

Think Smart: Using Brain Science to Redefine Intelligence for 21st Century Learners

Jack A. Naglieri, Ph.D.

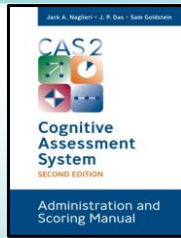
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**“Do not go where the path may lead, go instead where there is no path and leave a trail.”
Ralph Waldo Emerson**

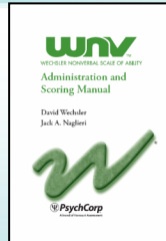
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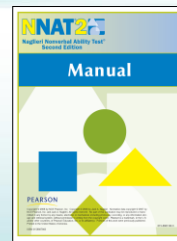
Resources and Disclosures



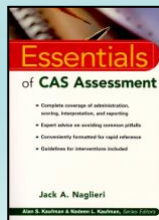
2014



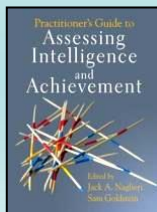
2006



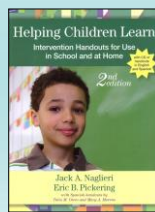
2008



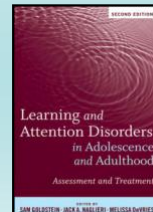
1999



2009



2010



2011

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My Background

- Interest in intelligence and instruction
- Experiences at UGA
- Test development
- Need for science to support practice
- Evidence based interpretation
- My personal responsibility as a researcher and test developer
- It's all about the people with test



Presentation Outline

- How were traditional IQ tests developed?
 - Does V/Q/NV work?
 - What is a more modern view of Intelligence?
 - Conceptualizing intelligence from brain function
 - Evidence that this approach has validity
 - Discrepancy / Consistency Model for SLD
 - Does research support second generation tests of intelligence?

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Origins of Traditional IQ

- April 6, 1917 is remembered as the day the United States entered World War I.



Origins of Traditional IQ

- On that day same a group of psychologists held a meeting in **Harvard University's Emerson Hall** to discuss the possible role psychologists could play with the war effort (Yerkes, 1921).
- Yerkes, Thorndike, Seashore, Terman, and others...



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Origins of Traditional IQ

- A group of psychologists decided to meet at the Training School in Vineland, New Jersey on May 28, 1917 to identify possible tests
- They considered many options (including the group tests that Lewis Terman's student Arthur S. Otis developed)



Lieut. Arthur S. Otis,
Fall 1917

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Origins of Traditional IQ

- The goal was to find tests that could efficiently evaluate a wide variety of men, be easy to administer and easy to score.
- The tests they assembled were examined in a study involving about 4,000 subjects and the data collected and analyzed by another group including: Woodworth, Thorndike (Chief Statistician), Otis, and Thurstone



E. L. Thorndike



R. Woodworth

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Origins of Traditional IQ

- If they were wealthy they traveled in..



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Origins of Traditional IQ

- On July 20, 1917 the first research study showed that the Alpha and Beta tests could
 - “aid in segregating and eliminating the mentally incompetent,
 - classify men according to their mental ability; and
 - assist in selecting competent men for responsible positions” (p. 19, Yerkes, 1921).
- Thus, **July 20, 1917** is the birth date of the verbal (& quantitative) / nonverbal IQ test format; what has become, **Traditional IQ tests.**

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Origins of Traditional IQ

- The next step was application of the Alpha and Beta tests which was accomplished in about 250 testing sites around the country
- One of the Enlisted personnel in the Medical Corps trained in the School for Military Psychology was
- **DAVID WECHSLER**

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Origins of Traditional IQ

- In May of 1918 a 22 year-old David Wechsler arrived at Camp Logan in Texas to use the newly developed Alpha and Beta (Yerkes, 1921, p. 40)

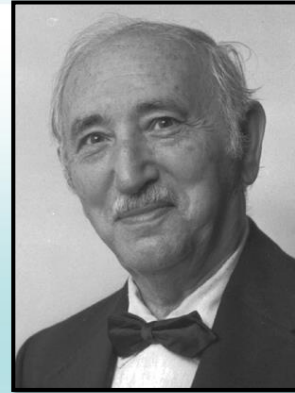


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Army Testing Program?

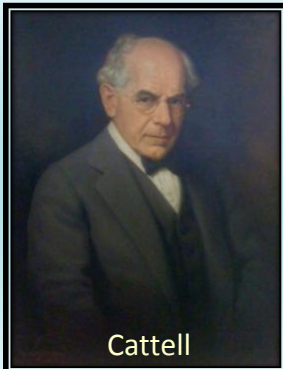
- David Wechsler (January 12, 1896 – May 2, 1981)
- The Army also sent Wechsler to the University of London to work with Spearman and Pearson (1918)
- He got an idea...make a version of the Army tests for use by clinical psychologists
- He contacted the Psychological Corporation...Who did he speak with?



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The Psychological Corporation

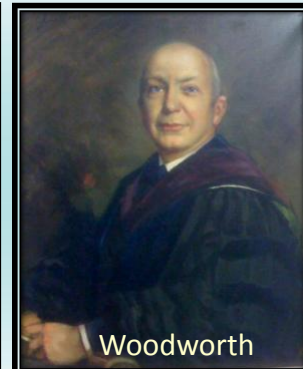
Cattell, Thorndike and Woodworth all have portraits at corporate headquarters of The Psychological Corporation (now Pearson) in San Antonio, Texas. They were on the board of the and instrumental in the formation of the company.



Cattell

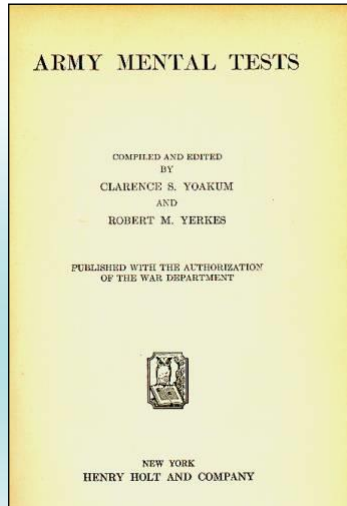


Thorndike



Woodworth

IQ's Origins



- Yoakum & Yerkes (1920) summarized the methods used by the military to
 - classify people from many backgrounds by mental capacity

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1920 Army Testing

- Army Alpha
 - Synonym- Antonym
 - Disarranged Sentences
 - Number Series
 - Arithmetic Problems
 - Analogies
 - Information

Verbal &
Quantitative



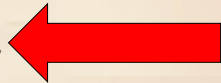
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Army Mental Tests → Information & WISC

No. 11 PSYCHOLOGICAL EXAMINING IN THE UNITED STATES ARMY. 213

EXAMINATION Q

Test 5 Information.



- 1 The color of fresh snow is white blue brown green
- 2 The cars are used in breathing digestion hearing seeing
- 3 Cows eat mostly meat grass nuts fruit
- 4 Dogs like best to eat grass seeds fruits meat
- 5 Thorns grow on daisies buttercups sun-flowers roses
- 6 Bull Durham is the name of chewing-gum aluminum-ware tobacco clothing
- 7 America was discovered by Drake Hudson Columbus Cabot
- 8 The apple grows on a vine bush tree rood
- 9 Berlin is the capital of Russia Germany England France
- 10 Blood is pumped by the lungs liver heart kidneys
- 11 Molasses is obtained from honey petroleum turpentine sugar-cane
- 12 Bowling is played with rackets cards balls dice
- 13 Baltimore is in Maryland Virginia Pennsylvania Ohio
- 14 St. Paul is in Missouri Minnesota Mississippi Florida
- 15 Ordinary flour is made from barley rye oats wheat
- 16 The lemon is most like the apple pear peach orange
- 17 The sacrifice hit comes in foot-ball tennis base-ball hand-ball
- 18 Gas engines are fabricated by gasoline air water oil
- 19 Buenos Ayres is a city of Spain Argentina Brazil Portugal

Army Mental Tests → Similarities on WISC

TEST 4

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If the two words of a pair mean the same or nearly the same, draw a line under *same*. If they mean the opposite or nearly the opposite, draw a line under *opposite*. If you cannot be sure, guess. The two samples are already marked as they should be.

