

One

OVERVIEW OF THE WJ III COG AND DS

The Woodcock-Johnson[®] III Tests of Cognitive Abilities (WJ III[®] COG; Woodcock, McGrew, & Mather, 2001, 2007c) is a battery of carefully engineered tests for measuring cognitive abilities and related aspects of cognitive functioning (Woodcock, 1992). The Diagnostic Supplement to the WJ III COG (DS; Woodcock, McGrew, Mather, & Schrank, 2003, 2007) provides additional tests that increase the diagnostic utility of the WJ III COG. In all, 31 tests are contained in the standard battery, an extended battery, and the diagnostic supplement. Some WJ III COG tests are appropriate for individuals as young as 24 months, and all of the tests can be used with individuals from 5 to 95 years of age. Various tests from the WJ III COG and DS are combined into clusters for interpretive purposes.

The WJ III COG was conormed with the Woodcock-Johnson III Tests of Achievement (WJ III ACH; Woodcock, McGrew, & Mather, 2001, 2007b). The conormed battery is referred to as the complete Woodcock-Johnson III (WJ III; Woodcock, McGrew, & Mather, 2001, 2007a). Using the WJ III COG, DS, and the WJ III ACH together, professionals are able to make accurate comparisons among an individual's cognitive abilities, oral language ability, and achievement.

The Woodcock-Johnson III Normative Update (WJ III NU; Woodcock, McGrew, Schrank, & Mather, 2007) provides the most current norms for the WJ III. The WJ III NU is based on 2005 census statistics (U.S. Census Bureau, 2005) and updated norm construction procedures. The WJ III NU norms are reflected in the Woodcock-Johnson III Normative Update Compuscore[®] and Profiles Program (Compuscore; Schrank & Woodcock, 2008) and the Woodcock Interpretation and Instructional Interventions Program[™] (WIIP[™]; Schrank, Wendling, & Woodcock, 2008). The WIIP is a particularly relevant tool for many assessment purposes because it provides a link between the

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WJ III COG, DS, and WJ III ACH scores and educational interventions or accommodations.

A MODEL OF CHC THEORY

The WJ III was designed to reflect the body of research on the structure of human cognitive abilities known as Cattell-Horn-Carroll (CHC) theory. CHC theory is based on an integration of two independently derived theories of intellectual abilities: *Gf-Gc* theory and Carroll's three-stratum theory.

Gf-Gc theory is a model that has been developed and refined over the last 60 years by Cattell, Horn, and their research associates. At an American Psychological Association conference in 1941, Cattell proposed that the constructs of fluid intelligence (*Gf*) and crystallized intelligence (*Gc*) could be distinguished as two basic types of human intellectual ability. As a result of this early conceptualization, this theory came to be called *Gf-Gc* theory (Horn, 1965, 1991; Horn & Noll, 1997), even though the theory has subsequently been expanded to include as many as 9 or 10 broad factors.

Carroll's (1993) three-stratum theory is based on exploratory factor analyses of more than 400 data sets of human cognitive ability experiments. Carroll developed the three-stratum theory to describe both the content and the hierarchical structure of cognitive abilities. Each stratum represents a different level of abstraction. Stratum I includes approximately 70 narrow abilities derived from more than 400 data sets; Stratum II represents Carroll's groupings of differentiated broad abilities that are similar to the *Gf-Gc* factors recognized by Horn and others; Stratum III represents the construct of general intellectual ability (*g*) (Carroll, 1993, 1998). Figure 1.1 is a pictographic representation of Carroll's three-stratum theory.

By mutual consensus, the integration of these two independently and empirically derived theories was named CHC theory (J. B. Carroll & J. L. Horn, personal communication, July 1999). CHC theory provided the blueprint for the WJ III and subsequent support for interpretation of the WJ III COG at three levels: general intellectual ability, several broad cognitive abilities, and specific (or narrow) cognitive abilities. Rapid Reference 1.1 summarizes the CHC abilities measured by the WJ III COG and DS.

GENERAL INTELLECTUAL ABILITY

The WJ III COG and DS include four different options for calculating general intellectual ability (called GIA in the WJ III; see Rapid Reference 1.2). Each option

