One

OVERVIEW

The *Woodcock-Johnson IV Tests of Cognitive Abilities* (WJ IV COG: Schrank, McGrew, & Mather, 2014b) is a battery of carefully engineered tests for measuring cognitive abilities and intellectual level. The WJ IV COG was conormed with the *Woodcock-Johnson IV Tests of Oral Language* (WJ IV OL; Schrank, Mather, & McGrew, 2014b), the WJ IV *Tests of Achievement* (WJ IV ACH; Schrank, Mather, & McGrew, 2014a) to form the complete *Woodcock-Johnson IV* (Schrank, McGrew, & Mather, 2014a). The three batteries can be used independently or together in any combination. When the entire system is used, comparisons can be made among an individual's cognitive abilities, oral language, and achievement scores. Normative data was obtained from a large, nationally representative sample of 7,416 individuals ranging in age from 2 to 90+ years of age. Although primarily recommended for use with school-age children, adolescents, college students, and adults, some of the WJ IV COG tests can be used selectively with preschool children. A conormed but separate battery of tests called the *Woodcock-Johnson IV Tests of Early Cognitive and Academic Development* (WJ IV ECAD; Schrank, McGrew, & Mather, 2015b) is recommended for use with preschool children of ages 3 through 5 or with children of ages 6 through 9 who have a cognitive developmental delay.

The WJ IV COG is based on an update to the Cattell-Horn-Carroll (CHC) theory of cognitive abilities as described by Schneider and McGrew (2012) and McGrew, LaForte, and Schrank (2014). Cognitive complexity has been infused within several new tests, and interpretive emphasis has been shifted to the most important abilities for learning, interventions, and accommodations.

This book is intended to help you understand the essentials of cognitive ability assessment using the WJ IV COG. Although interpretation of the WJ IV COG can be complex, this book is presented in an easy-to-read format. In one small guide, administration, scoring, and interpretation are addressed in simple

language. The clinical and psychoeducational case report chapters are intended to help you understand the use and interpretation of the WJ IV with practical examples and illustrations. Throughout the book, important points are highlighted by "Rapid Reference," "Caution," and "Don't Forget" boxes. At the end of Chapters 1 to 5, "Test Yourself" sections will help you assess your understanding of what you have read.

This chapter begins with a discussion of how the Woodcock-Johnson cognitive tests have evolved to become the most comprehensive battery of contemporary cognitive tests available to assessment professionals. The chapter ends with a summary of the technical characteristics of the WJ IV COG and a list of suggested resources for more information on the WJ IV COG.

HISTORY AND DEVELOPMENT

The WJ IV COG represents the fourth generation of the cognitive tests that originally formed Part One of the *Woodcock-Johnson Psycho-Educational Battery* (WJPEB; Woodcock & Johnson, 1977). Initial work on the WJPEB begin in 1973, although some of the tests were developed prior to that date. The first revision, the *Woodcock-Johnson Psycho-Educational Battery–Revised* (Woodcock & Johnson, 1989a), was published in 1989. The *Woodcock-Johnson III Tests of Cognitive Abilities* (Woodcock, McGrew, & Mather, 2001b) was published in 2001. The WJ IV COG was published in 2014.

1977: *The Woodcock-Johnson Psycho-Educational Battery*

The WJPEB began as one battery that consisted of three parts: Tests of Cognitive Ability, Tests of Achievement, and Tests of Interest Level. Initially, no overriding theoretical model guided development of the cognitive tests. Historically, test development began with a number of controlled experiments for measuring learning abilities. The first test constructed was Visual-Auditory Learning (Woodcock, 1958). Visual-Auditory Learning was the result of Woodcock's (1956) doctoral dissertation at the University of Oregon. Employing a set of reading rebuses, he developed the test to predict the ability to learn to read using a visual-auditory association, encoding, and retrieval experiment. Later, the Analysis-Synthesis test was developed to predict an individual's ability to learn mathematics. Additional cognitive tests were developed to create a heterogeneous mix of broad and complex cognitive abilities. In the end, 12 tests were included in the cognitive portion of the battery representing both verbal and nonverbal functions (a common interpretive construct of the era).

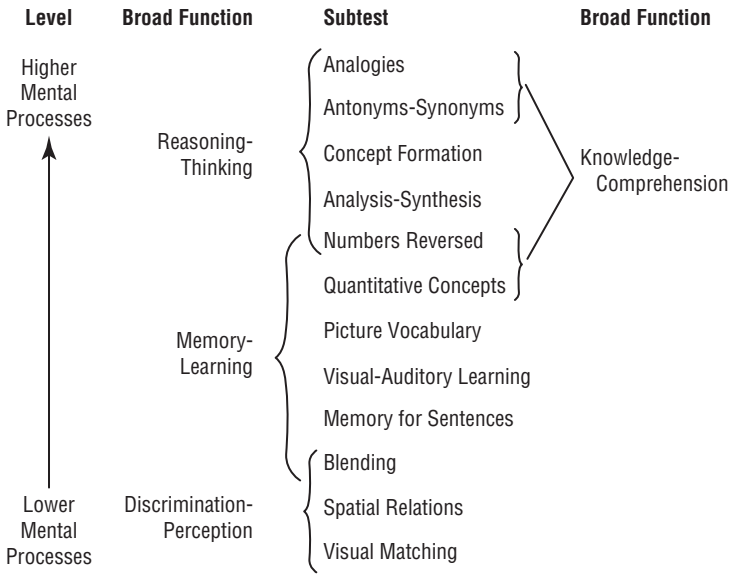

Figure 1.1 Broad functions, level-of-processing, and 12 cognitive tests from the 1977 WJPEB

Additionally, the abilities were designed to fall on a continuum from lower mental processes (simple operations) to higher mental processes (complex operations) as shown in Figure 1.1. Test-level analysis on the continuum from lower mental processes to higher mental processes has remained a useful model for interpreting test performance in all succeeding generations of the Woodcock-Johnson batteries.