- | | | | | |
|---------|----------------------------------|-----------|-----------------------|----|
| SAMPLES | { good—bad | | <u>same</u> —opposite | |
| | { little—small | | <u>same</u> —opposite | |
| | 1 wet—dry | | <u>same</u> —opposite | 1 |
| | 2 in—out | | <u>same</u> —opposite | 2 |
| | 3 hill—valley | | <u>same</u> —opposite | 3 |
| | 4 allow—permit | | <u>same</u> —opposite | 4 |
| | 5 expand—contract | | <u>same</u> —opposite | 5 |
| | 6 class—group | | <u>same</u> —opposite | 6 |
| | 7 former—latter | | <u>same</u> —opposite | 7 |
| | 8 confess—admit | | <u>same</u> —opposite | 8 |
| | 9 shy—timid | | <u>same</u> —opposite | 9 |
| | 10 delicate—tender | | <u>same</u> —opposite | 10 |
| | 11 extinguish—quench | | <u>same</u> —opposite | 11 |
| | 12 cheerful—melancholy | | <u>same</u> —opposite | 12 |
| | 13 accept—reject | | <u>same</u> —opposite | 13 |

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ARMY MENTAL TESTS

Army Mental Tests → Arithmetic on WISC

TEST 2

Get the answers to these examples as quickly as you can.
Use the side of this page to figure on if you need to.

- SAMPLES { 1 How many are 5 men and 10 men? Answer (15)
 2 If you walk 4 miles an hour for 3 hours, how far do you walk? Answer (12)
- 1 How many are 40 guns and 6 guns? Answer (46)
 - 2 If you save \$6 a month for 5 months, how much will you save? Answer (30)
 - 3 If 32 men are divided into squads of 8, how many squads will there be? Answer (4)
 - 4 Mike had 11 cigars. He bought 3 more and then smoked 6. How many cigars did he have left? Answer (8)
 - 5 A company advanced 6 miles and retreated 3 miles. How far was it then from its first position? Answer (3)
 - 6 How many hours will it take a truck to go 48 miles at the rate of 4 miles an hour? Answer (12)
 - 7 How many pencils can you buy for 40 cents at the rate of 2 for 5 cents? Answer (16)
 - 8 A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day 6 miles, the third 10 miles, the fourth 9 miles. How many miles did they march the last day? Answer (6)
 - 9 If you buy 2 packages of tobacco at 8 cents each and a pipe for 55 cents, how much change should you get from a two-dollar bill? Answer (1.27)
 - 10 If it takes 8 men 2 days to dig a 160-foot drain, how many men are needed to dig it in half a day? Answer (32)

ARMY MENTAL TESTS

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Army Mental Tests - Vocabulary

- SAMPLES { sky—blue :: grass—table green warm big
 fish—swims :: man—paper time walks girl
 day—night :: white—red black clear pure

In each of the lines below, the first two words are related to each other in some way. What you are to do in each line is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

- 1 gun—shoots :: knife—run cuts hat bird 1
- 2 ear—hear :: eye—table hand ~~see~~ play 2
- 3 dress—woman :: feathers—bird neck feet bill 3
- 4 handle—hammer :: knob—key room door ~~shoe~~ 4
- 5 shoe—foot :: hat—coat nose head ~~ocular~~ 5
- 6 water—drink :: bread—cake coffee eat pie 6
- 7 food—man :: gasoline—gas oil automobile spark 7
- 8 eat—fat :: starve—thing food read thirsty 8
- 9 man—home :: bird—fly insect worm nest 9
- 10 go—come :: sell—leave buy money papers 10
- 11 peninsula—land :: bay—boats pay ocean Massachusetts 11
- 12 hour—minute :: minute—man work ~~short~~ 12
- 13 abide—depart :: stay—over home play game 13
- 14 January—February :: June—July May month year 14
- 15 bold—timid :: advance—proceed retreat campaign soldier 15

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ARMY MENTAL TESTS

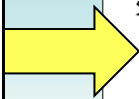
Army Mental Tests → Comprehension on WISC

This is a test of common sense. Below are sixteen questions. Three answers are given to each question. You are to look at the answers carefully; then make a cross in the square before the best answer to each question, as in the sample:

SAMPLE { Why do we use stoves? Because
 they look well
 they keep us warm
 they are black

Here the second answer is the best one and is marked with a cross. Begin with No. 1 and keep on until time is called.

- | | |
|--|--|
| <p>1 If plants are dying for lack of rain, you should</p> <p><input checked="" type="checkbox"/> water them</p> <p><input type="checkbox"/> ask a florist's advice</p> <p><input type="checkbox"/> put fertilizer around them</p> <p>2 A house is better than a tent, because</p> <p><input type="checkbox"/> it costs more</p> <p><input checked="" type="checkbox"/> it is more comfortable</p> <p><input type="checkbox"/> it is made of wood</p> | <p><input type="checkbox"/> give it to the first poor man you meet</p> <p><input checked="" type="checkbox"/> tell him of his mistake</p> <p>5 Why should food be chewed before swallowing?</p> <p><input checked="" type="checkbox"/> it is better for the health</p> <p><input type="checkbox"/> it is bad manners to swallow without chewing</p> <p><input type="checkbox"/> chewing keeps the teeth in condition</p> |
|--|--|



1920 Army Testing

- Army Alpha
 - Synonym- Antonym
 - Disarranged Sentences
 - Number Series
 - Arithmetic Problems
 - Analogies
 - Information
- Army Beta
 - Maze
 - Cube Imitation
 - Cube Construction
 - Digit Symbol
 - Pictorial Completion
 - Geometrical Construction

Verbal &
Quantitative

Nonverbal
(Performance)

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Army Mental Tests → WISC Picture Arrangement & Block Design

Test 9.—Picture Arrangement

E. presents demonstrational set and allows S. to see it for about 15 seconds. Then, making sure that S. is attending, he slowly rearranges the pictures and points to each one in succession, attractively.

Test 4.—Cube Construction

of important
sents set (a),
to indicate th
stand, E. sho
to set (b). S
as (a), except

(a) E. presents model 1 and the corresponding blocks, points to bottom, top, and sides of model; then places it upon the table and assembles the blocks rather slowly, turning each block over in the fingers and pointing to painted and unpainted sides. E. now presents the same model and the blocks in irregular order, then points in order to S., to the model, to the blocks, and nods affirmatively. E. repeats, if S. does not understand.

(b) E. presents model 2 with the nine blocks for its construction; shows S. bottom, top, and sides of model; then places it

Army Mental Tests → WISC Digit Symbol (Coding) & Mazes

Test 7.—Digit Symbol

record sheet, points to blank below 2
symbol for 2 at top of page, writes in s
me way with the other parts of the
cil, points to space below 3 in the te

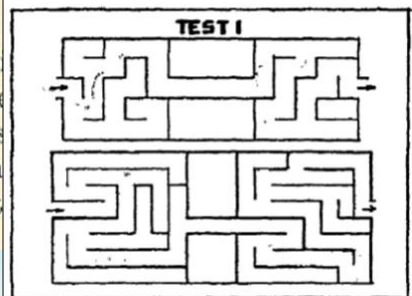
TEST 4

1	2	3	4	5	6	7	8	9
-	∇	∩	L	U	0	Λ	X	≡

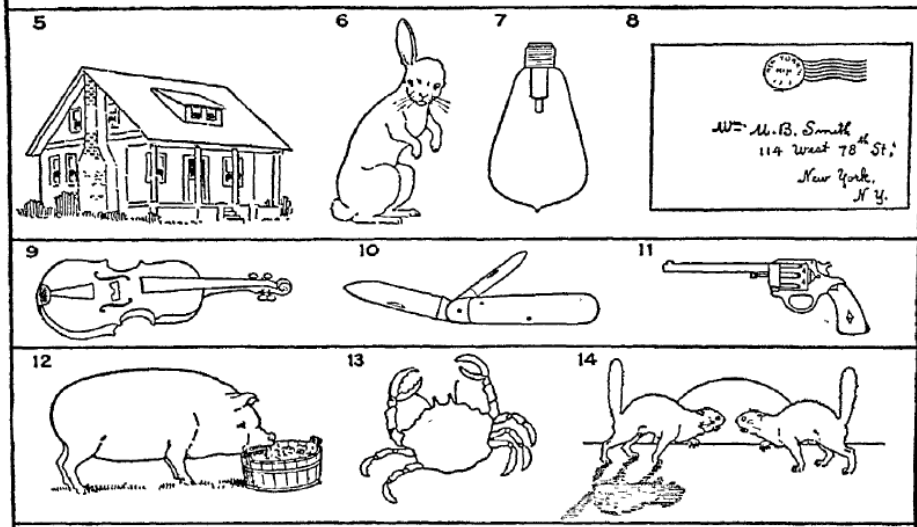
3	1	2	3	2	1	2	1	3	4	7	5	4	1	6

Test 8.—The Maze

onstration maze (a), and with his pencil
shortest way out. At critical points he
ll in wrong direction without marking, s
tinues to work in the right direction
t maze A, gives S. pencil, points to st



