person	—	63	—
—	54	—	—	—	Correct in reporting	—	48	—
—	51	—	—	—	Alert	—	54	—
—	49	—	—	—	Witty	—	—	—
—	44	—	—	—	Persevering	—	56	—
—	43	—	—	—	Courageous	—	46	—
—	—	—	—	—	To the point	—	44	—
—	—	—	—	—	Sensible	—	41	—
—	-41	—	—	—	Shallow	—	-44	—
—	—	54	—	—	Idealizing	—	—	56
—	—	53	—	—	Trusting	—	—	55
—	—	50	—	—	Straight	—	—	52
—	—	49	—	—	Unselfish	—	—	51
—	—	44	—	—	Good temper	—	—	47
—	—	-59	—	—	Suspicious	—	—	-59
—	—	-57	—	—	Slating	—	—	-58
—	—	-57	—	—	Egoistic	—	—	-56
—	—	-55	—	—	Imperious	—	—	-56
—	—	-55	—	—	Lustful of money	—	—	-54
—	—	-47	—	—	Self-complacent	—	—	-43
—	—	-41	—	—	Ambitious	—	—	-41
—	—	—	—	—	Irritable	—	—	-42

Constructive Approach

1. Propensities to particular behaviors are captured by verbal descriptions
2. Researchers construct items with a view to capturing/predicting phenomena of interest
3. Empirical application of item responses to solve specific prediction problems

The Eysenck organization of the 4 temperaments



The lexical hypothesis: Galton (1884) and Allport and Odbert (1936)

1. Those personality characteristics that are important to a group of people will eventually become a part of that group's language [Cattell \(1943a\)](#)
2. that character ought to be measured by carefully recorded acts, representative of the usual conduct. An ordinary generalization is nothing more than a muddle of vague memories of inexact observations. It is an easy vice to generalize. We want lists of facts, every one of which may be separably verified, valued and revalued, and the whole accurately summed. It is the statistics of each man's conduct in small every-day affairs, that will probably be found to give the simplest and most precise measure of his character. ... a practice of deliberately and methodically testing the character of others and of ourselves is not wholly fanciful, but deserves consideration and experiment. [Galton \(1884\)](#)

Allport and Odbert (1936)

1. Searched unabridged dictionary for personality terms
2. 18,000 stable traits and fluctuating states

Cattell (1943a,b, 1945); ?

1. selected words from Allport 4,504
2. formed intuitive clusters 36-46
3. factored rating scales 12-14
4. Subjects: Univ. Illinois fraternity members
5. early use of factor analysis formed personality instruments
14-16 self report scales

Cattell (1957)

1. <i>Adaptable</i> : flexible; accepts changes of plan easily; satisfied with compromises; is not upset, surprised, baffled, or irritated if things are different from what he expected	V s	<i>Rigid</i> : insists that things be done the way he has always done them; does not adapt his habits and ways of thinking to those of the group; nonplussed if his routine is upset
2. <i>Emotional</i> : excitable; cries a lot (children), laughs a lot, shows affection, anger, all emotions, to excess	V s	<i>Calm</i> : stable; shows few signs of emotional excitement of any kind; remains calm, even underreacts, in dispute, danger, social hilarity
3. <i>Conscientious</i> : honest; knows what is right and generally does not tell lies or attempt to deceive others; respects others' property	V s	<i>Unconscientious</i> : somewhat unscrupulous; not too careful about standards of right and wrong where personal desires are concerned; tells lies and is given to little deceits; does not respect others' property
4. <i>Conventional</i> : conforms to accepted standards, ways of acting, thinking, dressing, etc.; does the "proper" thing; seems distressed if he finds he is being different	V s	<i>Unconventional, Eccentric</i> : acts differently from others; not concerned about wearing the same clothes as others; has somewhat eccentric interests, attitudes, and ways of behaving; goes his own rather peculiar way

Reanalysis and extensions of Cattell (1957)

1. Fiske (1949) 5 factors
2. Tupes and Christal (1961) 5 factors of peer ratings
3. Norman (1963) "Toward an adequate taxonomy of personality attributes" 5 Factors of peer ratings:
4. Digman and Takemoto-Chock (1981); Digman (1990) 5 factors of ratings (teachers + peers)
5. Goldberg (1990) "The Big 5"
 - Surgency/Extraversion
 - greeableness
 - Conscientiousness
 - Emotional Stability versus Emotionality
 - Culture/Openness

Five Domains of Personality

Analyses and meta-analyses of constructive and analytic approaches converged on five domains ([Goldberg, 1990](#); [John, 1990](#); [McCrae and Costa, 1991](#))