WJPEB test construction followed a scientific-empirical method. Following the battery's norming (which occurred in 1976 and 1977), factor and cluster analyses were constructed to help define a small number of broad functions measured by the battery. Four functions were identified and labeled as Knowledge-Comprehension, Reasoning-Thinking, Memory-Learning, and Discrimination-Perception. In the 1970s, the term intelligence quotient and its abbreviation, IQ, were viewed somewhat negatively by many in the professional community. However, an overall cognitive score was viewed as a necessity. As a consequence, the term *Broad Cognitive Ability* (*BCA*) was introduced. In deriving the BCA, the 12 cognitive tests were differentially weighted to give a statistically better estimate of an individual's overall cognitive ability than would be obtained by weighting the tests equally.

1989: *The Woodcock-Johnson Psycho-Educational Battery–Revised*

In 1985, John Horn made a presentation at a conference honoring Lloyd Humphreys, who was one of his mentors. Horn's presentation fostered insight into the structure of human intellectual abilities and laid the theoretical foundation for the *Woodcock-Johnson–Revised Tests of Cognitive Ability* (WJ-R COG; Woodcock & Johnson, 1989c). The WJ-R COG interpretive model was closely associated with Horn's thesis and came to be described as an operational representation of *Gf-Gc* theory (Horn, 1991).

Kevin McGrew conducted much of the statistical work for the WJ-R and served as the primary author of the *WJ-R Technical Manual* (McGrew, Werder, & Woodcock, 1991). Following Horn's 1985 presentation, McGrew synthesized all of the extant exploratory and confirmatory factor analyses of the 1977 WJPEB. He developed a table similar to that found in Figure 1.2 that served as a blueprint for planning and organizing the revision to approximate *Gf-Gc* theory more closely.

Ten new tests were developed and added to the WJ-R COG. In the 1990s, the WJ-R COG became the primary battery of tests for measuring seven broad abilities identified in *Gf-Gc* theory: Long-Term Storage and Retrieval (*Glr*), Short-Term Memory (*Gsm*), Processing Speed (*Gs*), Auditory Processing (*Ga*), Visual Processing (*Gv*), Comprehension-Knowledge (*Gc*), and Fluid Reasoning (*Gf*). An eighth factor, Quantitative Ability (*Gq*), was available when using the WJ-R *Tests of Achievement* (Woodcock & Johnson, 1989b). **Rapid Reference** 1.1 outlines these eight abilities.

Gf-Gc theory was soon applied to the analysis and interpretation of other intelligence tests. In a groundbreaking analysis, Woodcock (1990) showed that

Rapid Reference 1.1 Eight Gf-Gc Abilities Measured by the 1989 WJ-R

Long-Term Storage and Retrieval *(Glr)*
Short-Term Memory *(Gsm)*
Processing Speed *(Gs)*
Auditory Processing *(Ga)*
Visual Processing *(Gv)*
Comprehension-Knowledge *(Gc)*
Fluid Reasoning *(Gf)*
Quantitative Ability *(Gq)*

WJPEB Subtests	COGNITIVE FACTORS							
	Glr	*Gsm*	*Gs*	*Ga*	*Gv**	*Gc*	*Gf*	*Gq*
Visual-Auditory Learning	●							
Memory for Sentences		○				○		
Numbers Reversed		○						
Spatial Relations**			●					
Visual Matching			●					
Blending				●				
Picture Vocabulary						●		
Antonyms-Synonyms						●		
Analysis-Synthesis							●	
Concept Formation							●	
Analogies						○	○	
Quantitative Concepts								●
Word Attack				○				
Calculation								●
Applied Problems								●
Science						●		
Social Studies						●		
Humanities						●		

Glr—Long-Term Retrieval
Gsm—Short-Term Memory
Gs—Processing Speed
Ga—Auditory Processing
Gv—Visual Processing
Gc—Comprehension-Knowledge
Gf—Fluid Reasoning
Gq—Quantitative Ability

● High Loadings
○ Moderate Loadings

* There are no measures of Gv in the 1977 WJPEB.

** Spatial Relations is a highly speeded test in the 1977 WJPEB.

Figure 1.2 Cognitive factors measured by the 1977 WJPEB

Gf-Gc theory describes the factor structure of other intelligence test batteries when their sets of tests are included in studies with sufficient breadth and depth of markers to ensure that the presence of all major factors could be identified. His article became widely cited in psychological and educational literature. As a consequence, *Gf-Gc* theory gained support as a major descriptor of human intellectual abilities and as a standard for evaluating tests of intelligence (McGrew & Flanagan, 1998).