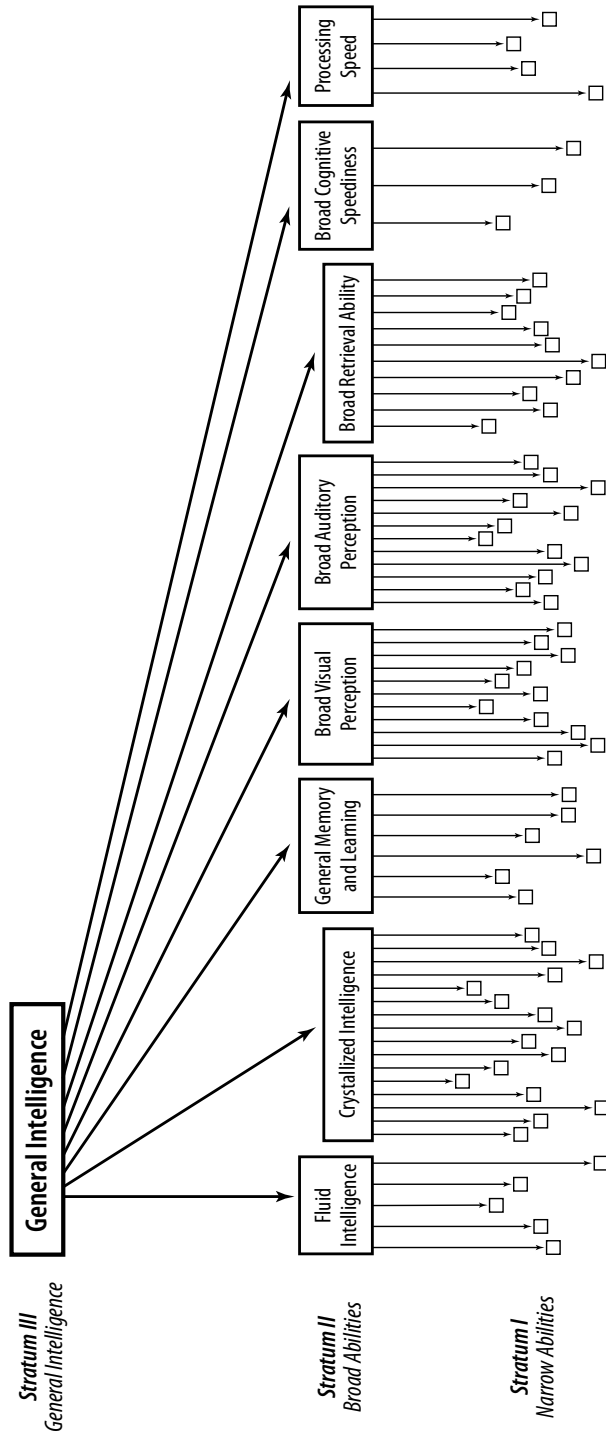


Figure 1.1 Representation of Carroll's Three-Stratum Theory

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 *Rapid Reference 1.1***CHC Abilities Measured by the WJ III COG and DS**

Stratum I	Stratum II	Stratum III
Lexical Knowledge/Language Development	Comprehension-Knowledge	General Intellectual Ability
General (verbal) Information		
Associative Memory	Long-Term Retrieval	
Ideational Fluency		
Visualization	Visual-Spatial Thinking	
Spatial Relations		
Visual Memory		
Spatial Scanning		
Closure Speed		
Speech-Sound Discrimination	Auditory Processing	
Resistance to Auditory Stimulus Distortion		
Phonetic Coding		
Induction	Fluid Reasoning	
Sequential Reasoning		
Quantitative Reasoning		
Semantic Processing Speed	Processing Speed	
Perceptual Speed		
Naming Facility		
Auditory Memory Span	Short-Term Memory	
Working Memory Capacity		

 *Rapid Reference 1.2***Four General Ability Scales in the WJ III COG and DS**

General Intellectual Ability–Standard (GIA-Std): Tests 1–7

General Intellectual Ability–Extended (GIA-Ext): Tests 1–7 and 11–17

General Intellectual Ability–Bilingual (GIA-Bil): Tests: 1, 3, 5, 6, 7, 21, 23, 31

General Intellectual Ability–Early Development (GIA-EDev): Tests 1, 6, 8, 21, 22, 27

includes a different combination of tests. General Intellectual Ability–Standard (GIA-Std) includes seven tests; each of the tests is a single measure of a broad CHC ability. General Intellectual Ability–Extended (GIA-Ext) includes fourteen tests; the GIA-Ext score includes two tests that measure each of the broad CHC abilities. The General Intellectual Ability–Bilingual (GIA-Bil) option includes seven tests that were selected for English-dominant bilingual individuals. Some of the GIA-Bil tests were selected for the scale because they provided a language-reduced format. One of the GIA-Bil tests includes an accommodation procedure for assessing verbal ability in English and Spanish combined (Test 31: Bilingual Verbal Comprehension–English/Spanish). The General Intellectual Ability–Early Development (GIA-EDev) scale includes six tests that are developmentally appropriate for young children. The six tests represent six broad CHC abilities. The GIA-EDev score does not include a measure of Fluid Reasoning (*Gf*).

Each general intellectual ability score is a measure of psychometric *g*, one of psychology's oldest and most solidly established constructs—and the first authentic latent variable in the history of psychology. The existence of *g* was originally hypothesized by Galton (1869) and was later empirically established by Spearman (1904). It may be important to understand that *g* (and, by inference, the WJ III GIA score) does not represent an ability per se; rather, it is a distillation of abilities. Unlike the broad or narrow abilities identified by CHC theory, *g* simply cannot be described in terms of information content. That is, there is no singular defining characteristic of *g* that can be stated in psychological terms. You should consider the GIA score as an index of a well-defined theoretical postulate (*g*) that is identified at Stratum III in Carroll's three-stratum model of human cognitive abilities (Carroll, 1993). However, the index has broad practical utility, as *g* will often be the best *single-score* predictor of various global criteria such as overall school achievement or other life outcomes that have some relationship to cognitive ability.

Each WJ III COG GIA score provides an index of the common variance among the broad and narrow cognitive abilities measured by the component tests in the scale. The GIA score represents a distillate of several cognitive abilities and the primary source of variance that is common to all of the tests included in its calculation. Some scholars of intelligence, notably Horn, state that *g* is merely a statistical artifact. Others, such as Jensen (1998), refer to *g* as a property of cognitive processing. For example, Jensen said that *g* “reflects individual differences in information processing as manifested in functions such as attending, selecting, searching, internalizing, deciding, discriminating, generalizing, learning, remembering, and using incoming and past-acquired information to solve problems and cope with the exigencies of the environment” (p. 117).

BROAD ABILITY CLUSTERS AND CONSTITUENT NARROW ABILITIES

The WJ III COG broad ability clusters represent the Stratum II broad factors in CHC theory. In the WJ III COG, the clusters representing the broad abilities were designed to provide breadth among the different narrow abilities within each broad cognitive factor. That is, each component test was designed to contribute a different aspect to the broad ability. The following description of the broad cognitive ability scores (Stratum II) includes information on the constituent narrow abilities (Stratum I) included in each cluster score.

Comprehension-Knowledge (Gc), sometimes called crystallized intelligence, includes the breadth and depth of a person's acquired knowledge, the ability to communicate one's knowledge (especially verbally), and the ability to reason using previously learned experiences or procedures. The *Gc* cluster includes two tests measuring different narrow abilities. Test 1: Verbal Comprehension primarily measures *lexical knowledge* and *language development*. Test 11: General Information primarily measures *general verbal information*. In the WJ III COG, this cluster is also called *Verbal Ability*.

Long-Term Retrieval (Glr) is the ability to store information and fluently retrieve it later. The *Glr* cluster includes two tests, each measuring a different aspect of retrieval. Test 2: Visual-Auditory Learning measures *associative memory*. Test 12: Retrieval Fluency measures *ideational fluency*.

Visual-Spatial Thinking (Gv) is the ability to perceive, analyze, synthesize, and think with visual patterns, including the ability to store and recall visual representations. This cluster includes two tests. Test 3: Spatial Relations measures the ability to use *visualization in thinking*. Test 13: Picture Recognition is a *visual memory* task.

