Research-based Approaches to Specific Learning Disability Identification and Assessment

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Continuum of Progress in Psychometric Theories of Intelligence

1930s to the late 1990s

Traditional Cognitive Assessment

FSIQ

Verbal Ability

Nonverbal Ability
Cattell-Horn Gf-Gc Theory

A Landmark Event in Understanding the Structure of Intelligence

Carroll’s (1993) Three-Stratum Theory of Cognitive Abilities

An Integration of the $G_f$-$G_c$ and Three-Stratum Theories of Cognitive Abilities

Based largely on McGrew’s analyses in 1997-1999
The Cattell-Horn-Carroll (CHC) Model of Cognitive Abilities that Guided Intelligence Test Construction from 2000-2010

We Have Knowledge of What Our Tests Measure According to CHC Theory

- Cross-Battery Assessment Approach
  - Classification system
  - Joint or CB-CFA
  - Expert Consensus
  - Helped to establish a nomenclature for the field
Cross-Battery Approach Assisted in Paving the Way for a Nomenclature in the Field of School Psychology

The WJ III

(Woodcock, McGrew, & Mather, 2001)

The first in a flurry of test revisions that represented advances unprecedented in assessment fields
Contemporary Cognitive Assessment

- **SB5** (2003) – Based on CHC theory
- **KABC-II** (2004) – Based on CHC theory and Luria
- **DAS-II** (2007) – Based on CHC theory

Contemporary Cognitive Assessment

- **WISC-IV** (2003) – CHC terminology (e.g., Fluid Reasoning, Working Memory) and CHC approach to interpretation (Flanagan & Kaufman, 2004, 2009)

Keith et al. (2006)
Continuum of Progress in Tests of Intelligence and Cognitive Abilities

Continuum of Progress in Methods of Interpretation

TABLE 2.4. Wechsler’s Case Example for “Adolescent Psychopath”

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Standard score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>11</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>6</td>
</tr>
<tr>
<td>Information</td>
<td>10</td>
</tr>
<tr>
<td>Digits</td>
<td>6</td>
</tr>
<tr>
<td>Similarities</td>
<td>5</td>
</tr>
<tr>
<td>Picture Arrangement</td>
<td>12</td>
</tr>
<tr>
<td>Picture Completion</td>
<td>10</td>
</tr>
<tr>
<td>Block Design</td>
<td>15</td>
</tr>
<tr>
<td>Object Assembly</td>
<td>16</td>
</tr>
<tr>
<td>Digit Symbol</td>
<td>12</td>
</tr>
<tr>
<td>Verbal IQ (VIQ)</td>
<td>60</td>
</tr>
<tr>
<td>Performance IQ (PIQ)</td>
<td>123</td>
</tr>
</tbody>
</table>

Continuum of Progress in Methods of Interpretation

Factor Analysis – Cohen’s Three-factor solution of the WISC

Kaufman’s Psychometric Approach

Continuum of Progress in Methods of Interpretation

KABC 1983

WJ-R 1989-1994

Cross-Battery 1998

Brought Gf-Gc and three-stratum theories to school psychology

Gf-Gc/CHC applied to Wechsler Scales 2000
Continuum of Progress in Methods of Interpretation

McGrew (2005) and Schneider and McGrew’s (2012) Refinements to CHC Theory

Integration of CHC and neuropsychological theory for cognitive test interpretation

• Dan Miller
• Scott Decker
• Brad Hale
• Cyndi Riccio
• George McCloskey
• Denise Maricle
AN INTEGRATIVE FRAMEWORK BASED ON PSYCHOMETRIC, NEUROPSYCHOLOGICAL, AND LURIAN PERSPECTIVES (Flanagan, Ortiz, Alfonso & Dynda, 2010)