Table: default

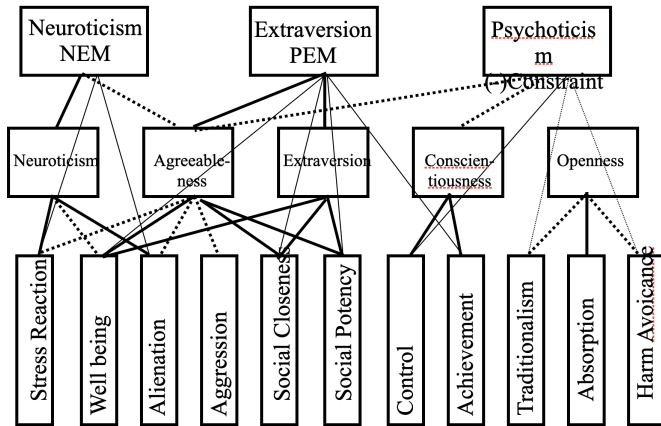
Technical domain name	colloquial domain name
Extraversion (surgency)	Power
Agreeableness	Affection
Conscientiousness	Work
Neuroticism	Emotionality
Openness	Intellect

Table: The characters of Theophrastus and the adjectives of the Big 5 show remarkable similarity. Big 5 adjectives from [John, 1990](#). The characters of Theophrastus are from [Theophrastus \(1909\)](#)

Extraversion	Agreeableness	Conscientious	Neuroticism	Openness
talkative assertive active energetic -quiet -reserved -shy -silent	sympathetic kind appreciative affectionate -cold -unfriendly -quarrelsome -hard-headed	organized thorough planful efficient -careless -disorderly -frivolous -irresponsible	tense anxious nervous moody -stable -calm -contented -unemotional	wide interests imaginative intelligent original -commonplace -simple -shallow -unintelligent
talker chatty boastful ironical petty ambition arrogant garrulous gossipy oligarch	anxious to please flatterer unpleasant feckless tiresome outcast complaisant surley evil speaker	hostile shameless distrustful slanderer penurious avaricious Reckless officious patron of rascals	coward grumbler mean unseasonable	stupid superstitious boor offensive gross

Alternative solutions

The Giant 3, Big 5, Small 11



But is Big 5 structure of what people say, not what people do

1. Is this the psychology of the stranger?
2. Is it merely dimensions of semantic lexicon
3. Are personality traits mere delusions?

Passini and Norman (1966)

1. Structure of strangers
2. Undergraduates rating other (unknown) undergraduates on 20 paragraph descriptors
3. Big 5 structure emerges
4. Is the structure of personality traits merely the structure of the lexicon, not of people?

See also [Mulaik \(1964\)](#) for the structure of adjectives.

Norman and Goldberg (1966) studied the effect of peer knowledge

1. Complete random (monte carlo)
2. Physical appearance, but no knowledge ([Passini and Norman, 1966](#))
3. ROTC trainees (some knowledge over training)
4. Peace Corps Trainees (intensive knowledge over 6 weeks)
5. Fraternity Seniors (shared housing for several years)

But interrater agreement increases with knowledge

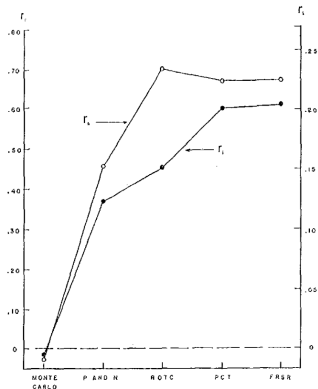


FIG. 1. r_s and r_t for average of all 20 scales. P and N = Passini and Norman data, PCT = Peace Corps trainee data, FRSR = fraternity senior data.

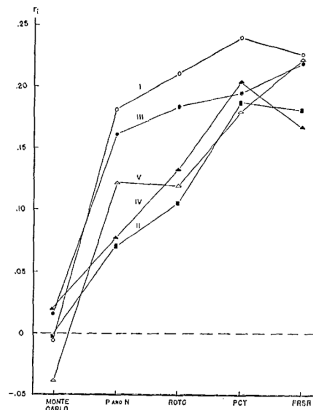


FIG. 2. r_t for averaged subsets of factor-marker scales. P and N = Passini and Norman data, PCT = Peace Corps trainee data, FRSR = fraternity senior data.

