



# WJ Perspectives



Kevin S. McGrew, Ph. D.

## Evolution and Revolution in CHC Theory and the WJ IV

Kevin S. McGrew, Ph.D.

The **Woodcock-Johnson® IV (WJ IV™)** (Schrang, McGrew, & Mather, 2014a) represents evolutionary and revolutionary thinking about CHC theory and its application to contemporary assessment practice. The **WJ IV** goes “beyond CHC theory” as it was initially specified. School psychologists have responded positively to the **WJ IV** changes and often want to know what drove such a major revision in theory and test design and organization. Three examples are provided.

The **Woodcock-Johnson IV** goes beyond the initial specifications of CHC theory—it is grounded in the most current elaboration, extension, and prospective evolution of the theory. In addition to a reconfigured set of tests for measuring general intelligence and specific cognitive abilities, the **WJ IV Tests of Cognitive Abilities (WJ IV COG)** (Schrang, McGrew, & Mather, 2014b) establishes the cutting edge of assessment practice by focusing on measuring the most important cognitive abilities.

The **WJ IV** design blueprint channeled the intellectually curious spirits of Cattell, Horn, and Carroll, who “would not idly stand by and let the current consensus-based theory calcify and suffer from hardening of the CHC categories” (Schneider & McGrew, 2012, p. 138). In addition, the **WJ IV** incorporates ideas from contemporary cognitive neuroscience research and CHC state-of-the-art research syntheses. The analysis of the **WJ IV**'s 50 different cognitive, language, and achievement tests in the **WJ IV** norm data revealed “aha” insights into previously under-appreciated or unrecognized narrow CHC abilities.

*“Cattell, Horn and Carroll would not idly stand by and let the current consensus-based theory calcify and suffer from hardening of the CHC categories.”*

### Working Memory: An Evolution

The **WJ IV COG** highlights the importance of working memory. Reflecting decades of research on the characteristics of working memory, the nature of short-term memory (previously initialized as Gsm) is clarified and renamed Short-Term Working Memory (Gwm). The broad-working memory ability factor (Gwm) now includes an array of narrow abilities: Memory Span (MS), Working Memory Capacity (WM), and Attentional Control (AC). Working memory tests in the **WJ IV COG** provide the ability to examine

working memory functions within a continuum of simple-to-complex tasks that measure memory span, working memory capacity (volume), and complex manipulation (mental juggling) of elements that require significant control of attention. The new Verbal Attention test is an example of a Gwm task designed to place significant demands on and attention to verbal stimuli and working memory capacity.

Working memory is an important construct for school psychologists to understand because it represents the mental workspace where learning occurs. Connections between prior knowledge and new learning occur in working memory, reasoning requires working memory, and all other cognitive abilities travel through this mental workspace. Some cognitive abilities (e.g., auditory processing, visual processing, and perhaps long-term retrieval) are likely employed at the command of the executive functions in working memory. The identification, use, and clarification of the Short-Term Working Memory (Gwm) factor and associated narrow abilities aligns the **WJ IV** terminology with the wider neuroscience community—helping school psychologists articulate performance using contemporary scientific nomenclature.

### Auditory Processing: A Revolution

No cluster in the **WJ IV** has been as critically re-thought, re-conceptualized, and re-purposed as Auditory Processing (Ga). Two new tests are included in this cluster: Phonological Processing and Nonword Repetition.

The Phonological Processing test has three subtests that together demonstrate g-loadings (correlations with general intelligence) equal to Oral Vocabulary (Gc) and higher than the fluid reasoning (Gf) tests of Number Series, Concept Formation, and Analysis-Synthesis. The Ga cluster correlated at the same level as the Gf and Gc clusters with the WISC®-IV and Stanford-Binet IV Full Scale IQ scores (.70's). This correlation is not a misprint! How can auditory processing abilities, abilities often accorded a lower class status in school psychology as not “real” domains of intelligence, demonstrate such strong correlations with indicators of general intelligence? Voodoo statistics? No. The answer is analogous to the complex behavior pattern often observed in large schools of fish.

Mentally construct a picture of a school of iridescent sardines swimming in a warm, sunlit, azure-colored ocean. Schools of sardines can effortlessly produce what appears as a complex, beautiful, rhythmic pattern of behavior. Although each fish is responding to a simple set of rules, when multiplied and added across hundreds of cohorts, a complex pattern of behavior is observed. So it is with the Phonological Processing test (as well as some other new and revised **WJ IV** tests such as Verbal Attention and Visualization).