2001: *The Woodcock-Johnson III*

In 1993, John Carroll published *Human Cognitive Abilities: A Survey of Factor Analytic Studies*. The thesis of this book is often described as Carroll's three-stratum theory (Carroll, 1993, 1998). Carroll said that human cognitive abilities could be conceptualized in a three-stratum hierarchy. Through his analysis of 461 data sets, Carroll identified 69 specific, or narrow, cognitive abilities (stratum I), similar to the Well Replicated Common Factor (WERCOF) abilities identified by Horn (1968, 1991) and associates (Ekstrom, French, & Harmon, 1979). In addition, Carroll grouped the narrow abilities into broad categories of cognitive abilities (stratum II) that are similar, in most respects, to the broad *Gf-Gc* factors described by Horn and his associates. Stratum III represents the construct of general intellectual ability (*g*) (Carroll, 1993, 1998). Figure 1.3 is a visual representation of Carroll's three-stratum theory.

The integration of these two independently and empirically derived theories has come to be called CHC theory. CHC theory provided the blueprint for the WJ III and subsequent support for interpretation of the WJ III COG. The primary difference between Carroll's three-stratum model and Horn's *Gf-Gc* model is the meaning of the general intellectual ability (*g*) factor at stratum III. Horn was emphatic that he did not believe *g* was an entity. The presence of a psychometric *g* was never the subject of debate; Horn suggested that *g* was merely a statistical artifact rather than a quality of cognitive functioning. However, because many assessment professionals expressed a need for a general intellectual ability score in the WJ III COG, the first-principal component (*g*) score was made available via computer scoring. The score was called General Intellectual Ability (GIA). Inclusion of this score on the WJ III can be traced to the influence of Carroll.

The primary emphasis in interpretation of the WJ III COG was the broad factors from stratum II. Kevin McGrew and Nancy Mather joined Richard Woodcock on the WJ III author team (Woodcock, McGrew, & Mather, 2001a, 2001b). The authors developed the model of two qualitatively different tests for each of the broad CHC factors so that interpretation of the ability would be as broad-based as possible. During the decade that followed publication, the WJ III COG became one of the most widely used tests for measurement of intellectual ability and differential cognitive abilities.

2014: *The Woodcock-Johnson IV*

When the time came to complete work on a fourth edition of the *Woodcock-Johnson*, Richard Woodcock had retired from active participation and a team of scientist-practitioner authors consisting of Fredrick Schrank,

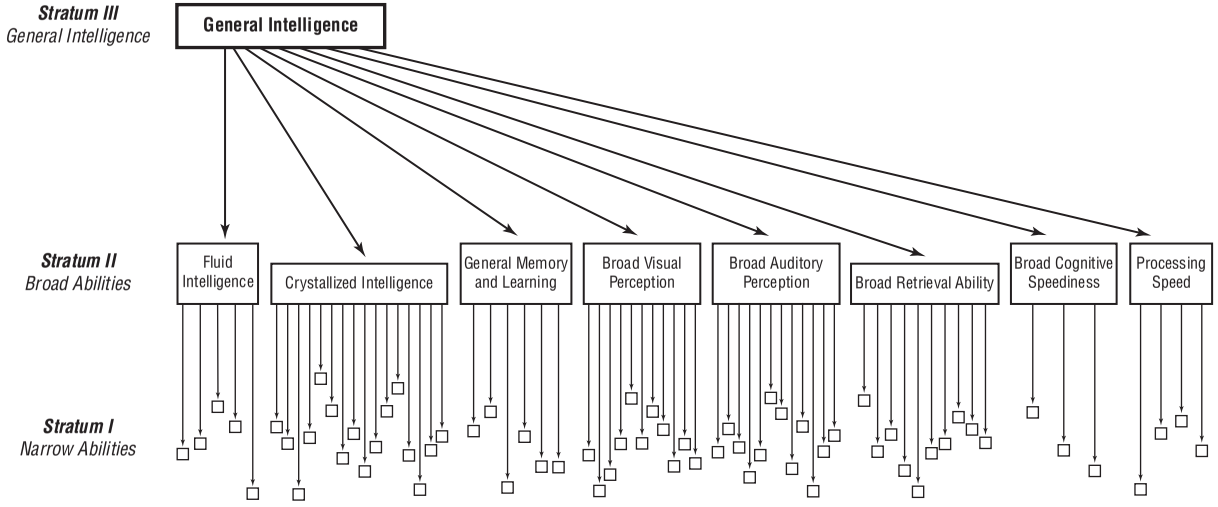

Figure 1.3 Carroll's three-stratum theory

Kevin McGrew, and Nancy Mather ushered in the new era of Woodcock-Johnson cognitive abilities assessment. Several new tests and interpretive procedures were created. One of the authors' goals was to move beyond the initial specification of CHC theory and base the WJ IV COG on the current status of contemporary research into human cognitive abilities. Impetus for this goal can be traced to a suggestion by John Carroll at the University of Virginia in 1994 when he offered a self-critique of his three-stratum theory. Among other considerations, he cautioned that the specifications in his theory were based on considerable subjectivity in sorting and classification of factors from independently derived data sets. He noted that his specification of abilities was based primarily on scores from psychometric tests and that cross-validation of the proposed constructs was needed from other data sets and other forms of scientific research. In the WJ IV, CHC theory has evolved beyond the initial specifications through both simplification and elaboration (McGrew et al., 2014; Schneider & McGrew, 2012). In Chapter 4 of this book, other sources of research are reviewed to cross-validate, modify, add to, or clarify some of the theoretical constructs posited by Cattell, Horn, Carroll, Woodcock, and others.