Auditory Processing (Ga) is the ability to analyze, synthesize, and discriminate auditory stimuli, including the ability to process and discriminate speech sounds that may be presented under distorted conditions. Test 4: Sound Blending measures *phonetic coding*. Test 14: Auditory Attention measures the ability to understand speech that has been distorted or masked in one or more ways (or *resistance to auditory stimulus distortion*).

Fluid Reasoning (Gf) includes the ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures. The *Gf* cluster includes two tests of fluid reasoning. Test 5: Concept Formation is a test of *induction*. Test 15: Analysis-Synthesis measures *sequential (deductive) reasoning*.

Processing Speed (Gs) represents the ability to perform automatic cognitive tasks, an aspect of cognitive efficiency. Test 6: Visual Matching measures *perceptual speed*. Test 16: Decision Speed measures *speed of semantic processing*.

Short-Term Memory (Gsm) is the ability to apprehend and hold information in immediate awareness and then use it within a few seconds. The *Gsm* cluster includes two tests. Test 7: Numbers Reversed is a complex measure of *working memory capacity*. Test 17: Memory for Words is a verbal *memory span* test.

Narrow Ability Cluster Scores

In contrast to the broad cognitive ability (CHC) clusters, the following clusters contain two or more tests that measure the same narrow cognitive ability:

- *Phonemic Awareness* (PC) measures the ability to attend to the sound structure of language through analyzing and synthesizing speech sounds (phonetic coding). This cluster includes Test 4: Sound Blending and Test 8: Incomplete Words. An extended cluster with greater content coverage (Phonemic Awareness 3) can be obtained by conjointly administering Test 21: Sound Awareness from the *Woodcock-Johnson III Tests of Achievement* (WJ III ACH; Woodcock, McGrew, & Mather, 2001, 2007b).
- *Associative Memory* (MA) measures the ability to store and retrieve associations through paired-associate learning. Test 2: Visual-Auditory Learning and Test 21: Memory for Names form this cluster. A measure of the ability to recall previously learned associations (*Associative Memory–Delayed*) may be obtained by administering Test 10: Visual-Auditory Learning–Delayed and Test 30: Memory for Names–Delayed.
- *Working Memory* (MW) measures the ability to hold information in immediate awareness while performing a mental operation on the information. This cluster includes Test 7: Numbers Reversed and Test 9: Auditory Working Memory.
- *Quantitative Reasoning* (RQ) measures the ability to reason with numbers or concepts involving mathematical relationships and properties. This cluster includes Test 24: Number Series and Test 25: Number Matrices.
- *Visualization* (Vz) measures the ability to apprehend visual objects or forms from incomplete or rotated objects or forms. This cluster includes Test 3: Spatial Relations and Test 28: Block Rotation.
- *Sound Discrimination* (U3) measures the ability to discriminate tones, tone patterns, or musical sounds that vary in pitch, intensity, duration, and rhythm. This cluster includes Test 23: Sound Patterns–Voice and Test 29: Sound Patterns–Music.

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- *Auditory Memory Span* (MS) measures the narrow ability to attend to, register, and immediately recall temporally ordered elements and then reproduce the elements in the correct order. This cluster includes Test 17: Memory for Words and Test 27: Memory for Sentences.
- *Perceptual Speed* (P) measures the ability to recognize visual patterns, scan and compare the visual stimuli (for similarities or differences) rapidly, and accurately identify similar visual elements presented side-by-side or separated in a visual field. This cluster includes Test 6: Visual Matching and Test 26: Cross Out.

Special Purpose Interpretive Clusters

Certain WJ III COG and DS tests are also combined to form additional interpretive clusters for special purposes. These unique-purpose clusters are not necessarily derived from CHC theory, but they were designed to fulfill certain practical assessment purposes.

For example, the Broad Cognitive Ability–Low Verbal cluster is an alternative to “nonverbal” scales on other intelligence batteries. It includes all of the tests in the GIA-Bil cluster, with the exception of Test 1: Verbal Comprehension and Test 31: Bilingual Verbal Ability–English/Spanish. The Brief Intellectual Ability (BIA) cluster is intended as a screening measure. It includes Test 1: Verbal Comprehension, Test 5: Concept Formation, and Test 6: Visual Matching. These two special-purpose intellectual ability clusters are not first-principal component *g* measures.

In addition, the broad CHC clusters are combined into three broad categories of cognitive functioning: Verbal Ability, Thinking Ability, and Cognitive Efficiency. Verbal Ability represents higher-order language-based acquired knowledge and the ability to communicate that knowledge. This cluster correlates very highly with verbal scales from other intelligence batteries. The Thinking Ability cluster represents a sampling of the different thinking processes (Long-Term Retrieval, Visual-Spatial Thinking, Auditory Processing, and Fluid Reasoning). These abilities are involved when information in short-term memory cannot be processed automatically. Comparisons among the different thinking abilities may provide clues to any preferred learning styles or evidence of specific difficulties. The Cognitive Efficiency cluster provides a sampling of two different automatic cognitive processes: processing speed and short-term memory, both of which are needed for complex cognitive functioning.

Certain WJ III COG tests provide overall indicators of categories of cognitive functioning, including fluency, attention, and information processing. For example, the Cognitive Fluency cluster is a measure of cognitive automaticity, or the speed

with which an individual performs simple to complex cognitive tasks. Interpretation of this cluster is related to Carroll's (1993) distinction between tests of level versus rate. The three tests that comprise this cluster (Test 12: Retrieval Fluency, Test 16: Decision Speed, and Test 18: Rapid Picture Naming) are all measures of rate of performance rather than level of ability. For example, Rapid Picture Naming measures rate of *naming facility*, a narrow CHC ability. The Cognitive Fluency cluster can provide important information when compared to the Academic Fluency cluster from the WJ III ACH, or to other cognitive tests measuring the level of performance, rather than the rate of performance, of the same broad cognitive ability.