In school neuropsychology consultation, the Cattell-Horn-Carroll (CHC) theory of intelligence and its operationalization in a Cross-Battery Assessment procedure may also improve school psychology assessment practice and facilitate the integration of neuropsychological methodology in school-based assessments. The CHC model benefits from more than a half-century of validity research on psychometric, developmental, heritability, academic outcome, and neurocognitive evidence (Flanagan & Harrison, 2005; Flanagan & Ortiz, 2005; McGrew, Keith, Flanagan, & Vanderwood, 1997). The CHC model is a multietiered model of intelligence, with tiers typically referred to as strata I, II, and III (Carroll, 1997). The broad abilities of stratum II are functionally similar to constructs measured in neuropsychology, although labels used to describe the measurements may differ (Dean et al., 2003). For example, neuropsychologists are familiar with constructs like executive functions, with such tests as the Wisconsin Card Sorting Test, Halstead’s Category Test, and the Trail Making Test, whereas school psychologists use equivalent concepts, like fluid intelligence. Psychometrically, these constructs are highly related but may differ in theoretical specifications (Decker, Hill, & Dean, 2007). The CHC and Cross-Battery Assessment approaches shift assessment practice from IQ composites to neurodevelopmental functions. This transition can be facilitated by training in contemporary psychometric models (Flanagan, Ortiz, & Alfonso, 2007). Furthermore, integrating Cross-Battery Assessment approaches within a global hypothesis-testing approach (Hale & Fiorello, 2004) may provide the best “alternative” method that meets federal requirements for a comprehensive evaluation.
Lurian, Neuropsychological, and Cattell-Horn-Carroll (CHC) Classifications of Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) Subtests

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Lurian Block</th>
<th>Neuropsychological Domain</th>
<th>CHC Broad and Narrow Abilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antonyms</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Block Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cancellation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coding</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Comprehension</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Digit Span</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Information</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Letter-Number Sequencing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Matrix Reasoning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Picture Completion</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Picture Concepts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Similarities</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Symbol Search</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Word Reasoning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Continuum of Progress in Methods of Interpretation

Refinements and Extensions to the CHC-Achievement Relations Research

Contemporary Cattell–Horn–Carroll (CHC) theory of cognitive abilities has evolved over the past 20 years and serves as the theoretical foundation for a number of current cognitive ability assessments. CHC theory provides a means by which we can better understand the relationships between cognitive abilities and academic achievement, an important component of learning disabilities identification and instructional planning. A research synthesis of the extant CHC cognitive-achievement (COG-ACH) research literature is reported. Systematic and operationally defined research synthesis procedures were employed to address limitations present in the only prior attempted synthesis.
## Continuum of Progress in Methods of Interpretation

<table>
<thead>
<tr>
<th>Clinical Profile Analysis (Second Wave)</th>
<th>Psychometric Profile Analysis (Third Wave)</th>
<th>Application of Theory to Interpretation (Fourth Wave)</th>
<th>Application of Refinements to Theory and CHC-Based Research to Psychological Tests Interpretation (Fifth Wave)</th>
</tr>
</thead>
</table>

### Refinements and Extensions to the Cross-Battery Approach

- Significantly improved evidence base
- Significantly improved and expanded software programs

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## Summary of Relations between CHC Abilities and Specific Areas of Academic Achievement

(Flanagan, Ortiz, Alfonso & Mascolo, 2006)