The interpretive model for the WJ IV reflects the most contemporary reflection of CHC theory at the time of publication. Analysis of the WJ-R, WJ III, and WJ IV standardization samples (which were not analyzed by Carroll) provided three large, multi-ability data sets to either confirm or revise initial construct specifications. Support for changes to the interpretive constructs was gleaned from other sources of neuroscience research. Perhaps the most significant changes to the WJ IV COG broad abilities were derived from contemporary research in the domains of working memory and phonological processing. See **Rapid Reference** 1.2.

Rapid Reference 1.2 Broad and Narrow CHC Abilities Measured by the WJ IV COG

WJ IV COG Test	Primary Broad CHC Ability *Narrow Ability*
1 Oral Vocabulary	Comprehension-Knowledge (*Gc*)
A: Synonyms	*Lexical knowledge* (VL)
B: Antonyms	*Language development* (LD)
2 Number Series	Fluid Reasoning (*Gf*)
	Quantitative reasoning (RQ)
	Inductive reasoning (I)

WJ IV COG Test	Primary Broad CHC Ability *Narrow Ability*
3 Verbal Attention	Short-Term Working Memory *(Gwm)* *Working memory capacity* (WM) *Attentional control* (AC)
4 Letter-Pattern Matching	Cognitive Processing Speed (*Gs*) *Perceptual speed* (P)
5 Phonological Processing A: Word Access B: Word Fluency C: Substitution	Auditory Processing (*Ga*) *Phonetic coding* (PC) *Speed of lexical access* (LA) *Word Fluency* (FW)
6 Story Recall	Long-Term Storage and Retrieval *(Glr)* *Meaningful memory* (MM) *Listening ability* (LS)
7 Visualization A: Spatial Relations B: Block Rotation	Visual Processing (*Gv*) *Visualization* (Vz)
8 General Information A: Where B: What	Comprehension-Knowledge *(Gc)* *General (verbal) information* (K0)
9 Concept Formation	Fluid Reasoning (*Gf*) *Inductive reasoning* (I)
10 Numbers Reversed	Short-Term Working Memory (*Gwm*) *Working memory capacity* (WM)
11 Number-Pattern Matching	Cognitive Processing Speed (*Gs*) *Perceptual speed* (P)
12 Nonword Repetition	Auditory Processing (*Ga*) *Phonetic coding* (PC) *Memory for sound patterns* (UM) *Auditory memory span* (MS)
13 Visual Auditory Learning	Long-Term Storage and Retrieval (*Glr*) *Associative memory* (MA)
14 Picture Recognition	Visual Processing (*Gv*) *Visual memory* (MV)
15 Analysis-Synthesis	Fluid Reasoning (*Gf*) *General sequential (deductive) reasoning* (RG)
16 Object-Number Sequencing	Short-Term Working Memory (*Gwm*) *Working memory capacity* (WM)
17 Pair Cancellation	Cognitive Processing Speed (*Gs*) *Perceptual speed* (P) *Spatial scanning* (SS) *Attentional control* (AC)
18 Memory for Words	Short-Term Working Memory (*Gwm*) *Auditory memory span* (MS)

Another primary goal for the WJ IV COG was to incorporate cognitive complexity into several of the tests and clusters. One interpretive model that has remained constant throughout all editions of the Woodcock-Johnson is the analysis of test requirements via level of cognitive complexity (see Figure 1.1). By deliberate design, the WJPEB, WJ-R, and WJ III all included tasks that fall on a continuum from simple cognitive operations to complex cognitive processes. In the WJ IV, a concerted effort was directed to increase the number of tests with cognitive complexity requirements to provide greater ecological validity and interpretive relevance for the test or cluster scores. In the WJ IV COG, increased cognitive complexity is most clearly evidenced in the composition of the tests that compose the auditory processing cluster. The tests that comprise the WJ IV COG Auditory Processing cluster are designed to measure cognitively complex, ecologically relevant processes that involve auditory processing abilities. Each test is based on a combination of narrow abilities that spans one or more other broad abilities. The two new tests are COG Test 5: Phonological Processing and COG Test 12: Nonword Repetition. More information on the interpretation of the auditory processing tests can be found in Chapter 4.

The new author team had many other goals in mind as well. To select the tests that compose the GIA score (the core tests), those that are included in the standard battery, and the tests that compose each cognitive cluster, the authors drew heavily on their experiences as psychologists and educators. Their aim was to select tests that would provide the most important information for professional practice needs. As a result, the composition of the GIA score and most of the broad CHC factor scores changed dramatically from the WJ III. New tests, such as Test 3: Verbal Attention, were developed to assess working memory in an ecologically valid format so that test results would more effectively mirror the typical working memory requirements often required in classroom and occupational performance. Another example is Test 4: Letter-Pattern Matching, which was developed to assess visual perceptual speed for orthographic pattern recognition, a foundational function that underlies reading and spelling performance.