The Broad Attention cluster is composed of four tests that require an individual's focused attention to perform well; however, each test consists of a different type of task requirement. Test 7: Numbers Reversed measures working memory, or the ability to hold information while performing an action on the information (reversing the sequence). Test 9: Auditory Working Memory measures the ability to rearrange information placed in short-term memory into two distinct sequences. Both of these tests measure, in part, a capacity to focus cognitive resources. Test 20: Pair Cancellation requires sustained attention, or the capacity to stay on task in a vigilant manner. Test 14: Auditory Attention requires selective attention, or the ability to focus cognitive resources when distracting stimuli are present. The Broad Attention cluster may be thought of as a broad index of focused attention.

The Executive Processes cluster measures some aspects of central executive functioning, such as response inhibition, cognitive flexibility, and the planning functions identified by Pennington (1997). For example, response inhibition and interference control are required by Test 20: Pair Cancellation. Because the test is a timed task, it also provides information about the examinee's ability to perform a simple cognitive task under time pressure. Test 5: Concept Formation requires the ability to shift one's mental set. Careful observation of the ease with which the examinee makes conceptual transformations provides important clinical information. Test 19: Planning provides the examiner with the opportunity to observe the individual performing a planning task. Individuals who begin this task impulsively, or those who use a trial-and-error approach, usually do not perform well. Individuals who perform well usually demonstrate a pattern of careful observation and reflection. Periods of reflection are the essential components of planning as they provide an opportunity for (a) the development of an operational framework, (b) the generation and consideration of a plan, (c) the sequencing of responses in an orderly fashion, and (d) the revision or modification of an action plan.

There are two other clusters that are available when a selected test from the WJ III COG is combined with a test from the WJ III ACH. The Delayed Recall

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cluster provides a broad index of the recalled and/or relearned information. This cluster includes WJ III COG Test 10: Visual-Auditory Learning–Delayed and WJ III ACH Test 12: Story Recall–Delayed. The Knowledge cluster provides a broad index of general information and curricular knowledge. The cluster includes WJ III COG Test 11: General Information and WJ III ACH Test 19: Academic Knowledge.

Rapid Reference 1.3 is a list and description of all of the WJ III COG and DS clusters, including the general intellectual ability scales, the broad CHC ability clusters, the narrow CHC ability clusters, and the special-purpose interpretive clusters.

Rapid Reference 1.3

WJ III COG and DS Cluster Descriptions

Cluster	Cluster Description
General Intellectual Ability	A measure of psychometric <i>g</i> . Selected and different mixes of narrow cognitive abilities comprise the GIA-Standard, GIA-Extended, GIA-Early Development, and GIA-Bilingual scales.
Comprehension-Knowledge (<i>Gc</i>)	The breadth and depth of a person's acquired knowledge, the ability to communicate one's knowledge (especially verbally), and the ability to reason using previously learned experiences or procedures.
Long-Term Retrieval (<i>Glr</i>)	The ability to store information and fluently retrieve it later.
Visual-Spatial Thinking (<i>Gv</i>)	The ability to perceive, analyze, synthesize, and think with visual patterns, including the ability to store and recall visual representations.
Auditory Processing (<i>Ga</i>)	The ability to analyze, synthesize, and discriminate auditory stimuli, including the ability to process and discriminate speech sounds that may be presented under distorted conditions.
Fluid Reasoning (<i>Gf</i>)	The ability to reason, form concepts, and solve problems using unfamiliar information or novel procedures.
Processing Speed (<i>Gs</i>)	The ability to perform automatic cognitive tasks, an aspect of cognitive efficiency.
Short-Term Memory (<i>Gsm</i>)	The ability to apprehend and hold information in immediate awareness and then use it within a few seconds (includes working memory capacity).

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Phonemic Awareness (PC)	The ability to attend to the sound structure of language through analyzing and synthesizing speech sounds (phonetic coding).
Working Memory (MW)	The ability to hold information in immediate awareness while performing a mental operation on the information.
Numerical Reasoning (RQ)	The ability to reason with mathematical concepts involving the relationships and properties of numbers.
Associative Memory (MA)	The ability to store and retrieve associations.
Visualization (Vz)	The ability to envision objects or patterns in space by perceiving how they would appear if presented in an altered form.
Sound Discrimination (U3)	The ability to distinguish between pairs of voice-like or musical patterns.
Auditory Memory Span (MS)	The ability to listen to a presentation of sequentially ordered information and then recall the sequence immediately.
Perceptual Speed (P)	The ability to rapidly scan and compare visual symbols.
Broad Cognitive Ability—Low Verbal	A special-purpose, broad measure of cognitive ability that has relatively low overall receptive and expressive verbal requirements.
Brief Intellectual Ability	A brief measure of intelligence consisting of three tests measuring acquired knowledge, reasoning, and cognitive efficiency.
Verbal Ability	High-order language-based acquired knowledge and the ability to communicate that knowledge.
Thinking Ability	A sampling of the different thinking processes (long-term retrieval, visual-spatial thinking, auditory processing, and fluid reasoning).
Cognitive Efficiency	A sampling of two different automatic cognitive processes: processing speed and short-term memory.
Broad Attention	A global measure of the cognitive components of attention.
Cognitive Fluency	A measure of cognitive automaticity, or the speed with which an individual performs simple to complex cognitive tasks.
Executive Processes	Measures selected aspects of the central executive, such as the response inhibition, cognitive flexibility, and planning functions.
Delayed Recall	Measures the ability to recall and relearn previously presented information.
Knowledge	Measures general information and curricular knowledge.

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THE WJ III COG AND DS TESTS

The fundamental units of measurement in the WJ III COG and DS are the individual tests. In the WJ III, each of these measurement units is called a *test*—not a subtest as in some other cognitive batteries. Unlike subtests contained in some other batteries, each WJ III COG and DS test provides interpretive level information and a full range of score options; however, some WJ III COG tests include *subtests*. For example, Test 1: Verbal Comprehension includes four subtests: Picture Vocabulary, Synonyms, Antonyms, and Verbal Analogies. Interpretive information and derived scores are not available for subtests.

Most of the WJ III COG and DS tests were designed to provide a measure of a single narrow CHC ability. Rapid Reference 1.4 lists the WJ III COG and DS tests and provides details about the broad and narrow CHC abilities that are measured by each test.