<table>
<thead>
<tr>
<th>Ability</th>
<th>Reading Achievement</th>
<th>Math Achievement</th>
<th>Writing Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gf</strong></td>
<td>Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in reading comprehension.</td>
<td>Inductive (I) and general sequential reasoning abilities are consistently very important at all ages.</td>
<td>Inductive (I) and general sequential reasoning abilities is related to basic writing skills primarily during the elementary school years (e.g., 6 to 13) and consistently related to written expression at all ages.</td>
</tr>
<tr>
<td><strong>Gc</strong></td>
<td>Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages. These abilities become increasingly more important with age.</td>
<td>Language development (LD), lexical knowledge (VL), and general information (KF) are important primarily after age 7. These abilities become increasingly more important with age.</td>
<td>Language development (LD), lexical knowledge (VL), and general information (KF) are important primarily after age 7. These abilities become increasingly more important with age.</td>
</tr>
<tr>
<td><strong>Gsm</strong></td>
<td>Memory span (MS) is important especially when evaluated within the context of working memory.</td>
<td>Memory span (MS) is important especially when evaluated within the context of working memory.</td>
<td>Memory span (MS) is important to writing, especially spelling skills whereas working memory has shown relations with advanced writing skills (e.g., written expression).</td>
</tr>
<tr>
<td><strong>Gv</strong></td>
<td>Orthographic Processing</td>
<td>May be important primarily for higher level or advanced mathematics (e.g., geometry, calculus).</td>
<td>Orthographic Processing may be important especially during advanced mathematics (e.g., geometry, calculus).</td>
</tr>
<tr>
<td><strong>Ga</strong></td>
<td>Phonetic coding (PC) or “phonological awareness/processing” is very important during the elementary school years.</td>
<td>Phonetic coding (PC) or “phonological awareness/processing” is very important for both basic writing skills and written expression (primarily before age 11).</td>
<td>Phonetic coding (PC) or “phonological awareness/processing” is very important during the elementary school years for both basic writing skills and written expression (primarily before age 11).</td>
</tr>
<tr>
<td><strong>Glr</strong></td>
<td>Naming facility (NA) or “rapid automatic naming” is very important during the elementary school years.</td>
<td>Naming Facility (NA); Associative Memory (MA) may be somewhat important at select ages (e.g., age 6).</td>
<td>Naming Facility (NA) or “rapid automatic naming” has demonstrated relations with written expression, primarily the fluency aspect of writing.</td>
</tr>
<tr>
<td><strong>Gs</strong></td>
<td>Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) abilities are important during all school years for basic writing and related to all ages for written expression.</td>
</tr>
</tbody>
</table>
Relations between CHC Abilities and Processes and Reading Achievement

**Gf** – Induction (I) and general sequential reasoning (RG) play a moderate role in reading comprehension.

Relations between CHC Abilities and Processes and Reading Achievement

- **Gc** – Language development (LD), lexical knowledge (VL), general information (KO) and listening ability (LS) are important at all ages. *These abilities become increasingly important with age.*
Relations between CHC Abilities and Processes and Reading Achievement

- **Gsm** – Memory span (MS) is important, especially when evaluated within the context of *working memory*

- **Gv** – Orthographic processing
Orthography (Wagner & Barker, 1994)

• The system of marks that make up the English language, including upper and lower case letters, numbers, and punctuation marks

Assessing Visual Processing Related to Reading

• Visual processing must be assessed using orthography (letters, words and numbers) rather than abstract designs or familiar pictures
Assessing Orthographic Processing Related to Reading

• *Examples of assessments of orthographic processing directly related to reading:*
  – Test of Silent Word Reading Fluency (TOSWRF)
  – Test of Irregular Word Reading Efficiency (TIWRE)
  – Test of Orthographic Competence (TOC)
  – Process Assessment of the Learner (PAL-II)
  – Early Reading Assessment (ERA)

Relations between CHC Abilities and Processes and Reading Achievement

• *Ga* – Phonetic Coding (PC) or phonological awareness; phonological processing – very important during the elementary school years.
Assessing Phonological Processing Related to Reading

- Examples of assessments of phonological processing directly related to reading:
  - PAL-II Rhyming, Syllables, Phonemes, Rimes
  - KTEA-II Phonological Awareness Subtest
  - NEPSY-II Phonological Processing Subtest
  - WJ III Sound Awareness, Sound Blending, and Incomplete Words Subtests
  - DAS-II Phonological Processing Subtest
  - CTOPP Blending and Segmenting Subtests

Relations between CHC Abilities and Processes and Reading Achievement

Glir – Naming facility (NA) or “rapid automatic naming” is very important during the elementary school years. Associative memory (MA) may be important at early elementary school ages.
Relations between CHC Abilities and Processes and Reading Achievement

• **Gs** – Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.

Building on the work of Flanagan and Colleagues (2006)

• McGrew and Wendling (2010)
  – Need to move from general to specific
    • **Reading** -> basic reading skills; reading comprehension
    • **Math** -> basic math skills; math application
  – Need to systematically take into account developmental level
    • Ages 6-8 years
    • Ages 9-13 years
    • Ages 14-19 years
  – Need to control for specification error
    • Seems necessary primarily if interested in percentage of variance accounted for in academic outcome
    • May pose more of a limitation (e.g., Flanagan et al. had over 100 studies in their review; McGrew and Wendling had less than 20)
### Relations between cognitive constructs and academic skills