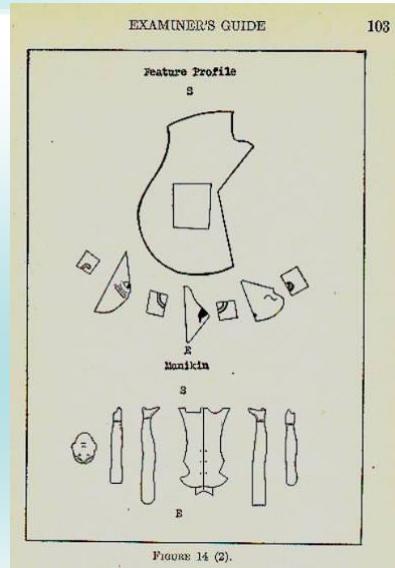
Army Mental Testing → WISC Picture Completion



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Army Mental Tests → WISC Object Assembly

- Wechsler used the Army tests as a basis for his tests
- Wechsler's nonverbal tests were much like those included in the Army Beta



Army Alpha and Beta


- The Army Alpha contained Verbal and Quantitative tests which Wechsler put on his **Verbal IQ scale**
- The Army Beta contained visual-spatial tests which Wechsler put on his **Performance IQ, (Perceptual Reasoning)** and which is often called Nonverbal
- Did this mean Wechsler believed in Verbal and Nonverbal intelligences?

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What a Nonverbal Test Measures

(Naglieri, Brulles, & Lansdown, 2008)

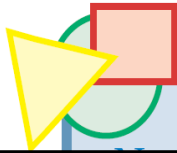
 Helping All Gifted Children Learn: A Teacher's Guide to Using the NNAT2

It is important to understand that even though Wechsler's intelligence (IQ) tests were organized into verbal and nonverbal sections, he did not mean that verbal and nonverbal are different types of ability. Wechsler (1958) explicitly stated that the organization of subtests into verbal and performance scales did *not* indicate that two distinctive types of intelligence were being measured. In fact, he

What a Nonverbal Test Measures

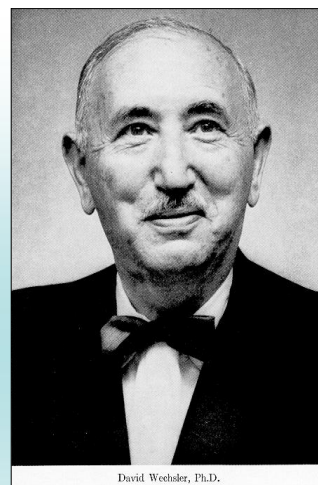
(Naglieri, Brulles, & Lansdown, 2008)

wrote: “the subtests are different measures of intelligence, not measures of different kinds of intelligence” (p. 64). Similarly, Naglieri (2003) further clarified that “the term nonverbal refers to the content of the test, not a type of ability” (p. 2). Thus, tests may differ in their content or specific demands, but still measure the concept of general intelligence.



Wechsler's Definition

- Definition of intelligence does not mention verbal or nonverbal *abilities*:
“The aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment (1939)”



David Wechsler, Ph.D.



Verbal Nonverbal Intelligence?

- Verbal / Nonverbal is a practical division
- Advantages of Verbal tests
 - they correlate with achievement because they have achievement in them
 - Information, Vocabulary, Arithmetic
- Advantages of Nonverbal Tests
 - they correlate with achievement without having achievement in them
- **Why NONVERBAL ?**

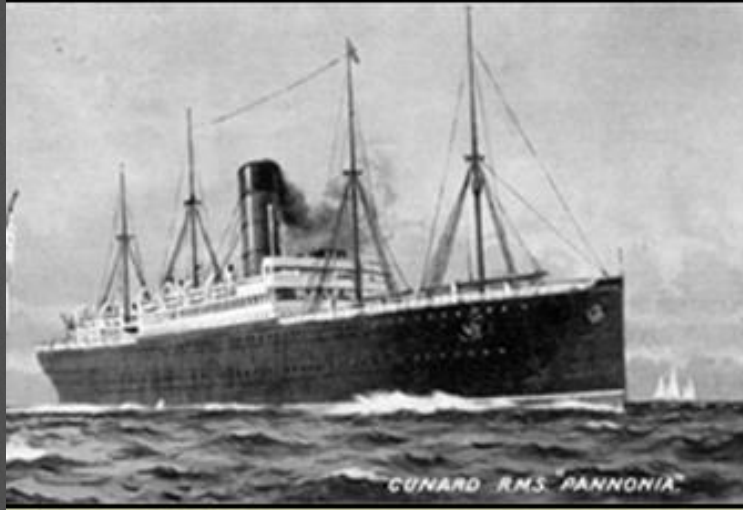


Antonino Mirenda (1894)

PASSENGER RECORD	
<small>American Family Immigration Library Center at Ellis Island</small>	
First Name:	Antonino
Last Name:	Mirenda
Ethnicity:	Italy
Last Place of Residence:	Bitonto, Italy
Date of Arrival:	Dec 30, 1912
Age at Arrival: 28y	Gender: M
Ship of Travel:	Alfonso
Port of Departure:	Naples
Manifest Line Number:	0029



**RMS Pannonia – Messina → Italy to NY City
December 30, 1912**



Ellis Island in New York Harbor



Ellis Island Screening



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Antonino Mirenda

Chalk Markings



Suspected
mental defect



Definite signs of
mental disease observed

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A. Mirenda Groceries 622 Ave X, Brooklyn, NY



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1927 Army Testing

METHODS AND RESULTS

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Why Beta?

Men who fail in alpha are sent to beta in order that injustice by reason of relative unfamiliarity with English may be avoided.
 Men who fail in beta are referred for individual examination by means of what may appear to be the most suitable and altogether appropriate procedure among the varied methods available. This reference for careful individual examination is yet another attempt to avoid injustice either by reason of linguistic handicap or accidents incident to group examining.

Note there is no mention of measuring verbal and nonverbal intelligences

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The case of Rocky

- ▶ Rocky¹ is a real child with a real problem
- ▶ He lives in a large middle class school district
 - a wide variety of services are available
- ▶ In first grade Rocky was performing significantly below grade benchmarks in reading, math, and writing.
 - He received group reading instruction weekly and six months of individual reading instruction from a reading specialist
 - He made little progress and was retained

Note: This child's name and other potentially revealing data have been changed to protect his identity.

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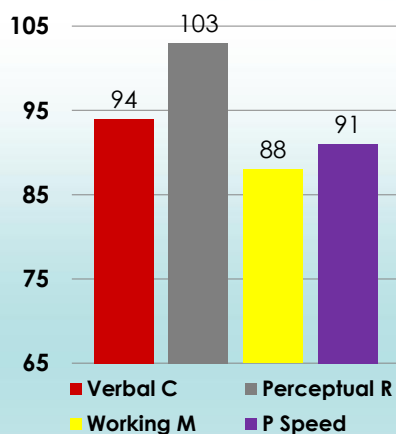
The case of Rocky

- ▶ By the middle of his second year in first grade Rocky is now working two grade levels below his peers and is having difficulty in reading, writing, and math
- ▶ Rocky was given a complete evaluation by the school psychologist

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The case of Rocky - WISC-IV



Rocky has an ability achievement discrepancy (LD). But we don't know what if anything is causing his academic failure despite much academic intervention.