Perhaps one of the most innovative features of the WJ IV COG is the *Gf-Gc* Composite, a measure of intellectual level that is derived solely from four academically predictive tests representing the two highest-order (*g*-loaded or *g*-saturated) factors included in the CHC theory of cognitive abilities (McGrew, 2005, 2009; McGrew et al., 2014; Schneider & McGrew, 2012). The *Gf-Gc* Composite is

highly correlated with general intelligence (*g*) as measured by the WJ IV COG GIA cluster score as well as by other global indices of general intelligence. By design, only *Gf* and *Gc* ability measures are included in the calculation of this intellectual development score. Conceptually, the *Gf-Gc* Composite is analogous to the Wechsler General Ability Index (GAI), a composite score developed to remove the influence of working memory capacity (WM) and processing speed (*Gs*) when estimating intelligence (Wechsler, 2008). Additional information on the *Gf-Gc* Composite and its use in the identification of specific learning disabilities can be found in **Appendix** of this book.

The WJ IV is now part of a three-battery configuration that also includes the WJ IV *Tests of Oral Language* and the WJ IV *Tests of Achievement*. The batteries are all conormed and can be used independently or in any combination. The new configuration recognizes the importance of oral language abilities as important correlates of cognitive and academic functioning. Some of the oral language clusters can be included in an analysis of intra-cognitive variations, including a Speed of Lexical Access cluster that represents a new contribution to CHC theory. The entire WJ IV system provides the most contemporary model for measuring a wide array of cognitive abilities that are described in CHC theory.

Finally, the WJ IV COG is easier to administer, score, and interpret than any of the predecessor batteries. The first seven tests are considered the core tests for analysis of strengths and weaknesses at the test level. Additional tests are available for cluster-level interpretation, and, as with previous editions of the Woodcock-Johnson cognitive batteries, selective testing remains an option for specific assessment needs. For example, there are new academic domain-specific Scholastic Aptitude clusters in the WJ IV COG that allow for more efficient comparisons to current levels of academic achievement.

Although much of the WJ IV is new, the authors sought to retain the focus on psychometric quality that has been associated with the previous editions Woodcock-Johnson batteries. This was achieved by providing a new, large, and nationally representative standardization sample of the US population; by updating items and simplifying test administration and interpretation procedures; by augmenting the underlying scaling of speeded tests; and by utilizing state-of-the art test development and data analytic methods as models to facilitate progress in the field of applied test development. **Rapid Reference** 1.3 lists the key innovative features of the WJ IV COG.

Rapid Reference 1.3 Key Innovative Features of the WJ IV COG

Reflects updated CHC theory
Core tests provide most important information
Increased cognitive complexity
Gf-Gc Composite
A comprehensive assessment system with WJ IV OL and WJ IV ACH
Ease of administration, scoring, and interpretation

Standardization Sample and Psychometric Properties. The WJ IV norming sample was selected to be representative of the US population from age 24 months to age 90 years and older. The *Standards for Educational and Psychological Testing* (American Educational Research Association [AERA], American Psychological Association, & National Council on Measurement in Education; 2014) were followed carefully (Reynolds & Niilesksela, 2015). Normative data were based on a total sample of 7,416 individuals who were administered selected cognitive, oral language, achievement, or preschool tests. The preschool sample (2–5 years of age and not enrolled in kindergarten) was composed of 664 individuals. The kindergarten to 12th-grade sample was composed of 3,891 individuals; the college/university sample was composed of 775 undergraduate and graduate students. The adult nonschool sample (14–95+ years of and age not enrolled in a secondary school or college) was composed of 2,086 individuals. These individuals were drawn from geographically and economically diverse communities in 46 states and the District of Columbia.

Data from the 7,416 norming subjects were summarized for each test and cluster. Age norms are provided at 1-month intervals from as young as age 2 years 0 months (2–0) (for some tests) to 18 years 11 months (18–11) and at 1-year intervals from age 19 through 95+. Grade norms are provided at 1-month intervals from K.0 to 17.9. Two-year college norms (grades 13 and 14) are also available for use with technical and community college students. Complete information on the WJ IV test design, development, and standardization procedures is described by McGrew et al. (2014).

Reliability. Reliability statistics were calculated for all WJ IV COG tests across their range of intended use. The reliabilities for all but the speeded

tests were calculated for all norming subjects 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 (Letter-Pattern Matching, Number-Pattern Matching, Pair Cancellation) were calculated from a 1-day-interval test-retest study across three age groups (ages 7–11; ages 14–17; and ages 26–79) (n = 146). 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 subjects' states or traits. **Rapid Reference** 1.4 reports the median reliability coefficients (r_{11} for nonspeeded tests and r_{12} for speeded tests) obtained using the procedures just described. Most numbers are .80 or higher, which is a desirable level for an individual test. **Rapid Reference** 1.5 reports median reliabilities for the clusters across their range of intended use. These reliabilities were computed using Mosier's (1943) formula. Most cluster reliabilities are .90 or higher.