#### Rapid Reference 10.5. Important Findings on Relations Between CHC Abilities and Reading Achievement

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Gf</td>
<td>Inductive (I) and General Sequential Reasoning (RO) abilities play a moderate role in reading comprehension.</td>
<td>Quantitative Reasoning (RO) is tentative/ speculative at ages 6-8 and 14-19 years for Basic Reading Skills (BRS). (^2) Broad Gf is tentative/ speculative at ages 14-19 years for Reading Comprehension (RC).</td>
<td>The lack of a relationship between Gf abilities and reading in the McGraw and Wendling summary may be related to the nature of the dependent measures. For example, RC was represented by the WJ Passage Comprehension and Reading Vocabulary tests, both of which draw minimally on reasoning (e.g., they do not require an individual to draw inferences or make predictions).</td>
</tr>
<tr>
<td>Gc</td>
<td>Language development (LD), lexical knowledge (VL), and listening abilities (L3) are important. These abilities become increasingly more important with age.</td>
<td>LS is moderately consistent at ages 6-8 years for BRS. LS is highly consistent at ages 6-19 years for RC. General Fund of Information (KI) is consistent at ages 6-8 years and moderately consistent at ages 9-19 years for BRS. KI is highly consistent at ages 6-19 years for RC. Broad Gc is moderately consistent at ages 6-13 years and highly consistent at ages 14-19 years for BRS. Broad Gc is highly consistent at ages 6-19 years for RC.</td>
<td>The findings across the Flanagan et al. and McGraw and Wendling summaries are quite similar given that Broad Gc in the McGraw and Wendling summary is defined primarily by the narrow abilities of L3 and VL. However, Flanagan et al. did not find a consistent relationship between the narrow ability of KI and reading, as KI was not well represented in the studies they reviewed.</td>
</tr>
<tr>
<td>Gw</td>
<td>Memory span (OIS) is important especially when evaluated within the context of working memory.</td>
<td>Working Memory (MW) moderately consistent at ages 6-19 years for BRS and highly consistent for RC at ages 6-19 years. MS is consistent at ages 6-19 years for BRS. MS is consistent at ages 6-13 years and moderately consistent at ages 14-19 years for RC.</td>
<td>Both the Flanagan et al. and McGraw and Wendling summaries highlight the importance of Gw for reading.</td>
</tr>
</tbody>
</table>

### Relations between cognitive constructs and academic skills

**Gc**

<table>
<thead>
<tr>
<th>Relations between cognitive constructs and academic skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive Construct</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>General Cognitive Ability (Gc)</td>
</tr>
</tbody>
</table>

Relations between cognitive constructs and academic skills

Comparison tables may be found in:

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### Relations between cognitive constructs and academic skills

Rapid Reference 10.5. Important Findings on Relations Between CBC Abilities and Reading Achievement

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>$G_r$</strong></td>
<td>Orthographic processing</td>
<td>Visual Memory (MV) is moderately consistent at ages 14-19 years for RC.</td>
<td>One possible explanation for the lack of a $G_r$ relationship with BRS in the McGrew and Wendling summary is that the types of tasks used to measure visual processing in the studies they reviewed (e.g., spatial relations) do not measure the visual aspects of reading (e.g., orthographic processing). Orthographic processing or awareness (the ability to rapidly map graphemes to phonemes) may be more related to the perceptual speed tasks found on cognitive tests (e.g., Symbol Search on the Wechsler Scales).</td>
</tr>
<tr>
<td><strong>$G_a$</strong></td>
<td>Phonemic Coding (PC) or phonological awareness processing are very important during the elementary school years.</td>
<td>PC is moderately consistent at ages 6-13 and consistent at ages 14-19 years for BRS.</td>
<td>Interestingly, and in contrast to Flanagan et al.'s summary, McGrew and Wendling's summary does not show a strong relation between PC/phonological processing and reading at any age level. Given the wealth of research on the relations between PC/phonological processing and reading coupled with the neuroimaging research showing normalization of brain function in response to effective interventions for PC/phonological processing deficits, a reasonable assumption is that PC/phonological processing plays an important role in reading development during the early elementary school years. The relationship between PC/phonological processing and reading may be more prominent in students with reading difficulties, a population not included in the McGrew and Wendling samples.</td>
</tr>
</tbody>
</table>
Basic Reading Skills Referral for ages 6 to 8 – WISC-IV Selected as Core Battery