Rapid Reference 1.4

WJ III COG and DS Tests, Category of Broad Ability, and Constituent Narrow Abilities

Test Name	Broad CHC Category	Narrow Abilities Measured
Test 1: Verbal Comprehension	Comprehension-Knowledge (Gc)	Lexical knowledge (VL) Language development (LD)
Test 2: Visual-Auditory Learning	Long-Term Retrieval (Glr)	Associative memory (MA)
Test 3: Spatial Relations	Visual-Spatial Thinking (Gv)	Visualization (Vz) Spatial relations (SR)
Test 4: Sound Blending	Auditory Processing (Ga)	Phonetic coding (PC)
Test 5: Concept Formation	Fluid Reasoning (Gf)	Induction (I)
Test 6: Visual Matching	Processing Speed (Gs)	Perceptual speed (P)
Test 7: Numbers Reversed	Short-Term Memory (Gsm)	Working memory (MW)
Test 8: Incomplete Words	Auditory Processing (Ga)	Phonetic coding (PC)
Test 9: Auditory Working Memory	Short-Term Memory (Gsm)	Working memory (MW)

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Test 10: Visual-Auditory Learning-Delayed	Long-Term Retrieval (<i>Glr</i>)	Associative memory (MA)
Test 11: General Information	Comprehension-Knowledge (<i>Gc</i>)	Verbal information (KD)
Test 12: Retrieval Fluency	Long-Term Retrieval (<i>Glr</i>)	Ideational fluency (FI)
Test 13: Picture Recognition	Visual-Spatial Thinking (<i>Gv</i>)	Visual memory (MV)
Test 14: Auditory Attention	Auditory Processing (<i>Ga</i>)	Speech-sound discrimination (US); Resistance to auditory stimulus distortion (UR)
Test 15: Analysis-Synthesis	Fluid Reasoning (<i>Gf</i>)	General sequential reasoning (RG)
Test 16: Decision Speed	Processing Speed (<i>Gs</i>)	Semantic/processing speed (R4)
Test 17: Memory for Words	Short-Term Memory (<i>Gsm</i>)	Auditory memory span (MS)
Test 18: Rapid Picture Naming	Processing Speed (<i>Gs</i>)	Naming facility (NA)
Test 19: Planning	Visual-Spatial Thinking (<i>Gv</i>) Fluid Reasoning (<i>Gf</i>)	Spatial scanning (SS) General sequential reasoning (RG)
Test 20: Pair Cancellation	Processing Speed (<i>Gs</i>)	Attention and concentration (AC)
Test 21: Memory for Names	Long-Term Retrieval (<i>Glr</i>)	Associative memory (MA)
Test 22: Visual Closure	Visual-Spatial Thinking (<i>Gv</i>)	Closure speed (CS)
Test 23: Sound Patterns-Voice	Auditory Processing (<i>Ga</i>)	Sound discrimination (U3)
Test 24: Number Series	Fluid Reasoning (<i>Gf</i>)	Quantitative reasoning (RQ)
Test 25: Number Matrices	Fluid Reasoning (<i>Gf</i>)	Quantitative reasoning (RQ)
Test 26: Cross Out	Processing Speed (<i>Gs</i>)	Perceptual speed (P)
Test 27: Memory for Sentences	Short-Term Memory (<i>Gsm</i>)	Auditory memory span (MS) Listening ability (LS)
Test 28: Block Rotation	Visual-Spatial Thinking (<i>Gv</i>)	Visualization (Vz) Spatial relations (SR)
Test 29: Sound Patterns-Music	Auditory Processing (<i>Ga</i>)	Sound discrimination (U3)
Test 30: Memory for Names-Delayed	Long-Term Retrieval (<i>Glr</i>)	Associative memory (MA)
Test 31: Bilingual Verbal Comprehension	Comprehension-Knowledge (<i>Gc</i>)	Lexical knowledge (VL) Language development (LD)

STANDARDIZATION AND PSYCHOMETRIC PROPERTIES

The WJ III norming sample was selected to be representative of the U.S. population from age 24 months to age 90 years and older. Original WJ III norm data were based on year 2000 census projections; norm data were recalculated based on 2005 U.S. census statistics (U.S. Census Bureau, 2005) to provide the most current comparison of test performance to the U.S. population. The recalculated data are called the normative update (WJ III NU). Normative statistics were compiled from 8,782 subjects. These individuals represented more than 100 geographically and economically diverse communities. The preschool sample (ages 2 to 5 and not enrolled in kindergarten) was composed of 1,153 subjects. The kindergarten through 12th grade sample was composed of 4,740 subjects. The adult sample was composed of 2,889 subjects, including 1,727 adults who were not attending college or university; the college/university sample was composed of 1,162 undergraduate and graduate students.

Data from the 8,782 norming subjects were summarized for each test and cluster. Age norms are provided at 1-month intervals from age 2 years 0 months (2-0) to 18 years 11 months (18-11), and at 1-year intervals from age 19 to 95+. Grade norms are provided at 1-month intervals from K.0 to 18.0. Two-year college norms (grades 13 and 14) are also available for use with technical and community college students.

Reliability

Reliability statistics were calculated for all WJ III COG tests across their range of intended use and included all norming subjects tested. The reliabilities for all but the speeded tests and tests with multiple-point scoring systems were calculated using the split-half procedure (odd and even items) and corrected for length using the Spearman-Brown correction formula. The reliabilities for the speeded tests (Visual Matching, Retrieval Fluency, Decision Speed, Rapid Picture Naming, Pair Cancellation, and Cross Out) and tests with multiple-point scored items (Spatial Relations, Retrieval Fluency, Picture Recognition, and Planning) were calculated using Rasch analysis procedures. Rapid Reference 1.5 reports the median reliability coefficients (r_{11}) and the standard errors of measurement (SEMs) obtained using the procedures described previously. Most r_{11} numbers are .80 or higher, which is a desirable level for an individual test. Rapid Reference 1.6 reports median reliabilities and SEMs for the clusters across their range of intended use. Most cluster reliabilities are .90 or higher. The SEM values are in standard score (SS) units for the tests and the clusters.