The concept of cognitive complexity was employed to develop or revise **WJ IV** tests to place greater demands on cognitive information processing (cognitive load) via the need for the examinee to allocate more key cognitive resources to complete tasks within a CHC domain. Cognitive complexity is not the same as factorial complexity (e.g., a mixed test of Gf and Gv), breadth of a domain, and does not mean complicated. The **WJ IV** Ga cluster correlates highly with measures of g—not because it requires high level abstract reasoning or problem solving—but because it requires the efficient interaction of simple cognitive operations (e.g., searching a person’s mental lexicon network based on sounds) and invokes parameters of cognitive efficiency (e.g., working memory capacity and attentional control). This test requires the fluent and coordinated interaction of multiple simple cognitive operations, much like the complex behavior of a school of sardines.

The beyond CHC framework also recognizes a parallel body of research, previously not integrated within CHC theory, that posits the existence of a phonological storage ability or short-term memory function for speech sounds. This research, plus analysis of the **WJ IV** battery, suggested the need to expand the CHC definition of Memory for Sound Patterns (UM) to include memory for speech sounds. Analysis of the **WJ IV** norming data also supported the inclusion of the new Nonword Repetition test in the **WJ IV COG**.

The new **WJ IV COG** Auditory Processing (Ga) cluster will allow school psychologists to better understand learning problems involving phonological processing or phonological short-term memory. The ability to access words from phonological cues is particularly important when learning to read. It also comes into play whenever a mature reader approaches an unknown or complex word. The ability to repeat nonwords has been linked to learning new words and is a diagnostic marker for potential reading- and language-related disabilities.

## Speed of Lexical Access: Another Evolution

The **WJ IV** configuration includes the **WJ IV Tests of Oral Language (WJ IV OL)** (Schrank, Mather, & McGrew, 2014) to measure important cognitive-linguistic abilities that expand and enhance interpretation of the **WJ IV COG**. The **WJ IV OL** includes clusters for measurement of oral language abilities in English (as well as Spanish) and includes two new clusters for in-depth evaluation of phonological and rapid naming disabilities.

In the analysis of the **WJ IV** norm data, an exciting discovery was the identification of a narrow Speed of Lexical Access (LA) factor. Existence of this ability was observed in the **WJ III**® norming data, but its precise nature and definition evolved over time. In the **WJ IV**, Speed of Lexical Access (LA) is defined as the ability to rapidly and fluently retrieve words from an individual’s lexicon. Although related to naming facility (NA) and rapid automatic naming (RAN), the LA factor draws from beyond the traditional boundaries of CHC- and RAN-centric research, specifically research on verbal efficiency and automaticity of word access.

Speed of Lexical Access (LA) may be a particularly important narrow ability for school psychologists to understand and assess. Rapid word access increases fluency of thought in understanding, and production of, oral and written discourse, such as speaking and reading. Limited or slow word access can consume cognitive resources and derail complex processing of information needed for conveying ideas in oral discourse or constructing mental representations when reading.

*“The new **WJ IV COG** Auditory Processing (Ga) cluster will allow school psychologists to better understand learning problems involving phonological processing or phonological short-term memory.”*

## Discussion

The influence of the beyond CHC theory framework on the **WJ IV** design concepts and other methodological and technical innovations is described thoroughly in the manuals. For example, cognitive complexity analysis of the **WJ IV** tests and clusters also informed the placement and prioritization of COG and OL tests and clusters across the two batteries, as well as within batteries. The concept of degree of cognitive complexity played a significant role in selecting tests to comprise the General Intellectual Ability cluster (GIA).

Regardless of the evolution vs. revolution analogy, the **WJ IV** reflects a significant organizational, structural, and interpretive revision. The **WJ IV** continues the **Woodcock-Johnson** legacy of “raising the bar” and pushing the edge of the assessment instrument envelope by embracing change based on the most current theory, research, and test development tools and techniques.

*Appreciation is extended to Dr. Fred Schrank for his assistance in preparation of this material.*

## References

- Schneider, W. J., & McGrew, K. S. (2012). The Cattell-Horn-Carroll model of intelligence. In, D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (3rd ed., pp. 99–144). New York, NY: Guilford Press.
- Schrank, F. A., McGrew, K. S., Mather N. (2014a). *Woodcock-Johnson IV*. Rolling Meadows, IL: Riverside.
- Schrank, F. A., McGrew, K. S., Mather N. (2014b). *Woodcock-Johnson IV Tests of Cognitive Abilities*. Rolling Meadows, IL: Riverside.
- Schrank, F. A., Mather N., & McGrew, K. S. (2014). *Woodcock-Johnson IV Test of Oral Language*. Rolling Meadows, IL: Riverside.

Houghton Mifflin Harcourt™, HMH®, Woodcock-Johnson®, WJ IV™, WJ III® and the WJ III logo, and Riverside® are trademarks or registered trademarks of Houghton Mifflin Harcourt. © Houghton Mifflin Harcourt. Wechsler Intelligence Scale for Children® (WISC®) is a registered trademark of NCS Pearson, Inc. All rights reserved. 05/16 MS176084

hmhco.com • 800.323.9540