WISC-IV

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The case of Rocky

- What have we done to enhance the information from the WISC?
 - Subtest analysis (doesn't work)
 - Interpretation of subtests according to other views (Working Memory, Speed, CHC, etc) which doesn't work
 - Abandon IQ testing all together (doesn't work)
- We want to help our students, but how?

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Take Away Message

- Wechsler used the Army Mental Tests to make an individually administered measure of IQ
- There was no theory of intelligence upon which the Army Mental Tests, Wechsler's tests, the Binet, DAS and WJ were built
- We have worked hard to bring a model or theory of intelligence to IQ tests
- Instead we should demand that all intelligence tests be built on a theory (not a model or idea)

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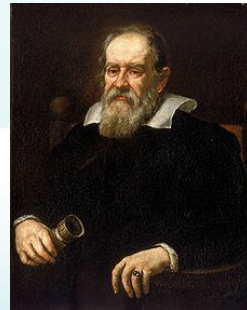
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The Solution: Rethink IQ and Intelligence

Start with a
THEORY OF INTELLIGENCE
Then Build a Test of Intelligence

Galileo Galilei


- “It appears to me”, Vincenzo Galileo remarked, “that those who rely simply on the weight of authority to prove any assertion, without search out the arguments to support it, act absurdly. I wish to question freely without any sort of adulation. That well becomes any who are sincere in the search for truth.”
(James Reston’s book, Galileo)



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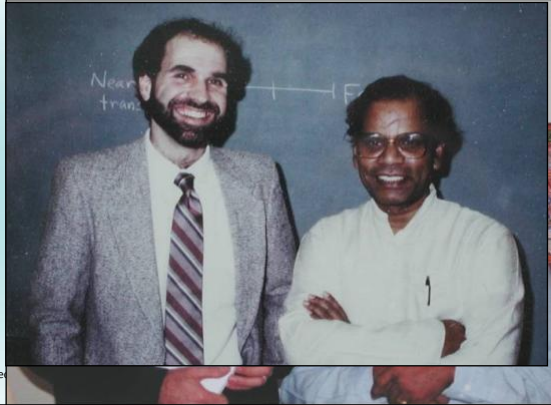
IQ as Neurocognitive Abilities

- Start with a *theory*
- A theory based on brain research
- Build a new test on the theory
- Do not let traditional IQ constrain the content of a new test
- Expand the scope of the test to include specific abilities not in traditional IQ
- Replace IQ with neurocognitive abilities

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IQ as Neurocognitive Abilities

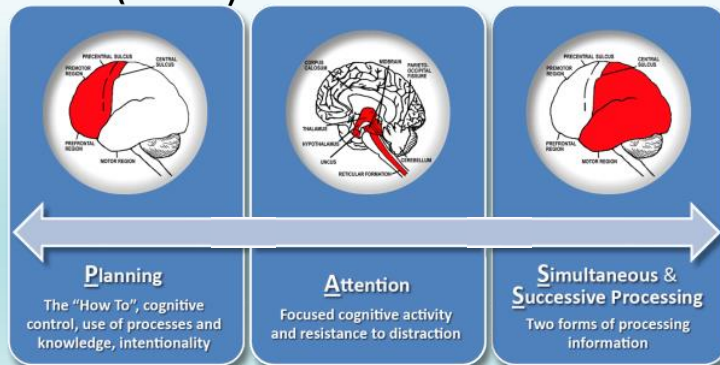
- Das and Naglieri publish the Cognitive Assessment System (Naglieri & Das, 1997) and the CAS2 (Naglieri, Das, & Goldstein, 2014.)
- The CAS is the first intelligence test to be built on a specific theory of intelligence.
- How?



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IQ as Neurocognitive Abilities

Three Functional Units described by A. R. Luria (1972)



IQ as Neurocognitive Abilities

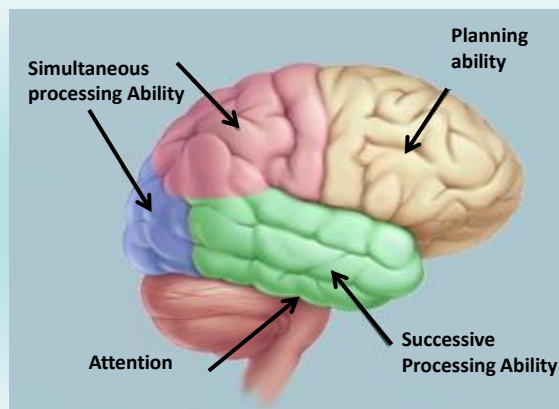
- **PASS** theory is a modern way to define 'ability' (AKA – intelligence)
- **Planning** = THINKING ABOUT THINKING
- **Attention** = BEING ALERT
- **Simultaneous** = GETTING THE BIG PICTURE
- **Successive** = FOLLOWING A SEQUENCE



IQ as Neurocognitive Abilities

- The brain is the seat of abilities called PASS
- These abilities comprise what has been described as a modern view of intelligence (Naglieri & Otero, 2011)

Naglieri, J. A. & Otero, T. (2011). Cognitive Assessment System: Redefining Intelligence from A Neuropsychological Perspective. In A. Davis (Ed.). *Handbook of Pediatric Neuropsychology* (320-333). New York: Springer Publishing.



The Neurocognitive Theory

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Cognitive Assessment System: Redefining Intelligence From a Neuropsychological Perspective

Jack A. Naglieri and Tulio M. Otero

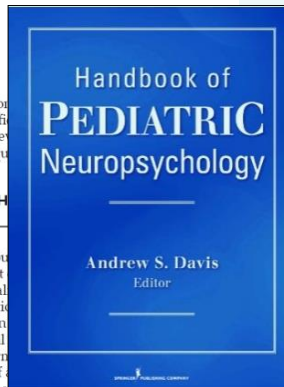
INTRODUCTION

Pediatric neuropsychology has become an important field for understanding and treating developmental, psychiatric, psychosocial, and learning disorders. By addressing both brain functions and environmental factors intrinsic in complex behaviors, such as thinking, reasoning, planning, and the variety of executive capacities, clinicians are able to offer needed services to children with a variety of learning, psychiatric, and developmental disorders. Brain-behavior relationships are investigated by neuropsychologists by interpreting several aspects of an individual's cognitive, language, emotional, social, and motor behavior. Standardized instruments are used by neuropsychologists to collect information and derive inferences about brain-behavior relationships. Technology, such as magnetic resonance imaging (MRI), functional MRI (fMRI), positron emission tomography, computerized tomography, and diffusion tensor imaging, has reduced the need for neuropsychological tests to localize and access brain damage. Neuropsychological tests, however,

Such tools should not only assess necessary for efficient processes necessary for efficient also provide for the development and address the quality

FROM NEUROPSYCHOLOGY TO ASSESSMENT

Luria's theoretical account perhaps one of the most influential (2008). Luria conceptualized of brain-behavior relationships orders that the clinician understand the brain, the functional syndromes and impairments and clinical methods of assessment. Luria's theoretical formulations, methods, and tests are articulated in works such as *Higher cortical functions in man* (1966, 1980) and *The Working Brain* (1973). Luria viewed the brain as a functional mosaic, the parts of which interact in dif-



The Neurocognitive Test

The Cognitive Assessment System

Jack A. Naglieri, Cara Conway

THEORY UNDERLYING THE CAS

The *Cognitive Assessment System (CAS)* (Naglieri & Das, 1997a) is a multidimensional measure of ability based on a cognitive and neuropsychological processing theory called *Planning, Attention, Simultaneous, and Successive (PASS)* (Naglieri, 1999a, 2005). The PASS theory described by Naglieri and Das (1997b, 2005) is a reconceptualization of intelligence largely, but not solely, based on the neuropsychological work of A. R. Luria (1966, 1973, 1980, 1982). The four processes that make up the PASS theory represent a blend of cognitive and neuropsychological constructs, such as executive functioning (Planning) and selective attention (Attention), including tests that in the past were often arguably described as nonverbal/visual-spatial (Simultaneous) and sequencing/memory (Successive) (Naglieri & Das, 2002).