Rapid Reference 1.5

Median Test Reliability Statistics

Test	Median r_{11}	Median SEM (SS)
<i>Standard Battery</i>		
Test 1: Verbal Comprehension	.92	4.24
Test 2: Visual-Auditory Learning	.86	5.61
Test 3: Spatial Relations	.81	6.54
Test 4: Sound Blending	.89	4.97
Test 5: Concept Formation	.94	3.67
Test 6: Visual Matching	.88	5.24
Test 7: Numbers Reversed	.87	5.41
Test 8: Incomplete Words	.81	6.54
Test 9: Auditory Working Memory	.87	5.41
Test 10: Visual Auditory Learning–Delayed	.94	3.67
<i>Extended Battery</i>		
Test 11: General Information	.89	4.97
Test 12: Retrieval Fluency	.85	5.81
Test 13: Picture Recognition	.76	7.35
Test 14: Auditory Attention	.88	5.20
Test 15: Analysis-Synthesis	.90	4.74
Test 16: Decision Speed	.88	5.16
Test 17: Memory for Words	.80	6.71
Test 18: Rapid Picture Naming	.97	2.51
Test 19: Planning	.74	7.65
Test 20: Pair Cancellation	.96	2.92
<i>Diagnostic Supplement</i>		
Test 21: Memory for Names	.88	5.20
Test 22: Visual Closure	.82	6.36
Test 23: Sound Patterns–Voice	.94	3.67
Test 24: Number Series	.89	4.97
Test 25: Number Matrices	.91	4.50
Test 26: Cross Out	.72	7.94
Test 27: Memory for Sentences	.89	4.97
Test 28: Block Rotation	.82	6.36
Test 29: Sound Patterns–Music	.90	4.86
Test 30: Memory for Names–Delayed	.90	4.74
Test 31: Bilingual Verbal Comprehension	.92	4.24

Note: SEM (SS) = Standard error of measurement (in standard score units).

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 *Rapid Reference 1.6*
Median Cluster Reliability Statistics

Cluster	Median r_{11}	Median SEM (SS)
General Intellectual Ability–Std	.97	2.60
General Intellectual Ability–Ext	.98	2.12
General Intellectual Ability–Early Development	.95	3.35
General Intellectual Ability–Bilingual	.97	2.60
Comprehension–Knowledge (<i>Gc</i>)	.95	3.35
Long-Term Retrieval (<i>Glr</i>)	.88	5.20
Visual–Spatial Thinking (<i>Gv</i>)	.81	6.54
Visual–Spatial Thinking 3 (<i>Gv3</i>)	.85	5.81
Auditory Processing (<i>Ga</i>)	.91	4.50
Fluid Reasoning (<i>Gf</i>)	.95	3.35
Fluid Reasoning 3 (<i>Gf3</i>)	.96	3.00
Processing Speed (<i>Gs</i>)	.92	4.24
Short-Term Memory (<i>Gsm</i>)	.88	5.20
Phonemic Awareness (PC)	.90	4.74
Phonemic Awareness 3 (PC)	.90	4.74
Working Memory (MW)	.91	4.50
Numerical Reasoning (RQ)	.94	3.82
Associative Memory (MA)	.92	4.24
Associative Memory–Delayed (MA)	.94	3.67
Visualization (<i>Vz</i>)	.83	6.18
Sound Discrimination (U3)	.96	3.00
Auditory Memory Span (MS)	.88	5.20
Perceptual Speed (P)	.88	5.20
Broad Cognitive Ability–Low Verbal	.96	3.00
Brief Intellectual Ability	.96	3.00
Verbal Ability–Std	.92	4.24
Verbal Ability–Ext	.95	3.35
Thinking Ability–Std	.95	3.35
Thinking Ability–Ext	.96	3.00
Cognitive Efficiency–Std	.91	4.50
Cognitive Efficiency–Ext	.92	4.24
Broad Attention	.94	3.67
Cognitive Fluency	.96	3.00
Executive Processes	.96	3.00
Knowledge	.94	3.67

Note: SEM (SS) = Standard error of measurement (in standard score units).

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Test-retest reliabilities were evaluated for the six speeded tests. These six tests were administered in a counterbalanced order to 165 subjects in three age-differentiated samples. The retest interval in this study was set at 1 day to minimize (but not entirely eliminate) changes in test scores due to changes in the subjects' states or traits. Rapid Reference 1.7 reports the summary statistics and test-retest reliabilities for the speeded tests.

Rapid Reference 1.7

Summary Statistics and Test-Retest Reliabilities for Six Speeded Tests

Test	Ages 7–11		Ages 14–17		Ages 26–79	
	<i>n</i>	<i>r</i> ₁₂	<i>n</i>	<i>r</i> ₁₂	<i>n</i>	<i>r</i> ₁₂
Visual Matching	59	.87	50	.75	54	.68
Decision Speed	55	.80	48	.72	54	.73
Retrieval Fluency	59	.83	51	.85	54	.84
Rapid Picture Naming	59	.78	52	.78	53	.86
Pair Cancellation	59	.83	52	.78	53	.67
Cross Out	59	.82	50	.73	54	.78

Adapted from the *Technical Manual, WJ III NU* by K. S. McGrew, F. A. Schrank, and R. W. Woodcock, 2007, p. 45. Copyright 2007 by the Riverside Publishing Company.

Validity

Validity is the most important consideration in test development, evaluation, and interpretation. The WJ III COG is based on several sources of validity evidence that can be found throughout this book. For example, content validity is addressed through mapping test and cluster content to CHC theory (outlined in Rapid Reference 1.1, 1.3, and 1.4). Chapter 4 of this book includes a discussion of the relationship between the WJ III tests, CHC theory, and related cognitive processing research. Chapter 4 also provides information on *consequential validity*—that is, how the WJ III COG and DS tests are aligned with (a) evidenced-based interventions that may enhance cognitive and/or academic performance, or (b) accommodations for limitations in cognitive abilities.