<table>
<thead>
<tr>
<th>Broad Domain Markers</th>
<th>Narrow Domain Markers</th>
<th>Relevant WISC-IV tests</th>
<th>XBA with Selected Tests from WJ III and ERA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gsm Short-Term Memory</td>
<td>Working Memory (MW)</td>
<td>*Digit Span (MS/MW)</td>
<td>* 14 Subtests – More Information Than Any Stand Alone Battery</td>
</tr>
<tr>
<td>Gs Processing Speed</td>
<td>Perceptual Speed (P)</td>
<td>* Letter-Number Seq. (MW)</td>
<td></td>
</tr>
<tr>
<td>Gc Crystallized Intelligence</td>
<td>Language Dev. (LD)</td>
<td>* Coding (P)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Listening Ability (LS)</td>
<td>* Symbol Search (P)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Information (K0)</td>
<td>Cancellation (P)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lexical Knowledge (VL)</td>
<td>* Vocabulary (VL)</td>
<td></td>
</tr>
<tr>
<td>Glr Long-Term Retrieval</td>
<td>Associative Mem. (MA)</td>
<td>* Similarities (VL)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Naming Facility (NA)</td>
<td>* Comprehension (LD)</td>
<td></td>
</tr>
<tr>
<td>Ga Auditory Processing</td>
<td>Phonetic Coding (PC)</td>
<td>Information (K0)</td>
<td></td>
</tr>
<tr>
<td>Gv Visual Processing</td>
<td>Orthographic Processing</td>
<td>Word Reasoning (VL)</td>
<td></td>
</tr>
</tbody>
</table>

* Sound Aware (PC/MW)  
* Sound Blending (PC)  
* Rapid Orthographic Naming  
* Silent Orthographic Efficiency

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Go To XBA Handout
How has chc theory evolved in recent years?

Current and Expanded Cattell-Horn-Carroll (CHC) Model of Cognitive Abilities
(adapted from Schneider & McGrew, 2012)

Sixteen broad and approximately 80 narrow abilities; approximately 9 broad and 35 narrow abilities represented on current intelligence and achievement batteries

Revisions and Refinements to CHC Theory

- Nine of the 10 CHC factors were refined by Schneider and McGrew (2012; Gq remained the same)
- First, with regard to Gf, Piagetian Reasoning (RP) and Reasoning Speed (RE) were deemphasized, primarily because there is little evidence that they are distinct factors.
Revisions and Refinements to CHC Theory

- Second, four narrow Gc abilities (Foreign Language Proficiency [KL], Geography Achievement [A5], General Science Information [K1], and Knowledge of Culture [K2]) were moved to a different CHC broad ability, called *Domain-Specific Knowledge (Gkn)*.

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Revisions and Refinements to CHC Theory

- Another refinement to Gc involved

  - dropping the narrow ability of *Oral Production and Fluency (OP)* because it is difficult to distinguish it from the narrow ability of Communication Ability (CM).
Revisions and Refinements to CHC Theory

• Third, in the area of **Grw**
  - Verbal (Printed) Language Comprehension (V) was dropped because it appears to represent a number of different abilities (e.g., reading decoding, reading comprehension, reading speed) and, therefore, is not a distinct ability.
  - Cloze Ability (CZ) was dropped because it is not meaningfully distinct from reading comprehension (RC). Rather, CZ appears to be an alternative method of measuring reading comprehension.
  - Writing Speed (WS) was added to Grw, as this ability appears to cut across more than one broad ability (see Schneider & McGrew, 2012).

• Fourth, several refinements were made to **Glr** and Gsm.
  - **Learning Abilities (L1)** was dropped from both Glr and Gsm. Carroll conceived of L1 as a superordinate category consisting of different kinds of long-term learning abilities.
  - Schneider and McGrew refer to L1 as “Glr-Learning Efficiency,” which includes the narrow abilities of Free Recall Memory, Associative Memory, and Meaningful Memory.
  - The remaining Glr narrow abilities are referred to as “Retrieval Fluency” abilities.
Revisions and Refinements to CHC Theory

• In the area of Gsm, the name Working Memory (MW) was changed to Working Memory Capacity, as Schneider and McGrew believe this term is more descriptive of the types of tasks that are used most frequently to measure MW (e.g., Wechsler Letter-Number Sequencing).