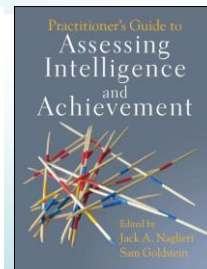
The PASS theory is a different approach to understanding intelligence that not only

the theory may have its roots in neuropsychology, "its branches are spread over developmental and educational psychology" (Varnhagen & Das, 1986, p. 130). Thus, with its connections to developmental and cognitive processing, the PASS theory offers an advantage in explanatory power over the notion of traditional general intelligence (Naglieri & Das, 2002).

PASS Defined

The four cognitive processes that make up the PASS theory are each associated with different brain regions, cognitive abilities, and behaviors (Naglieri, Conway, & Goldstein, 2007). The four processes of the PASS theory are described more fully below.

Planning is a mental activity that provides cognitive control, intentionality, organization, self-regulation and use of processes, knowledge, and skills. This includes self-monitoring and impulse control as well as generation, evaluation, and execution of a plan. This process may involve control over the other three processes, as well as



Jack A. Naglieri - J. P. Das - Sam Goldstein



Cognitive Assessment System
SECOND EDITION

Administration and Scoring Manual

Neurocognitive Abilities For Teachers

(www.kathleenkryza.com)



Kathleen Kryza's
InfiniteHorizons
www.kathleenkryza.com

Inspiring Ideas for Teachers
August, 2013
Quick Links

"It is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail." - Abraham Harold Maslow

Plan to Succeed!

In the July newsletter, [Self-Regulation Empowers Students](#), we discussed Jack Naglieri's P.A.S.S. theory (Naglieri, 2010).

We described the four abilities as presented in the P.A.S.S. theory: Planning, Attention, Simultaneous processing, and Successive processing. When taught in conjunction, these abilities are shown to have long-term positive effects for students both in terms of academic success as well as personal concepts of self-efficacy.

As promised, we will now dig a little deeper into the first ability listed in the P.A.S.S. theory – Planning. *Planning is a neurocognitive ability that a person uses to determine, select, and use efficient solutions to problems. It involves: evaluating tasks, selecting or developing



 [Resources](#)
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PASS Theory: Planning

► **Planning** is a neurocognitive ability that a person uses to determine, select, and use efficient solutions to problems

- developing plans and using strategies
- Know when to get more information
- impulse control and self-control
- control of behavior, emotions, and thinking

Planned Codes

- ▶ Child fills in the codes in the empty boxes
- ▶ Students are encouraged to think of a good way to complete the page

A	B	C	D
X O	O O	X X	O X

A	B	C	D	A
X O	O O	X X		
A	B	C	D	A
X O	O O			
A	B	C	D	A
X O	O O			
A	B	C	D	A
X O	O O			

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Planned Codes 2

- Page 2
- What is a good plan to complete this page?
- Note orientation

A	B	C	D
X O	O O	X X	O X

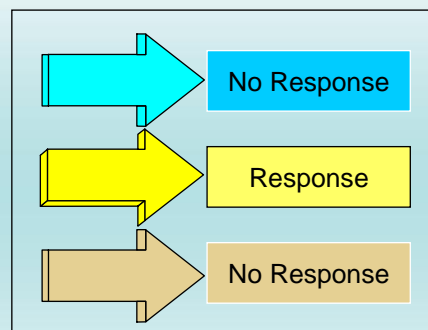
A	B	C	D	A
X O	O O	X X		
D	A	B	C	D
O X	X O			
C	D	A	B	C
X X	O X			
B	C	D	A	B
O O	X X			



PASS Theory

► **Attention** is a neurocognitive ability used to selectively attend and resist distractions

- selective attention
- focused cognitive activity over time
- resistance to distraction



**Attention Test Instructions:
You will see words like**

RED

**Your task: say the COLOR (blue)
not the word (red)**

READY ?

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B **L** **U** **E** **!**

Expressive Attention - Italiano

ROSSO	BLU	VERDE	GIALLO
GIALLO	VERDE	ROSSO	BLU
ROSSO	GIALLO	GIALLO	VERDE
BLU	VERDE	ROSSO	ROSSO
VERDE	GIALLO	BLU	GIALLO

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PASS Theory

- **Simultaneous** is a neurocognitive ability a person uses to integrate stimuli into groups
 - Parts are seen as a whole
 - Seeing relationships among parts
 - Visual spatial tasks like Block Design, Object Assembly, Matrices
 - WISC Perceptual Reasoning, KABC Simultaneous Scale

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Simultaneous Neurocognitive Ability

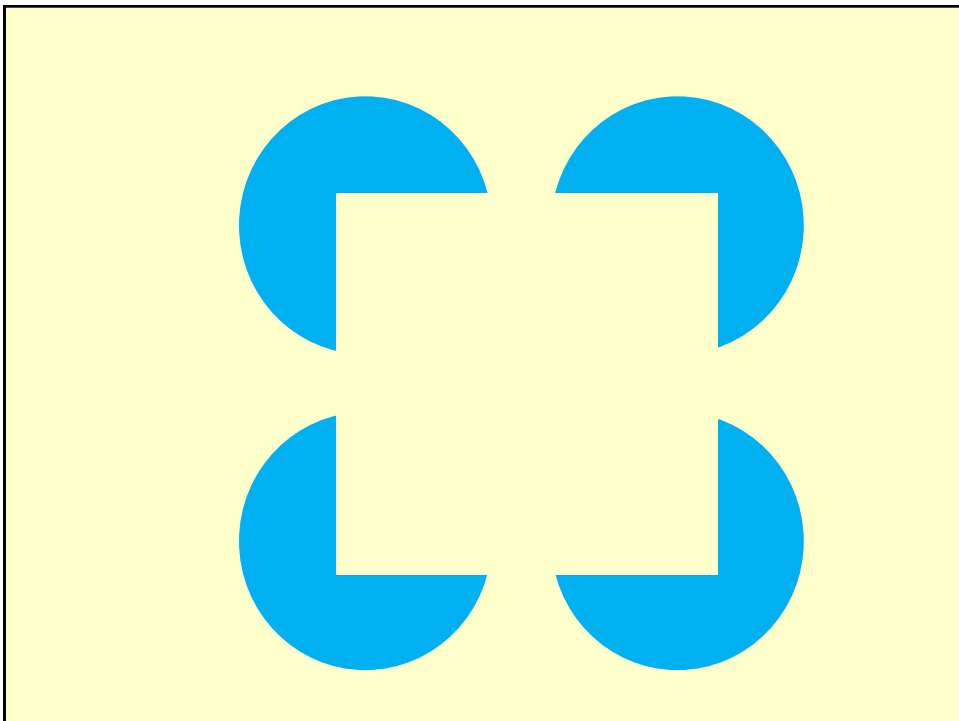
Girl is to woman as boy is to _____?

Simultaneous ability is used whenever the inter-relationships among ideas is required.

The diagram illustrates an analogical reasoning puzzle. It consists of a 2x2 grid of shapes in the top row: a yellow square and a blue square. Below it is another 2x2 grid: a yellow circle and a dotted box containing a question mark. Below these are five numbered options: 1. a blue square, 2. a yellow circle, 3. a blue diamond, 4. a blue circle, and 5. a circle that is half blue and half white.

Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

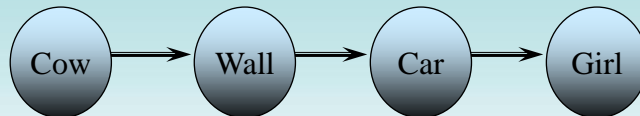
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Successive Processing Ability

▶ **Successive** processing is a basic cognitive ability which we use to manage stimuli in a specific serial order

- Stimuli form a chain-like progression
- Stimuli are not inter-related
- Speech, motor movements, reading decoding, spelling, recall of numbers in order, etc.