The existence of divergent growth curves among the broad CHC abilities is another type of evidence for the existence of unique abilities (Carroll, 1983,

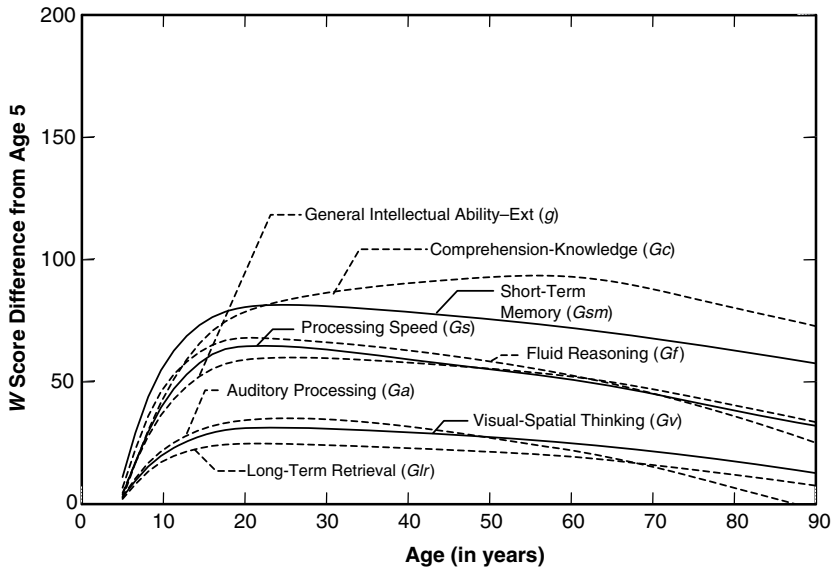


Figure 1.2 Plot of Seven WJ III NU COG CHC Factors and GIA-EXT W Score Differences by Age

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1993). Figure 1.2 presents the growth curves for ages 5 to 90 years for the broad CHC factors measured by the WJ III COG. The figure also includes a curve for the GIA-Ext score as a referent. (The examples were constructed using age 5-0 as an arbitrary starting point.) The growth curves illustrate that the unique abilities measured by the WJ III COG follow different developmental courses or trajectories over the age span from childhood to geriatric levels. These pictographic patterns of growth and decline are based on cross-sectional data, not longitudinal data. Therefore, they portray the rise and decline of median performance across age for the general population in the WJ III norm sample, not performance changes in an individual over time.

The patterns of test and cluster score intercorrelations presented in the WJ III NU Technical Manual (McGrew, Schrank, & Woodcock, 2007) support the interpretation of the growth curves and provide both convergent and discriminant validity evidence for the WJ III COG clusters. The typical range of cognitive factor intercorrelations is .20 to .60. The growth curves and intercorrelations provide support to the concept that the cognitive clusters measure intellectual abilities that are distinct from one another. Confirmatory factor analyses

presented in McGrew and Woodcock (2001) demonstrate that the relationships among the WJ III tests conform to the narrow ability, broad ability, and general intellectual ability strata derived from CHC theory.

The WJ III GIA scores correlate fairly well with the overall scores from other intelligence test batteries (such as IQ or composite scores) even though the overall scores from other batteries are not distillate measures of psychometric g . An IQ or other composite score is an aggregate of the standardized scores on a set of subtests that comprise the scale, not a distillate of general intellectual ability. Rather, IQ, composite, or overall scores are an arbitrary mix of different subtest scores, the selection of which varies according to the orientation of each test's authors or publisher. Spearman (1927) called such scores a "hotch pot" because they are not necessarily good proxies for g .

In the WJ III COG and DS, computer scoring makes calculation of general intellectual ability, or g , possible. Each test included in the GIA scores is weighted, as a function of age, to provide the best estimate of g . In general, the tests that measure Gc (Test 1: Verbal Comprehension and Test 11: General Information) and Gf (Test 5: Concept Formation and Test 15: Analysis-Synthesis) are among the highest g -weighted tests, a finding that is consistent with the extant factor-analytic research on g (e. g., Carroll, 1993). Table 1.1 provides the average GIA weights for the four general intellectual ability scales in the WJ III COG: General Intellectual Ability–Standard (GIA-Std), General Intellectual Ability–Extended (GIA-Ext), General Intellectual Ability–Bilingual (GIA-Bil), and General Intellectual Ability–Early Development (GIA-EDev).

In a series of studies reported in McGrew and Woodcock (2001) and Schrank, Mather, McGrew, and Woodcock (2003), the WJ III COG general and brief

Table 1.1 Average Test Weight Contributions to the Four General Intellectual Ability Scales

Test	GIA-Std	GIA-Ext	GIA-Bil	GIA-EDev
Test 1: Verbal Comprehension	0.19	0.12	0.20	0.27
Test 2: Visual-Auditory Learning	0.16	0.09		
Test 3: Spatial Relations	0.10	0.05	0.10	
Test 4: Sound Blending	0.12	0.07		
Test 5: Concept Formation	0.18	0.10	0.20	
Test 6: Visual Matching	0.11	0.07	0.12	0.15
Test 7: Numbers Reversed	0.14	0.07	0.15	

(continued)

20 ESSENTIALS OF WJ III COGNITIVE ABILITIES ASSESSMENT

Table 1.1 (Continued)

Test	GIA-Std	GIA-Ext	GIA-Bil	GIA-EDev
Test 8: Incomplete Words				0.14
Test 11: General Information		0.10		
Test 12: Retrieval Fluency		0.06		
Test 13: Picture Recognition		0.04		
Test 14: Auditory Attention		0.04		
Test 15: Analysis-Synthesis		0.09		
Test 16: Decision Speed		0.06		
Test 17: Memory for Words		0.06		
Test 21: Memory for Names			0.12	0.17
Test 22: Visual Closure				0.08
Test 23: Sound Patterns–Voice			0.12	
Test 27: Memory for Sentences				0.19

intellectual ability scores were compared to scores obtained by the same individuals on other intelligence batteries. Table 1.2 includes the median correlations abstracted from these sources. For example, correlations with the Wechsler Intelligence Scale for Children[®]–Third Edition (WISC-III[®]; Wechsler, 1991) are reported as .71 for GIA-Std, .70 for GIA-Bil, and .76 for GIA-Ext. Correlations with the Differential Ability Scales[®]–Second Edition (DAS II[®]; Elliott, 2007) General Conceptual Ability (GCA) are .72 for GIA-Std, .74 for the GIA-Ext, and .68 for the GIA-Bil, GIA-EDev, and the BIA. Correlations in the range reported in Table 1.2 are similar to those obtained between full-scale or composite scores of other major intelligence batteries, as reported in other publications and test manuals. Consequently, these correlations support the interpretation of the WJ III GIA first-principal component (*g*) scores as valid measures of overall intellectual functioning.