Norman and Goldberg (1966)

The systematic distortion hypothesis: Shweder and D'Andrade (1979, 1980)

1. We see what isn't there
2. To believe in personality traits is to believe in witchcraft
3. Showed this by comparing "online" ratings with memory based ratings and semantic structure.
4. memory and semantic structures correlate, online and memory do not.
5. They conclude that trait beliefs are fantasies.

Shweder and D'Andrade (1979)

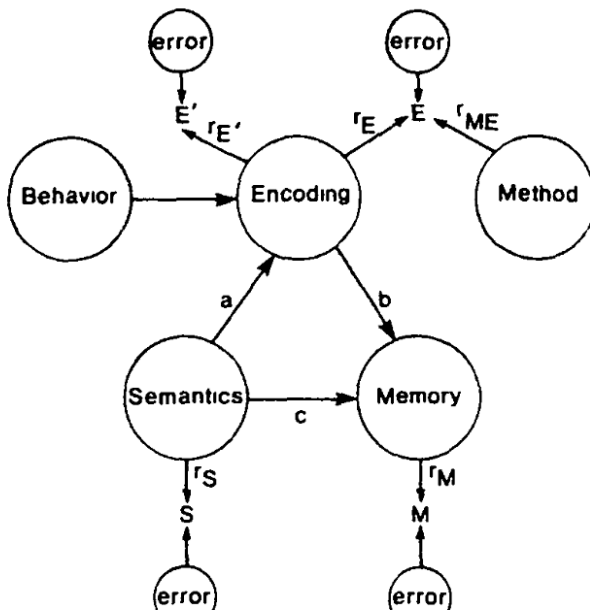
Results

1. structure of "on line measures" not the same as memory based
2. structure of memory based equivalent to semantic structure
3. Implication: structure of personality ratings is in mind of beholder, not in the behavior of target
4. But: "on line" measures were forced choice!

Romer and Revelle (1984)

1. Conceptual replication of Shweder's "on line ratings"
2. Varied "on line ratings"
3. forced choice (ala Shweder)
4. which trait does this behavior represent
 - complete rating of all traits
 - how X is this behavior Y?
5. structure of "on line ratings" depends upon method forced choice categories do not correlate on line ratings of traits match memory based

Romer and Revelle (1984) show this is an artifact.



Romer and Revelle (1984) show this is an artifact.

Table 5

Intercorrelations Between Behavior Categories for Two Observers

Behavior	Observer A (Identification)								Observer E (Scaling)							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Immediate codings																
1. Dominant	—								—							
2. Arrogant	-.18	—							.86	—						
3. Cold	.10	-.15	—						.10	.46	—					
4. Introverted	-.18	-.15	-.15	—					-.96	-.76	.17	—				
5. Submissive	-.18	-.15	-.15	-.15	—				-.96	-.73	.19	.99	—			
6. Unassuming	-.18	-.15	-.15	-.15	-.15	—			-.93	-.69	.26	.98	.99	—		
7. Warm	-.23	-.18	-.18	-.18	-.18	-.18	—		.07	-.30	-.98	-.34	-.36	-.44	—	
8. Extraverted	-.24	.18	-.19	-.19	-.19	-.19	.04	—	.91	.70	-.26	-.99	-.98	-.97	.40	—
Memory Ratings																
1. Dominant	—								—							
2. Arrogant	.86	—							.90	—						
3. Cold	.63	.66	—						.32	.51	—					
4. Introverted	-.89	-.70	-.40	—					-.88	-.78	.04	—				
5. Submissive	-.91	-.79	-.55	.79	—				-.88	-.78	.04	.99	—			
6. Unassuming	-.91	-.91	-.53	.81	.71	—			-.86	-.74	.11	.96	.96	—		
7. Warm	-.54	-.71	-.80	.19	.41	.53	—		-.01	-.31	-.82	-.34	-.34	-.34	—	
8. Extraverted	.65	.54	.03	-.87	-.65	-.65	.13	—	.91	.70	-.05	-.88	-.88	-.93	.26	—

The data for each subject

Table 4

Results of Experiment for Each Observer

		Correlations between							
Observer	$\bar{\alpha}$	Immediate coding and memory rating ^a	Immediate and memory matrices ^b		Immediate and semantics matrices ^b		Memory and semantics matrices ^b		
			<i>r</i>	<i>r</i> _s	<i>r</i>	<i>r</i> _s	<i>r</i>	<i>r</i> _s	
Identification condition									
A	.93	.66	.31	.26	.19	.27	.74	.79	
B	.84	.30	.43	.22	.43	.33	.73	.74	
C	.82	.65	.53	.58	.49	.49	.67	.69	
D	.79	.40	.52	.57	.49	.48	.53	.57	
<i>M</i>	.85	.50	.45	.41	.40	.39	.67	.70	
Scaling condition									
E	.95	.82	.99	.98	.73	.72	.74	.70	
F	.95	.95	.99	.96	.71	.74	.73	.73	
G	.91	.11	.92	.86	.76	.79	.62	.73	
H	.81	.36	.74	.72	.65	.74	.43	.45	
<i>M</i>	.91	.56	.91	.88	.71	.75	.63	.65	

Note Correlations between immediate, memory and semantics matrices are reported with Pearson (r) and Spearman (r_s) coefficients.