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Take Away Message

- Intelligence is better conceptualized based on brain function
- PASS is a brain-based theory of intelligence
- PASS is measured by the Cognitive Assessment System (Naglieri & Das, 1997) and the Cognitive Assessment System – Second Edition (Naglieri, Das & Goldstein, 2014)

Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

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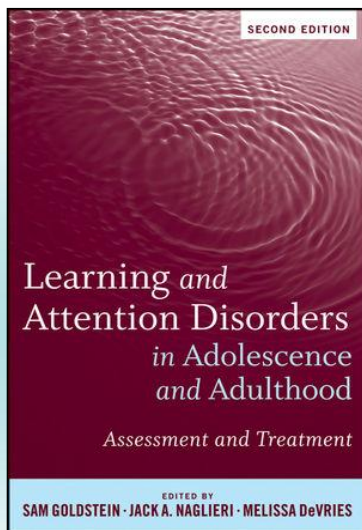
Presentation Outline

- How were traditional IQ tests developed?
- Does V/Q/NV work?
- What is a more modern view of Intelligence?
 - Conceptualizing intelligence from brain function
 - Evidence that this approach has validity
 - Discrepancy / Consistency Model for SLD
- Does research support second generation tests of intelligence?

Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

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Comparison of Intelligence Tests



CHAPTER

6

Assessment of Cognitive and Neuropsychological Processes

JACK A. NAGLIERI
SAM GOLDSTEIN

INTRODUCTION

Assessment of intelligence plays an important role in the process of determining if an adolescent or adult has a disability. For those suspected of having a Specific Learning Disability (SLD), the intelligence test provides an important reference point to compare to levels of achievement. For those who may have Attention-Deficit/Hyperactivity Disorder (ADHD), the measure of intelligence is used to rule out other disabilities that may better explain the person's behavior. Intelligence tests have and will continue to provide a critical component of any comprehensive assessment needed to determine the presence of disabilities, such as SLD and ADHD. Their importance, however, demands a thorough understanding of the strengths and limitations of these tests of ability, an appreciation of the research on their effectiveness, and an examination of modern views of assessing intelligence. The goal of this chapter is to address these issues.

This chapter reexamines intelligence as measured by traditional IQ tests with special attention to the utility such tests have for diagnosis. In order to achieve this goal, the chapter includes a brief overview of the history and definitions of intelligence and examines examples of measures of intelligence more closely. Emphasis will be placed on the importance of understanding how intelligence is conceptualized and measured by different tests and the implications this has for assessment. The chapter also provides a conceptual model of assessment of basic psychological processes and how that information can aid in the diagnostic process and treatment of adolescents and adults.

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Naglieri

Naglieri & Goldstein (2011)

GROUP PROFILES BY ABILITY TEST

Because ability tests play such an important role in the diagnostic process, it is crucial to understand the sensitivity each test may have to any unique characteristics of those with an SLD or attention deficit. Clinicians need to know if an adolescent or adult has a specific deficit in ability that is related to a specific academic learning problem. There has been considerable research on, for example, Wechsler subtest profile analysis, and most researchers conclude that no profile has diagnostic utility for individuals with SLD or ADHD (Kavale & Forness, 1995). The failure of subtest profiles has led some to argue (e.g., Naglieri, 1999) that scale, rather than subtest, variability should

1. We need to know if intelligence tests yield distinctive profiles

2. Subtest profiles –
UNSUPPORTED so use
Scales instead

slides by Jack A. Naglieri, Ph.D. (jnag)

Naglieri & Goldstein (2011)

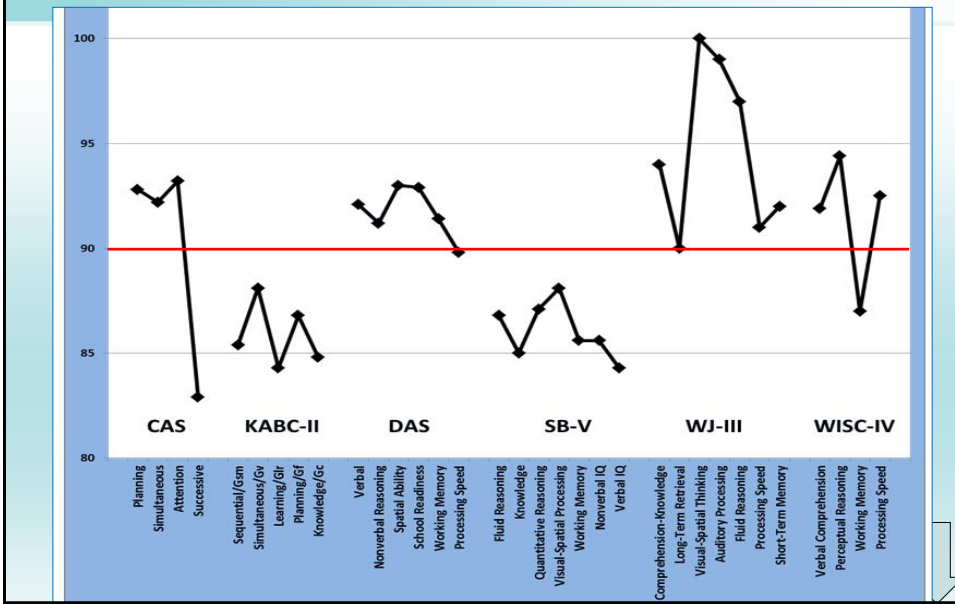
Scales should fit a theory and show mean score differences within a measure

be examined, especially if the separate scales have ample theoretical and empirical support. In the sections that follow, research on the scale profiles is presented first for those ability tests that are used for adolescents and adults, and then for those that can be used only with adolescents. The goal is not to describe these instruments; interested readers should examine their respective test manuals. Instead, the goal is to examine the mean scores of the scales from each test. This examination helps us understand if the ability test shows a particular pattern for a specific clinical group. Such information could have important implications for understanding the cognitive characteristics of that clinical group and allow for possible diagnostic and intervention considerations. These findings, however, must be taken with recognition that the samples are not matched across the various studies, the accuracy of the diagnosis may not have been verified, and some of the sample sizes may be small. Notwithstanding these limitations, the findings do provide important insights into the extent to which these various tests can be used for assessment of adolescents and adults suspected of having an SLD or attention deficit.

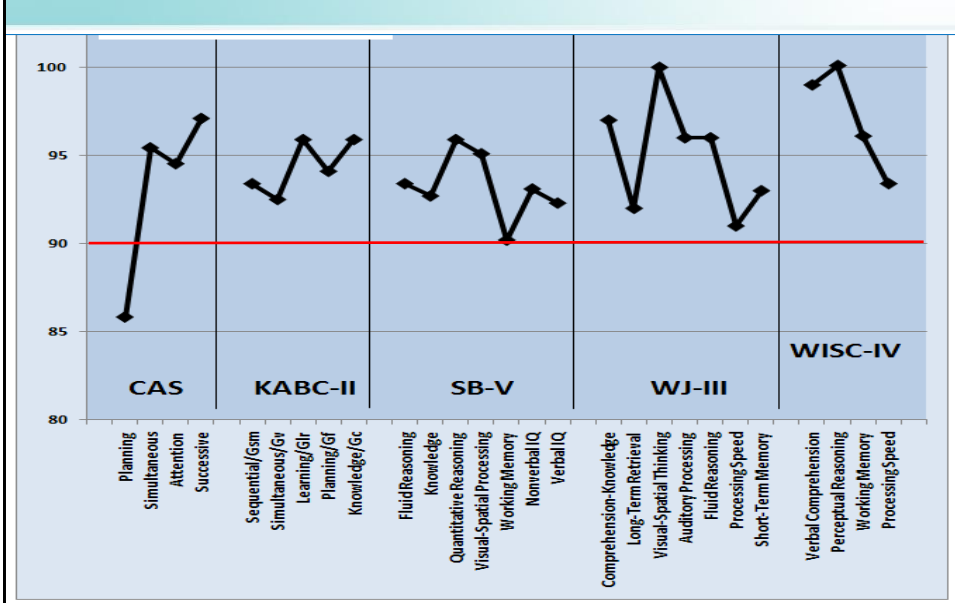
Limitations: different samples and accuracy of diagnostic group likely varies