Rapid Reference 1.4 WJ IV COG Median Test Reliabilities

Test	Median Reliability
Standard Battery	
Test 1: Oral Vocabulary	.89
Test 2: Number Series	.91
Test 3: Verbal Attention	.86
Test 4: Letter-Pattern Matching	.91
Test 5: Phonological Processing	.84
Test 6: Story Recall	.93
Test 7: Visualization	.85
Test 8: General Information	.88
Test 9: Concept Formation	.93
Test 10: Numbers Reversed	.88
Extended Battery	
Test 11: Number-Pattern Matching	.85
Test 12: Nonword Repetition	.91
Test 13: Visual-Auditory Learning	.97
Test 14: Picture Recognition	.74
Test 15: Analysis-Synthesis	.93
Test 16: Object-Number Sequencing	.89
Test 17: Pair Cancellation	.89
Test 18: Memory for Words	.97

Rapid Reference 1.5 WJ IV COG Median Cluster Reliabilities

Cluster	Median Reliability
General Intellectual Ability	.97
Brief Intellectual Ability	.94
Gf-Gc Composite	.96
Comprehension-Knowledge (*Gc*)	.93
Comprehension-Knowledge-Extended	.94
Fluid Reasoning (*Gf*)	.94
Fluid Reasoning-Extended	.96
Short-Term Working Memory (*Gsm*)	.91
Short-Term Working Memory-Extended	.93
Cognitive Processing Speed (*Gs*)	.94
Auditory Processing (*Ga*)	.92
Long-Term Storage and Retrieval (*Glr*)	.97
Visual Processing (*Gv*)	.86
Quantitative Reasoning (RQ)	.94
Auditory Memory Span (MS)	.90
Number Facility (N)	.90
Perceptual Speed (P)	.93
Cognitive Efficiency	.93
Cognitive Efficiency-Extended	.95
Reading Aptitude A	.89
Reading Aptitude B	.90
Math Aptitude A	.89
Math Aptitude B	.89
Writing Aptitude A	.89
Writing Aptitude B	.90

Validity. Validity is the most important consideration in test development, evaluation, and interpretation. The WJ IV COG is based on several sources of validity evidence. Chapter 4 of this book includes a discussion of the relationships among the WJ IV tests, CHC theory, and related neurocognitive research. Chapter 4 also provides information on *consequential validity*, that is, how the WJ IV COG tests are aligned with evidenced-based interventions that may enhance cognitive and/or academic performance and/or accommodations for limitations in cognitive abilities.

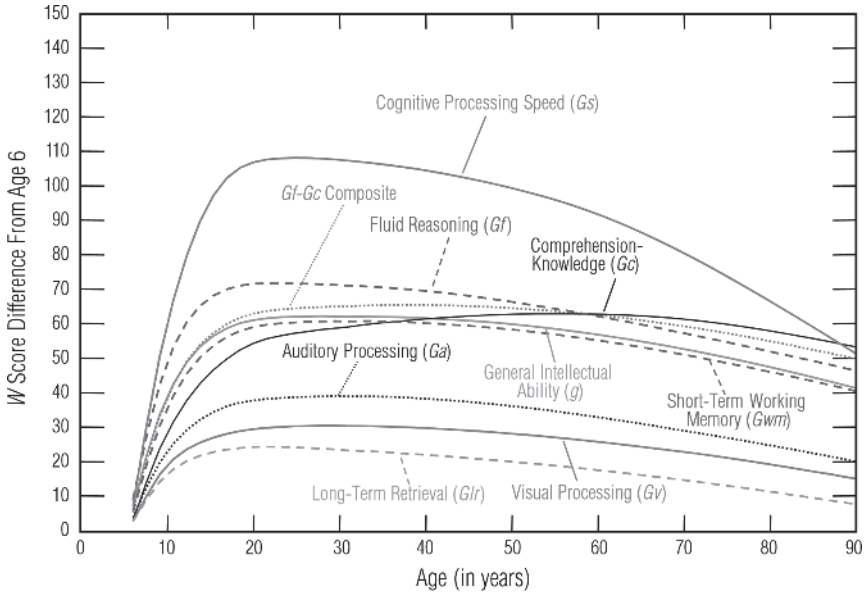

Figure 1.4 Plot of seven WJ IV COG CHC factors, GIA, and *Gf-Gc* Composite *W* scores differences by age

The existence of divergent growth curves among the broad and narrow CHC abilities is another type of evidence for the existence of unique abilities (Carroll, 1983, 1993). Figure 1.4 presents the growth curves for ages 6 to 90 years for the broad CHC factors measured by the WJ IV COG. The figure also includes a curve for the GIA score and a curve for the *Gf-Gc* Composite, showing how these two clusters develop in parallel until about age 15 and then differentiate.

Figure 1.5 is a plot of the WJ IV COG narrow CHC abilities (including the curve for Cognitive Efficiency) with the General Intellectual Ability (GIA) score as a referent. Figures 1.4 and 1.5 illustrate that the unique abilities measured by the WJ IV 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,