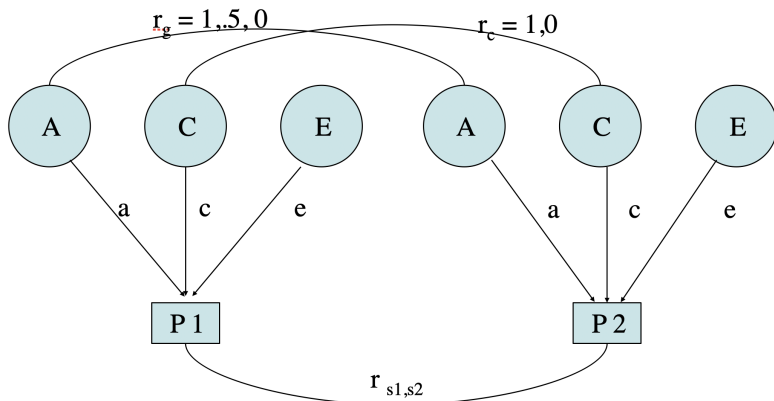
^a $N = 64$. ^b $N = 28$.

Additional construct validity studies

1. If traits have basis in behavior of targets, not in the eye of the beholder, then they should show trans-situational consistency
2. Consistency over long period of time
3. Consistency across situations
4. Consistency across degree of genetic relationship

Genetics is just psychometrics

Estimating the Genetics of Personality



A = additive genetic variance
 C = Common family environment
 E = Unique environment

$r_g = 1$ for MZ, $.5$ for DZ, sibs
 $r_c = 1$ for together, 0 apart

Table: Estimates of Heritability

Trait	Narrow heritability	Broad heritability	Shared Environment
Extraversion	0.36	0.49	0
Neuroticism	0.28	0.39	0.09
Agreeableness	0.28	0.38	0.04
Conscientiousness	0.31	0.41	0.05
Openness	0.46	0.45	0.05
IQ	0.5	0.75	0.04

McGue and Bouchard (1998)

Heritability of Occupational Interests

Table: default

interest	Narrow heritability	Broad heritability	Shared Environment
Realistic	0.36	0.41	0.12
Investigative	0.36	0.66	0.1
Artistic	0.39	0.5	0.12
Social	0.38	0.52	0.08
Enterprising	0.31	0.5	0.11
Conventional	0.38	0.38	0.11

McGue and Bouchard (1998)

Table: default

Psychiatric illness	Broad heritability	Shared Environment
Schizophrenia	0.8	No
Major Depression	0.37	No
Panic disorder	.30-.40	No
Generalized Anx	0.3	Small, females
Phobias	.2-.4	No
Alcoholism	.50-.60	Yes

Table: Genetics of attitudes

Social Attitudes	Broad heritability	Shared Environment	
Conservatism			
Under age	20	0	Yes
Over age 20	.45-.65	Yes, females	
Right Wing Auth	.50-.64	.0-.16	
Religiousness (adult)	.30-.45	.2-.4	
Specific religion	0	NA	

Heritability: misconceptions

1. High heritability => Constancy: but
2. Heritability changes by changing the environment
3. Reducing environmental variation increases the heritability
4. Herrnstein's paradox: higher heritabilities imply more equal environments
5. Low heritability => high environmental inequality

Cognitive and non-cognitive aspects of personality

1. Traditional personality variables are central tendencies of behavior: what do you like to do, how do you normally feel
2. Cognitive Ability measures are limit measures: how much can you do, what are the limits of performance

Cognitive ability and cognitive psychology

1. Ability studies emphasize individual differences and shared variance between divergent tests
2. Little emphasis upon cognitive processes
3. Traditional cognitive psychology emphasizes development of processes and distinctions between processes
4. Little emphasis upon individual differences