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Comparison of Tests: Reading Decoding



Comparison of Tests: ADHD



Johnson, Bardos & Tayebi, 2003

- “this study suggests that the CAS...yields information that contributes to the differential diagnosis of students suspected of having a learning disability in writing”

Journal of Psychoeducational Assessment
2003, 21, 180-195

DISCRIMINANT VALIDITY OF THE COGNITIVE ASSESSMENT SYSTEM FOR STUDENTS WITH WRITTEN EXPRESSION DISABILITIES

Judy A. Johnson
University of Houston - Victoria

Achilles N. Bardos
University of Northern Colorado

Kandi A. Tayebi
Sam Houston State University

This study explored the PASS cognitive processing theory in junior high students (aged 11-15 years) with and without written expression disabilities. Ninety-six students with ($n = 48$) and without ($n = 48$) written expression disabilities were administered the Das-Naglieri: Cognitive Assessment System (DN-CAS; 1997) and the writing subtests of the Wechsler Individual Achievement Test (WIAT; 1992). Discriminant analyses were utilized to identify

the DN-CAS subtests and composites that contributed to group differentiation. The Planning composite was found to be the most significant contributor among the four composite scores. Subsequent efficiency of classification analyses provided strong support for the validity of the obtained discriminant functions in that the four DN-CAS composite scale scores correctly identified 83% of the students as members of their respective groups.

Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

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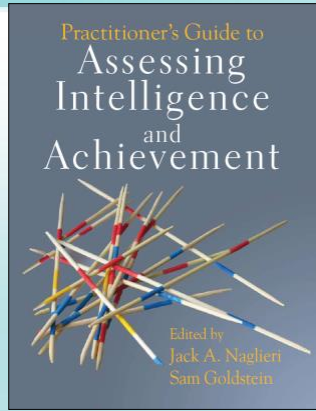
Performance Across Race, Ethnicity, Culture and Language

Non-discriminatory Assessment

Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

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Why PASS?



CHAPTER 3

The Cognitive Assessment System

Jack A. Naglieri, Cara Conway

THEORY UNDERLYING THE CAS

The *Cognitive Assessment System (CAS)* (Naglieri & Das, 1997a) is a multidimensional measure of ability based on a cognitive and neuropsychological processing theory called *Planning, Attention, Simultaneous, and Successive (PASS)* (Naglieri, 1999a, 2005). The PASS theory described by Naglieri and Das (1997b, 2005) is a reconceptualization of intelligence largely, but not solely, based on the neuropsychological work of A. R. Luria (1966, 1973, 1980, 1982). The four processes that make up the PASS theory represent a blend of cognitive and neuropsychological constructs, such as executive functioning (Planning) and selective attention (Attention), including tests that in the past were often arguably described as nonverbal/visual-spatial (Simultaneous) and sequencing/memory (Successive) (Naglieri & Das, 2002).

The PASS theory is a different approach to understanding intelligence that not only expands the idea of what "abilities" should be measured, but also stresses the significance of basic psychological or cognitive processes. Additionally, the functions of the brain that encompass the PASS processes are considered the building blocks of ability conceptualized within a cognitive processing framework. While

the theory may have its roots in neuropsychology, "its branches are spread over developmental and educational psychology" (Varnhagen & Das, 1986, p. 130). Thus, with its connections to developmental and cognitive processing, the PASS theory offers an advantage in explanatory power over the notion of traditional general intelligence (Naglieri & Das, 2002).

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The essence of the construct of Planning and tests to measure it is that they provide a novel problem-solving situation for which one does not have a previously acquired strategy. This is also similar to how the concept of executive function

Mean Score Differences by Race

Traditional

SB-IV (matched)	12.6
WISC-IV (normative sample)	11.5
WJ- III (normative sample)	10.9
WISC-IV (matched)	10.0

Second-Generation

K-ABC (normative sample)	7.0
K-ABC (matched)	6.1
KABC-2 (matched)	5.0
CAS-2 (normative sample)	6.3
CAS (demographic controls)	4.8
CAS-2 (demographic controls)	4.3

Notes: Stanford-Binet IV (SB-IV) from Wasserman (2000); (Woodcock-Johnson III) WJ-III from Edwards & Oakland (2006); Kaufman Assessment Battery for Children (K-ABC) matched from Naglieri (1986); Kaufman Assessment Battery for Children-2 from (Lichenberger, Sotelo-Dynega & Kaufman, 2009); CAS from Naglieri, Rojahn, Matto & Aquilino (2005); Wechsler Intelligence Scale for Children -IV (WISC-IV) from O'Donnell (2009).

Bilingual Hispanic Children's Performance on the English and Spanish Versions of the Cognitive Assessment System

Jack A. Naglieri

George Mason University

Tulio Otero

Columbia College, Elgin Campus

Brianna DeLauder

George Mason University

Holly Matto

Virginia Commonwealth University

School Psychology Quarterly
2007, Vol. 22, No. 3, 432–448

This study compared the performance of referred bilingual Hispanic children on the Planning, Attention, Simultaneous, Successive (PASS) theory as measured by English and Spanish versions of the Cognitive Assessment System (CAS; Naglieri & Das, 1997a). The results suggest that students scored similarly on both English and Spanish versions of the CAS. Within each version of the CAS, the bilingual children earned their lowest scores in Successive processing regardless of the language used during test administration. Small mean differences were noted between the means of the English and Spanish versions for the Simultaneous and Successive processing scales; however, mean Full Scale scores were similar. Specific subtests within the Simultaneous and Successive scales were found to contribute to the differences between the English and Spanish versions of the CAS. Comparisons of the children's profiles of cognitive weakness on both versions of the CAS showed that these children performed consistently despite the language difference.

Keywords: bilingual assessment, intelligence, PASS Theory, Cognitive Assessment System, non-biased assessment

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English Spanish CAS

Table 2. Means, Standard Deviations, *d* Ratios, and Obtained and Correction Correlations Between the English and Spanish Versions of the Cognitive Assessment System (CAS; *N* = 55)

CAS Subtests and Scales	CAS English		CAS Spanish		<i>d</i>	Correlations	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		Obtained	Corrected
Scales							
Planning	92.65	13.19	92.65	13.48	.00	.96	.97
Simultaneous	89.05	12.81	93.05	13.76	-.30	.90	.93
Attention	94.84	13.96	95.11	13.94	-.02	.98	.98
Successive	78.04	13.17	83.15	12.69	-.40	.82	.89
Full Scale	84.64	13.66	87.64	13.85	-.22	.96	.97

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US and Italian Samples – Factor Structure

Psychological Assessment
2013, Vol. 25, No. 1, 157–166

© 2012 American Psychological Association
1040-3590/13/\$12.00 DOI: 10.1037/a0029828

Multigroup Confirmatory Factor Analysis of U.S. and Italian Children's Performance on the PASS Theory of Intelligence as Measured by the Cognitive Assessment System

Jack A. Naglieri
University of Virginia and Devereux Center for Resilient Children

Stefano Taddei
University of Florence

Kevin M. Williams
Multi-Health Services, Toronto, Ontario, Canada

This study examined Italian and U.S. children's performance on the English and Italian versions, respectively, of the Cognitive Assessment System (CAS; Naglieri & Conway, 2009; Naglieri & Das, 1997), a test based on a neurocognitive theory of intelligence entitled PASS (Planning, Attention, Simultaneous, and Successive; Naglieri & Das, 1997; Naglieri & Otero, 2011). CAS subtest, PASS scales, and Full Scale scores for Italian ($N = 809$) and U.S. ($N = 1,174$) samples, matched by age and gender, were examined. Multigroup confirmatory factor analysis results supported the configural invariance of the CAS factor structure between Italians and Americans for the 5- to 7-year-old (root-mean-square error of approximation [RMSEA] = .038; 90% confidence interval [CI] = .033, .043; comparative fit index [CFI] = .96) and 8- to 18-year-old (RMSEA = .036; 90% CI = .028, .043; CFI = .97) age groups. The Full Scale standard scores (using the U.S. norms) for the Italian (100.9) and U.S. (100.5) samples were nearly identical. The scores between the samples for the PASS scales were very similar, except for the Attention Scale ($d = 0.26$), where the Italian sample's mean score was slightly higher. Negligible mean differences were found for 9 of the 13 subtest scores, 3 showed small d -ratios (2 in favor of the Italian sample), and 1 was large (in favor of the U.S. sample), but some differences in subtest variances were found. These findings suggest that the PASS theory, as measured by CAS, yields similar mean scores and showed factorial invariance for these samples of Italian and American children, who differ on cultural and linguistic characteristics.