Schneider and McGrew’s Conceptualization of Gsm and Glr in Contemporary CHC Theory

*Figure 4.6. Conceptual map of memory-related abilities in CHC theory.*
Revisions and Refinements to CHC Theory

• Fifth, one refinement was made to Gv.

• The name Spatial Relations (SR) was changed to “Speeded Rotation” (also “SR”) to more accurately describe this ability.
  – Speeded Rotation is the ability to solve problems quickly using mental rotation of simple images (Schneider & McGrew, 2012, p. 129).
  – This ability is similar to visualization because it involves rotating mental images but it is distinct because it has more to do with the speed at which mental rotation tasks can be completed (Lohman, 1996).
  – Speeded Rotation tasks typically involve fairly simple images. It is likely that the majority of tests that were classified as Spatial Relations in the past should have been classified as measures of Vz only (rather than SR, Vz).

Revisions and Refinements to CHC Theory

• Sixth, in the area of Ga, Temporal Tracking (UK) was dropped because these tasks are thought to measure Attentional Control within working memory.

• Six additional narrow Ga were dropped because they are considered to represent sensory acuity factors, which fall outside the scope of CHC theory (Schneider & McGrew)
  – General Sound Discrimination [U3], Sound-Intensity/Duration Discrimination [U6], Sound-Frequency Discrimination [U5], and Hearing and Speech Threshold [UA, UT, UU]
Questions About Auditory Attention

- Auditory Attention on WJ III (current classification is US/U3, UR)

- **Now** - Resistance to auditory stimulus distortion (UR): *The ability to hear words correctly even under conditions of distortion or loud background noise.* It is not yet clear to what degree this ability depends on sensory acuity. As people age, they tend to complain that they have greater difficulty understanding speech in noisy public places or on a telephone with background noise. Speaking louder usually helps them understand better.

Revisions and Refinements to CHC Theory

- Seventh, in the area of **Gs**, Reading Speed (RS) and Writing Speed (WS) were added (also listed under Grw)
  - Reading and writing speed demand quick, accurate performance and, therefore, are measures of Gs.

- The narrow Gs ability of Semantic Processing Speed (R4) was moved to Gt and Inspection Time (IT) was added to Gt.
Revisions and Refinements to CHC Theory

- **Six broad abilities were added** to CHC theory (McGrew, 2005; Schneider & McGrew, 2012)
  - General (Domain-Specific) Knowledge (Gkn)
  - Olfactory Abilities (Go)
  - Tactile Abilities (Gh)
  - Psychomotor Abilities (Gp)
  - Kinesthetic Abilities (Gk)
  - Psychomotor Speed (Gps)

- Many of these broad abilities appear to be assessed by neuropsychological instruments
  - Intention is to understand the sensory and motor manifestations of typical and atypical fine and gross motor development, traumatic brain injury, and other neurologically-based disorders.

- With rare exception, there do not appear to be any commercially published and commonly used intelligence or neuropsychological batteries that measure Go, Gt, or Gps.
### Broad and Narrow CHC Ability Representation on Seven Current Intelligence Batteries

Table X. Broad and Narrow CHC Ability Representation on Seven Current Intelligence Batteries (Essentials of XBA3 book: Flanagan, Ortiz & Alforno, 2012)

<table>
<thead>
<tr>
<th></th>
<th>Gf</th>
<th>Gc</th>
<th>Gy</th>
<th>Gsm</th>
<th>Glr</th>
<th>Ga</th>
<th>Gs</th>
</tr>
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*Note: Gf = Fluid Reasoning; Gc = Crystallized Reasoning; Gy = Knowledge; Gsm = Semantic Memory; Glr = Long-term Retrieval; Ga = Attention; Gs = Splitting of Attention.*

**Next Generation of Cognitive Tests**

- Better measurement of Narrow CHC Abilities
- Bridge CHC and neuropsychological theories
  - KABC-II
- Greater attention paid to Executive Functioning
  - *Essentials of Executive Functioning* by George McCloskey coming soon
- More computerized assessment
Next Generation of Cognitive Tests

• BETTER DIAGNOSTIC TOOLS
  – Drill down and understand disorders more precisely (e.g., subtypes)
  – Make better connections between disorder and treatment/intervention

Subtypes of Reading Disability

• Dysphonetic Dyslexia – difficulty sounding out words in a phonological manner

• Surface Dyslexia – difficulty with the rapid and automatic recognition of words in print

• Mixed Dyslexia – multiple reading deficits characterized by impaired phonological and orthographic processing skills. It is probably the most severe form of dyslexia.