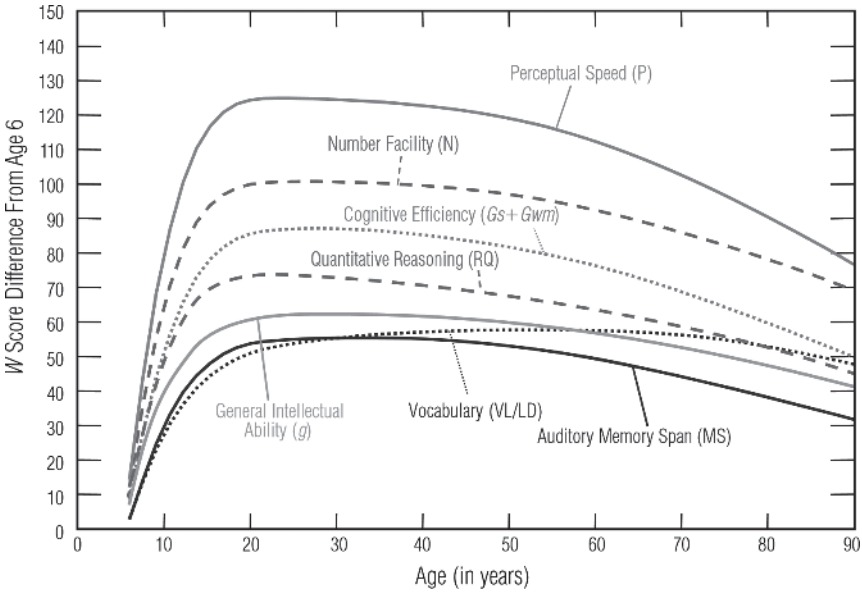

Figure 1.5 Plot of six WJ IV COG narrow CHC factors (including Cognitive Efficiency) and GIA *W* scores differences by age

they portray the rise and decline of median performance across age for the general population in the WJ IV norm sample, not performance changes in an individual over time.

The patterns of test and cluster score intercorrelations presented in the *WJ IV Technical Manual* (McGrew et al., 2014) support the interpretation of the growth curves and provide both convergent and discriminate validity evidence for the WJ IV COG clusters. The typical range of test and cluster intercorrelations is .30 to .60. Together, the growth curves and intercorrelations provide support to the concept that the cognitive tests and clusters measure intellectual abilities that are distinct from one another. In addition, confirmatory factor analyses presented in McGrew et al. demonstrate that the relationships among the WJ IV tests conform to the cognitive ability constructs derived from CHC theory (AERA et al., 2014; Campbell & Fiske, 1959).

The WJ IV intellectual ability scores correlate very well with the overall scores from other intelligence test batteries (such as IQ or composite scores), including the *Wechsler Intelligence Scale for Children®–Fourth Edition (WISC®*-IV) (Wechsler, 2003), the *Wechsler Adult Intelligence Scale ®–Fourth Edition* (WAIS®-IV) (Wechsler, 2008), the *Kaufman Assessment Battery for Children–Second Edition* (KABC-II) (Kaufman & Kaufman 2004), the *Stanford-Binet Intelligence Scales, Fifth Edition* (SB-5) (Roid, 2003). **Rapid Reference** 1.6 presents correlations for the WJ IV COG General Intellectual Ability (*g*; GIA), Brief Intellectual Ability (BIA), and *Gf-Gc* Composite cluster scores with the composite measures of general intelligence (*g*) from the other measures. The .72 to .86 correlations for the WJ IV GIA cluster with the general intelligence total scores from the other intelligence batteries support the conclusion that the WJ IV GIA is a strong and valid measure of the complex set of abilities that constitute general intelligence. The magnitude of the correlations between the WJ IV BIA cluster and the general intelligence scores from the other batteries support the validity of the BIA cluster as a valid screening measure of general intelligence.

The high correlations between the WJ IV *Gf-Gc* Composite and the WISC–IV, WAIS–IV, and SB– Full Scale IQ scores, in contrast to the noticeably lower correlation between the WJ IV COG *Gf-Gc* Composite cluster and the KABC–II Mental Processing Index, support the interpretation of the WJ IV COG *Gf-Gc* Composite cluster score as a valid alternate measure of intellectual level that is less influenced by cognitive processing abilities than is the WJ IV COG GIA score. By design, when compared to the GIA cluster score and other full scale intelligence scores, an obtained *Gf-Gc* Composite cluster score may be less attenuated by the

Rapid Reference 1.6 WJ IV COG GIA, BIA, Gf-Gc Composite Correlations with Other Intellectual Ability Scales

Other Intellectual Ability Scale	GIA	BIA	*Gf-Gc*
WISC–IV FSIQ	0.86	0.83	0.83
SB–5 FSIQ	0.80	0.79	0.82
WAIS–IV FSIQ	0.84	0.74	0.78
KABC–II Mental Processing Index	0.72	0.67	0.57

FSIQ = Full Scale IQ

effects of a cognitive processing or cognitive efficiency disability for some individuals, particularly for many individuals with a specific learning disability. This makes the *Gf-Gc* Composite a particularly valuable alternative measure of intellectual level in an evaluation for a specific learning disability (see **Appendix** of this book).

As reported by McGrew and colleagues (2014), the patterns of mean WJ IV COG scores for gifted individuals, individuals with intellectual disabilities, and individuals with specific learning disabilities in reading, math, and writing were generally consistent with expectation for those groups. For example, the standard score ranges for individuals with giftedness and individuals with intellectual disabilities differed markedly. The gifted group typically scored above 115; the individuals with intellectual disabilities typically scored in the 50 to 60 range of standard scores. The individuals with specific learning disabilities displayed mean test and cluster standard scores that were in the 80 to 89 range for achievement tests in areas of disability. Score patterns also are reported for individuals with language delay, attention-deficit/hyperactivity disorder, head injury, and autism spectrum disorders.