Keywords: intelligence, neuropsychology, cross-cultural, cognitive assessment system, PASS theory

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US and Italian Samples— Mean Scores

Table 5

Means and SDs for Italian Children ($N = 809$) on the CAS Subtests and PASS and Full Scales Using U.S. Norms and Comparisons to U.S. Sample ($N = 1,174$), Matched by Age

Subtests and scales	Italian			U.S.			F	p	d -ratio
	M	SD	n	M	SD	n			
CAS composite scales									
Planning	97.7	13.4	809	100.5	15.4	1,174	18.1	<.01	-0.19
Simultaneous	103.0	13.9	809	101.1	14.1	1,174	9.3	<.01	0.14
Attention	104.2	13.7	809	100.6	14.4	1,174	32.2	<.01	0.26
Successive	99.0	12.5	809	100.5	14.5	1,174	5.1	.02	-0.11
Full Scale	100.9	12.9	809	100.5	14.8	1,174	2.3	.13	0.03

Note. CAS = Cognitive Assessment System; PASS = Planning, Attention, Simultaneous, and Successive. U.S. sample N s vary due to missing data. Designations for d -ratios are as follows: T = trivial (.02), S = small (.2), M = medium (.5), and L = large (.8). For all F values the dfs are 1, 1219 and Sentence Length (1, 1219) and Sentence Length (1, 1219).

Italian mean = 100.9 & US mean = 100.5

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Take Away Message

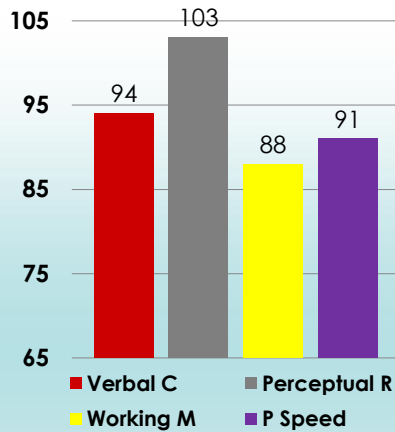
- Why does PASS theory work?
 - It measures important basic neurocognitive processes
 - It does not measure ability by tests that involve academic skills, that is no vocabulary, information, arithmetic, etc.
- All traditional IQ tests with verbal and quantitative tests are contaminated by knowledge

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Back to Rocky

He has a severe learning disability

Rocky's WISC-IV and CAS results

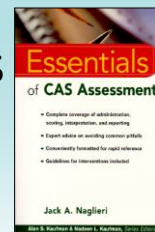


WISC-IV

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The case of Rocky

- ▶ Rocky meets the definition of SLD in IDEA: a “disorder in one or more of the basic psychological processes”
 - Planning = 72 & Successive = 76
- ▶ Rocky has documented academic failure
- ▶ He has a pattern of strengths and weaknesses in cognitive processes that underlie his academic problems
- ▶ See Naglieri (1999) Essentials of CAS Assessment for more information



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The case of Rocky

▶ Rocky needs...

- Specialized instruction that takes into account his learning needs
- Instruction should emphasize the use of strategies and plans in all content areas
- Instruction should include ways to better work with serial information
- Rote memory and phonics instruction are ill-advised

Jack A. Naglieri, Ph.D. George Mason Univ, Fairfax, VA 22030. naglieri@gmu.edu

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The case of Rocky

Using Plans to Overcome Anxiety

Some children do. Anxiety is strong if a child does not have a good plan. A child may actually be in a new situation and make a new plan. When a new situation is recognized, a

Teaching Students About Planning

How Learning Depends on Planning Ability

Segmenting Words for Reading/Decoding and Spelling

How to Use:

Follow these

1. Read the word.
2. Divide the word into chunks.

Decoding requires the student to look at the sequence of the letters in words and understand the organization of specific sounds in order. Some students have difficulty with long sequences of letters and may benefit from instruction that helps them break the word into smaller, more manageable units, called *chunks*. Sometimes the order of the sounds in a word is more easily organized if the entire word is broken into these units. These chunks can be combined into units for accurate decoding. Chunking for reading/decoding is a strategy designed to do this.

Chunking for Reading/Decoding

Reading/decoding requires the student to look at the sequence of the letters in words and understand the organization of specific sounds in order. Some students have difficulty with long sequences of letters and may benefit from instruction that helps them break the word into smaller, more manageable units, called *chunks*. Sometimes the order of the sounds in a word is more easily organized if the entire word is broken into these units. These chunks can be combined into units for accurate decoding. Chunking for reading/decoding is a strategy designed to do this.

Rocky Needs Cognitive Strategy Instruction

A Cognitive Strategy Instruction to Improve Math Calculation for Children With ADHD and LD: A Randomized Controlled Study

HAMMILL INSTITUTE
ON DISABILITIES

Journal of Learning Disabilities
44(2) 184-195
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sagepub.com/journalsPermissions.nav
DOI: 10.1177/0022219410391190
http://journalsoflearningdisabilities
.sagepub.com
SAGE

Jackie S. Iseman¹ and Jack A. Naglieri¹

Abstract

The authors examined the effectiveness of cognitive strategy instruction based on PASS (Planning, Attention, Simultaneous, Successive) given by special education teachers to students with ADHD randomly assigned by classroom. Students in the experimental group were exposed to a brief cognitive strategy instruction for 10 days, which was designed to encourage development and application of effective planning for mathematical computation, whereas the comparison group received standard math instruction. Standardized tests of cognitive processes and math achievement were given at pretest. All students completed math worksheets throughout the experimental phase. Standardized achievement tests (*Woodcock-Johnson Tests of Achievement, Third Edition*, Math Fluency and *Wechsler Individualized Achievement Test, Second Edition*, Numerical Operations) were administered pre- and postintervention, and Math Fluency was also administered at 1 year follow-up. Large pre-post effect sizes were found for students in the experimental group but not the comparison group on math worksheets (0.85 and 0.26), Math Fluency (1.17 and 0.09), and Numerical Operations (0.40 and -0.14, respectively). At 1 year follow-up, the experimental group continued to outperform the comparison group. These findings suggest that students with ADHD evidenced greater improvement in math worksheets, far transfer to standardized tests of math (which measured the skill of generalizing learned strategies to other similar tasks), and continued advantage 1 year later when provided the PASS-based cognitive strategy instruction.

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Take Away Message

- Traditional IQ tests have limits
- Neurocognitive tests are a logical step in the evolution of intelligence testing
 - Sensitivity to learning problems
 - Equitable assessment for diverse groups
 - Relationship to instruction
- **We will help more students using second-generation ability tests...and a final thought**

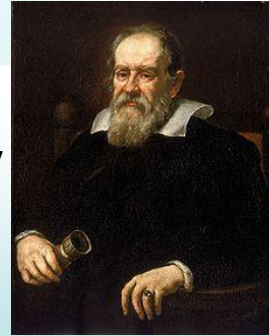
Slides by Jack A. Naglieri, Ph.D. (jnaglieri@gmail.com)

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Galileo Galilei

Vicenzo Galileo:

“It appears to me that they who rely simply on the weight of authority to prove any assertion, without searching out the arguments to support it, act absurdly. I wish to question freely and to answer freely without any sort of adulation. That well becomes any who are sincere in the search for truth” (From James Reston’s book entitled *Galileo*)



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