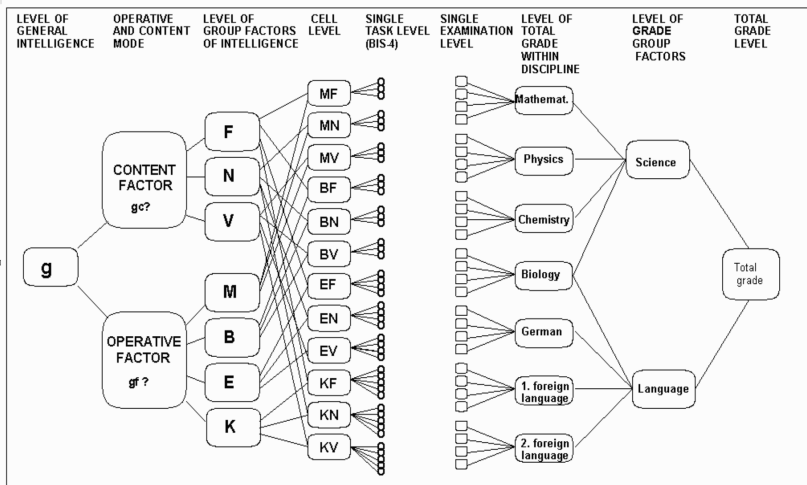
Conventional measures of ability

1. Wechsler Adult Intelligence Scales
2. Verbal and Performance subscales
3. Raven's Progressive Matrices abstract reasoning (culture fair?)
4. SAT/ACT
 - How much has been learned in 12 years of schooling
 - Vocabulary/quantitative skills

Berlin model of intelligence and performance

Fig. 9:

Hierarchical version of the Berlin model of intelligence and a grade hierarchy model



K: Processing capacity for complex information, i.e. reasoning

E: Creativity

B: Speed on relatively simple tasks

M: Memory, i.e. storage capacity for information

F: figural

N: numerical

V: verbal

Intelligence

Intelligence

Intelligence

Life as an intelligence test

1. Conventional tests are short (30 minutes to 2-3 hours) and use representative content
2. Continued performance across many situations is a continuing test of ability
3. (Gottfredson, 2004, 1997)

Table: " Relative risk (odds ratio) of this outcome for "dull" (IQ 75-90) vs. "bright" (IQ 110-125) persons: Young white adults"

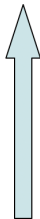
High school dropout	133.9
Chronic welfare recipient (female)	10
Ever incarcerated (male)	7.5
Lives in poverty	6.2
Had illegitimate child (women)	4.9
Unemployed 1+ mo/yr (male)	1.5
Out of labor force 1+mo/yr (male)	1.4
Divorced in 5 years (ever married)	1.3

Gottfredson (2004)

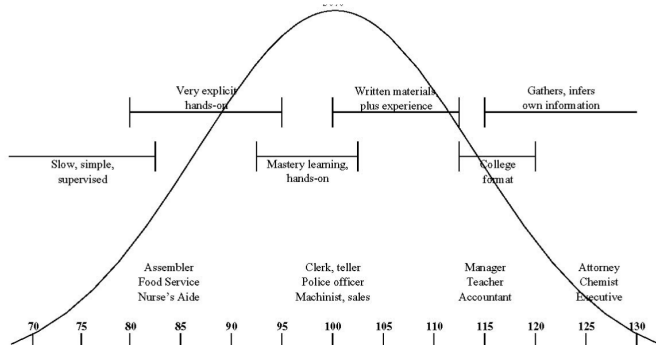
Cognitive ability and occupation

g -Related Relative Risk Varies by Kind of Outcome

**Complex
Cumulative**



**Simple
Episodic**



Cognitive ability, unanswered questions

1. Stability and change over time
2. within individuals and between individuals
3. Cultural effects
4. Genetic Effects

The “Flynn Effect”

1. Although normed for a mean of 100, $sd=15$, IQ scores have increased over time
 2. Comparisons of standardization samples given older and newer tests
 3. IQ scores on “culture fair” tests have tended to go up about 1 sd /generation
 4. IQ scores on “crystallized” tests have not increased as much
- (Flynn, 1984, 1987, 1999, 2000)

The Flynn effect: shadows on the wall?

1. Flynn effect is on observed variables, but what about change on the unobserved?
2. Jensen and Plato's cave
3. Latent variables as real heights
4. Observed variables as shadow heights
5. Shadow length is changing (Flynn effect) but are the real heights?

Group differences and heritability

1. Within group heritability does not explain between group differences
2. Consider height ([Johnson, 2010](#))
3. Within group heritability of height is \approx , .8 – .9
4. But North and South Koreans differ by 2-4 inches in height due to nutrition
5. Similar example by Lewontin

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