• Comprehension Deficits – the mechanical side of reading is fine but difficulty persists deriving meaning from print

Predicting the 4 Subtypes of Reading Disability

- GF - Gc - Gy - Ga - Gsm - Glr - Gs - etc

Criterion DVs
- Dysphonetic Dyslexia
- Surface Dyslexia
- Mixed Dyslexia
- Comprehension Deficits

Legend:
- □ = most likely a strong predictor
- ■ = most likely a moderate predictor
- ▲ = most likely non-significant

Note: four subtypes from Feifer (2011); identification of IVs from Flanagan

Correspondence Between Diagnosis and Treatment

as syndromes/disorders become more discretely defined, there may be a greater correspondence between diagnoses and treatment

Kratochwill and McGivern's (1996; p. 351)
# Measures and Processes involved suggested by Flanagan

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Brain relationship</th>
<th>Description of Disorder</th>
<th>Norm-Based Measures for Identification</th>
<th>CHC and Neuropsychological Process involved</th>
<th>Treatment</th>
</tr>
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<tbody>
<tr>
<td>Dysphonic Dyslexia</td>
<td>Supramarginal gyrus, located at the juncture of the temporal and parietal lobes</td>
<td>Difficulty sounding out words in a phonological manner; inability to use phonological route to bridge letters and sounds; over-reliance on visual or orthographic cues; tend to guess on words based on initial letters observed; typically memorize whole words</td>
<td>Letter-Word Identification; Word Attack; Reading Decoding</td>
<td>Ga = PC: A, PC:S Gsm</td>
<td>Intervention should include an explicit phonological approach</td>
</tr>
<tr>
<td>Surface Dyslexia</td>
<td>Left fusiform gyrus</td>
<td>Difficulty with the rapid and automatic recognition of words in print; can sound out words, but cannot recognize words in print automatically and effortlessly; letter-by-letter and sound-by-sound readers; over-reliance on phonological properties and under-representation of orthographic or spatial properties of the word; reading is slow and laborious</td>
<td>Test of Silent Word Reading Fluency (TOSWRF); Test of Orthographic Competence (TOC)</td>
<td>Gr = VM Orthographic Processing Gr = NA Gc = VL</td>
<td>Intervention should focus on automaticity and fluency goals (not necessarily an explicit phonological approach)</td>
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# Measures and Processes involved suggested by Flanagan

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<tr>
<td>Mixed Dyslexia</td>
<td>Show weaker modulatory effects from the left fusiform gyrus to the left inferior parietal lobes, suggesting deficits integrating both the phonological representation and orthographical representation of words</td>
<td>Multiple reading deficits characterized by impaired phonological and orthographic processing skills. Most likely the most severe form of dyslexia, characterized by a combination of poor phonological processing skills, slower rapid and automatic word recognition skills, inconsistent language comprehension skills; bizarre error patterns in reading; double-deficit.</td>
<td>Combination of tests for two previous subtypes</td>
<td>Ga = PC: A, PC:S Gv = VM Orthographic Processing Gr = NA Gsm Gc = VL</td>
<td>Intervention should incorporate a balanced literacy approach</td>
</tr>
<tr>
<td>Comprehension Deficits</td>
<td>The brain’s executive attention network – modulated primarily by the anterior cingulate gyrus in the frontal lobes</td>
<td>The mechanical side of reading is fine, but difficulty deriving meaning from print</td>
<td>D-KEFS BRIEF NEPSY-II Tests of MW Language skills assessment</td>
<td>Executive Functioning Gf = I, RG Gsm = MW Gc = VL, KO, MY Attention</td>
<td>Intervention should be at the language level, not the phonological level; externalize the reasoning process – Summarize, Clarify, Question and Predict</td>
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