COMPREHENSIVE REFERENCES ON THE WJ III COG

The WJ III Tests of Cognitive Abilities *Examiner's Manual* (Mather & Woodcock, 2001) provides detailed information about administering, scoring, and interpreting the WJ III COG. The *Technical Manual* for the Woodcock-Johnson III Normative Update (McGrew, Schrank, & Woodcock, 2007) contains technical

Table 1.2 Correlations from Several Criterion Validity Studies for the General Intellectual Ability (GIA) and Brief Intellectual Ability (BIA) Scores

Criterion Measure	Median Correlations				BIA
	GIA-Std	GIA-Ext	GIA-Bil	GIA-EDev	
Differential Ability Scales	0.72	0.74	0.68	0.68	0.68
Wechsler Preschool and Primary Scale of Intelligence–Revised	0.73	0.74	0.71	0.72	0.67
Stanford-Binet Intelligence Scale–Fourth Edition	0.76	0.71			0.60
Wechsler Intelligence Scale for Children–Third Edition	0.71	0.76	0.70		0.69
Wechsler Adult Intelligence Scale	0.67		0.64		0.62
Kaufman Adolescent and Adult Intelligence Test	0.75		0.72		0.68
Das-Naglieri Cognitive Assessment System					0.70

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Manual, WJ III Diagnostic Supplement by F. A. Schrank, N. Mather, K. S. McGrew, and R. W. Woodcock, 2003. Copyright 2003 by the Riverside Publishing Company.

information that was calculated based on the WJ III NU; the WJ III *Technical Manual* (McGrew & Woodcock, 2001) provides information that was made available at the time of publication, including some information on structural and concurrent validity that is not contained in the normative update technical manual. Rapid Reference 1.8 provides basic information on the components of the WJ III COG. The following resources also contain important information on the WJ III COG and DS:

- Schrank, F. A. (2005). Woodcock-Johnson III Tests of Cognitive Abilities. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 371–401). New York: Guilford.
- McGrew, K. S. (2005). The Cattell-Horn-Carroll Theory of Cognitive Abilities: Past, Present, and Future. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 136–181). New York: Guilford.

Rapid Reference 1.8

Components of the WJ III Tests of Cognitive Abilities

Woodcock-Johnson III Tests of Cognitive Abilities (Standard and Extended Batteries)

Authors: Richard W. Woodcock, Kevin S. McGrew, Nancy Mather

Publication Date: 2001, 2007

What the Battery Measures: General Intellectual Ability (g); Comprehension-Knowledge (lexical knowledge/language development, general [verbal] information); Long-Term Retrieval (associative memory, ideational fluency); Auditory Processing (phonetic coding, resistance to auditory stimulus distortion, speech-sound discrimination); Visual-Spatial Thinking (visualization, spatial relations, spatial scanning); Fluid Reasoning (induction, sequential reasoning); Short-Term Memory (memory span, working memory capacity); Processing Speed (semantic processing speed, perceptual speed, naming facility); Phonemic Awareness; Working Memory; Cognitive Fluency; Attention; and Executive Processes

Administration Time: Varies; approximately 5 minutes per test

Qualification of Examiners: Graduate-level training in cognitive assessment

Diagnostic Supplement to the Tests of Cognitive Abilities

Authors: Richard W. Woodcock, Kevin S. McGrew, Nancy Mather, Fredrick A. Schrank

Publication Date: 2003, 2007

What the Battery Measures: Supplements the WJ III COG (Standard and Extended Batteries) to provide special-purpose measures of General Intellectual Ability (g) for bilingual and early development applications; low verbal cluster for broad cognitive ability; several narrow ability clusters (Perceptual Speed, Associative Memory, Visualization, Sound Discrimination, Auditory Memory Span, Numerical Reasoning); extended Visual-Spatial Thinking and Fluid Reasoning clusters

Administration Time: Varies; approximately 5 minutes per test

Qualification of Examiners: Graduate-level training in cognitive assessment

WJ III Normative Update Compuscore and Profiles Program

Authors: Fredrick A. Schrank, Richard W. Woodcock

Publication Date: 2008

What the Software Provides: Computer scoring for all WJ III COG, DS, and Batería III tests and clusters, summary narrative, profiles reports

Woodcock Interpretation and Instructional Interventions Program (WIIIP)

Authors: Fredrick A. Schrank, Barbara J. Wendling, Richard W. Woodcock

Publication Date: 2008

What the Software Provides: Computer scoring for all WJ III COG, DS, and Bateria III tests and clusters, comprehensive narrative reports, profiles reports, instructional interventions and accommodations related to test performance, checklists (Reason for Referral Checklist, Parent's Checklist, Teacher's Checklist, Classroom Observation Form, Self-Report Checklist: Adolescent/Adult, Academic Processes Checklist, Executive Processes and Cognitive Fluency Checklist, Writing Evaluation Scale)

Publisher, All Components:

Riverside Publishing Company
3800 Golf Road
Suite 100
Rolling Meadows, IL 60008



TEST YOURSELF



- 1. The WJ III COG and DS are based on the Cattell-Horn-Carroll (CHC) theory of human cognitive abilities.**
True or False?
- 2. What is the age range for the WJ III COG and DS?**
 - (a) 4–90 years
 - (b) 5–18 years
 - (c) 2–90+ years
 - (d) 5–23 years
- 3. Who is credited with developing the three-stratum theory of human cognitive abilities?**
 - (a) Raymond Cattell
 - (b) John Horn
 - (c) John Carroll
 - (d) Elaine Crampfoot
- 4. Perceptual Speed (P) is considered a broad cognitive ability.**
True or False?
- 5. What is the total norming sample for the WJ III Normative Update?**
 - (a) 4,783
 - (b) 8,782
 - (c) 9,000+
 - (d) 6,359

Answers: 1. True; 2. c; 3. c; 4. False; 5. b