Further Information on the WJ IV COG. The WJ IV *Technical Manual* (McGrew et al., 2014) is the most comprehensive source for information on the WJ IV, including the WJ IV COG. Detailed information on the purposes, design, standardization, reliability, and validity of the WJ IV COG can be obtained from this manual, which is supplied as part of the WJ IV COG test kit. The *Technical Manual* also includes an appendix with the most contemporary ability specifications of CHC theory. The *WJ IV Technical Abstract* (LaForte, McGrew, & Schrank, 2015), an extensive summary of the information provided in the *Technical Manual*, can be downloaded without cost from the publisher's website, http://www.riversidepublishing.com/products/wj-iv/pdf/Woodcock-Johnson_IV_Assessment_Service_Bulletin_2.pdf. Other topical bulletins on the WJ IV are also available from the publisher's website at no cost.

The *Examiner's Manual* (Mather & Wendling, 2014) for the WJ IV COG includes the basic principles of individual clinical assessment, specific information regarding use of the tests, and suggested procedures for learning to administer, score, and complete the interpretive options for the WJ IV COG. The *WJ IV Interpretation and Instructional Interventions Program* (WIIIP; Schrank & Wendling, 2015a) is an online program option designed to help professionals interpret the WJ IV. The program also links limitations in performance on the WJ IV tests and clusters, including the WJ IV COG, to evidence-based

instructional interventions and/or accommodations. The WIIIP also includes a number of checklists for gathering and documenting background information and observations that can be used to interpret test performance. Mather and Jaffe's (2015) *Woodcock-Johnson IV: Recommendations, Reports, and Strategies* includes a wide variety of WJ IV reports written by contributing assessment professionals that also include recommendations and instructional strategies based on a student's school-related difficulties. See **Rapid Reference** 1.7.

Rapid Reference 1.7 Components of the WJ IV Tests of Cognitive Abilities

Woodcock-Johnson IV Tests of Cognitive Abilities

Authors: Fredrick A. Schrank, Kevin S. McGrew, & Nancy Mather

Publication Date: 2014

What the Battery Measures: General Intellectual Ability (*g*); Brief Intellectual Ability; Gf-Gc Composite (intellectual level); Scholastic Aptitudes; Comprehension-Knowledge (lexical knowledge/language development, general [verbal] information; Fluid Reasoning (quantitative reasoning, deduction, induction); Short-Term Working Memory (working memory capacity, auditory short-term memory); Cognitive Processing Speed (perceptual speed); Auditory Processing (phonetic coding, speed of phono-lexical access; word fluency; memory for sound patterns); Long-Term Storage and Retrieval (listening ability; meaningful memory; associative memory); Visual Processing (visualization, spatial relations, visual memory); Cognitive Efficiency (perceptual speed and working memory capacity)

Administration Time: Varies; approximately 5–10 minutes per test; about 1 hour for Standard Battery

Qualification of Examiners: Graduate-level training in cognitive assessment

What the Battery Includes: Standard and extended test books; 25 test records; online scoring and reporting with purchase of test records; examiner's manual; technical manual; scoring templates for selected tests

WJ IV Interpretation and Instructional Interventions Program

Authors: Fredrick A. Schrank & Barbara J. Wendling

Publication Date: 2015

What the WIIIP Provides: Comprehensive narrative 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; Writing Evaluation Scale).

Publisher, All Components:

Houghton Mifflin Harcourt/Riverside Publishing Company
One Pierce Place
Suite 900W
Itasca, IL 60143

TEST YOURSELF

1. **The WJ IV COG is based on the Cattell-Horn-Carroll (CHC) theory of human cognitive abilities. True or false?**
   a. True
   b. False
2. **Who is credited with distinguishing two types of intelligence—fluid and crystallized?**
   a. Richard Woodcock
   b. John Horn
   c. Raymond Cattell
   d. John Carroll
3. **Who is credited with expanding *Gf-Gc* theory to include multiple cognitive abilities?**
   a. Richard Woodcock
   b. John Horn
   c. Raymond Cattell
   d. John Carroll
4. **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
5. **Which of the following broad CHC factors is not included in the WJ IV COG?**
   a. Comprehenion-Knowledge (*Gc*)
   b. Fluid Reasoning (*Gf*)
   c. Short-Term Working Memory (*Gwm*)
   d. Cognitive Processing Speed (*Gs*)

e. Auditory Processing (*Ga*)
f. Long-Term Retrieval (*Glr*)
g. Visual Processing (*Gv*)
h. None of the above (all are included)

6. Which of the following tests is new to the WJ IV COG?

a. Visual-Auditory Learning
b. Phonological Processing
c. Numbers Reversed
d. Concept Formation

7. Perceptual Speed (P) is considered a broad cognitive ability. True or false?

a. True
b. False

8. What is the total norming sample for the WJ IV COG?

a. 4,783
b. 7,416
c. 9000+
d. 6,359

9. The *Gf-Gc* Composite is a measure of intellectual level. True or false?

a. True
b. False

10. Who are the authors of the *WJ IV Interpretation and Instructional Interventions Program* (WIIIP)?

a. Nancy Mather, Kevin McGrew, and Fredrick Schrank
b. Nancy Mather and Barbara Wendling
c. Nancy Mather and Lynne Jaffe
d. Fredrick Schrank and Barbara Wendling

Answers: 1. True; 2. c; 3. b; 4. c; 5. h; 6. b; 7. False; 8. b; 9. True; 10. d