



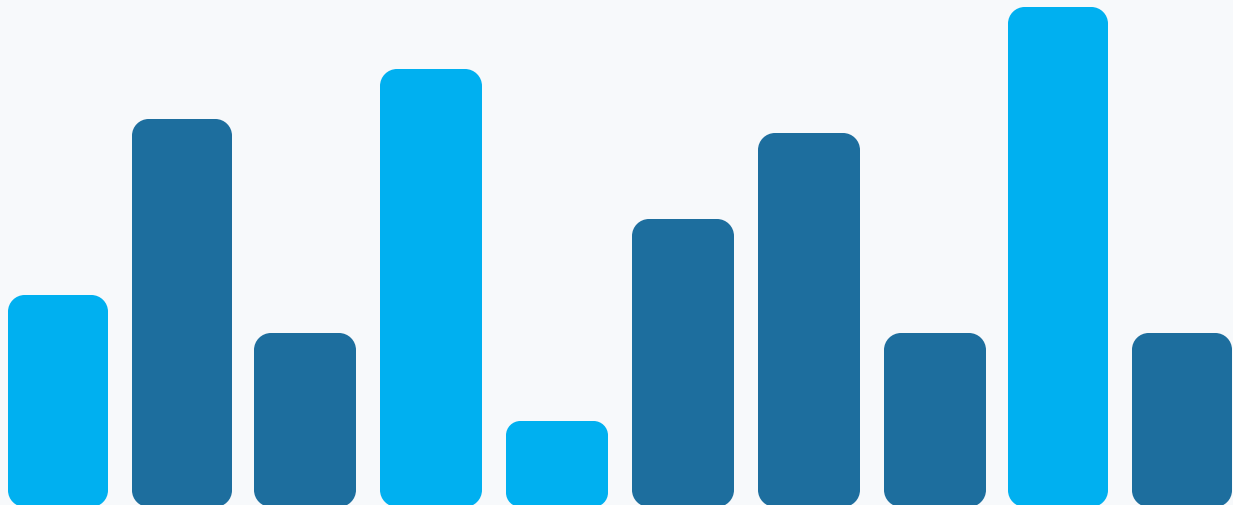
# Structure

## Technical Manual for the Structural Framework of the Advanced Comprehensive Intelligence Scale (ACIS)

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This manual documents the conceptual structure of ACIS, including its alignment with the Cattell-Horn-Carroll (CHC) model, the intended constructs of each subtest and index, and the composition of the available assessment forms.

Document status: Technical reference (no administration materials; no item content).  
Audience: Researchers, test developers, and advanced users requiring a construct-level map of ACIS.



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## 0. Purpose and Scope

The purpose of this document is to provide technical knowledge and construct-level reference information about the structure of ACIS (Advanced Comprehensive Intelligence Scale). The scope of this manual is limited to: (a) the conceptual relationship between ACIS and the CHC model of cognitive abilities; (b) the intended psychological constructs targeted by each subtest; (c) the interpretive intent of each index and composite index; and (d) the composition of the three supported assessment forms (Quick, Optimized, and Full Scale).

This manual is designed to be descriptive rather than prescriptive. It does not include item content, administration scripts, timing rules, or normative tables. Any psychometric properties (e.g., reliability, factor structure, or measurement invariance) must be established separately using empirical data.

Notation. The following conventions are used throughout: Gc = Comprehension-Knowledge; Gf = Fluid Reasoning; Gv = Visual Processing; Gq = Quantitative Knowledge; Gwm = Working Memory; Gs = Processing Speed; g = general cognitive ability (as a statistical factor).



# 1. ACIS and the Cattell-Horn-Carroll (CHC) Model

ACIS is described as being based on the CHC (Cattell-Horn-Carroll) model of cognitive abilities. CHC is a hierarchical taxonomy that organizes cognitive performance into multiple levels of abstraction, ranging from a general factor (often labeled *g*) to broad abilities (e.g., *Gf*, *Gc*) and narrower abilities that represent more specific cognitive processes. In practice, CHC is used as a construct map: it helps test developers specify what a subtest is intended to measure and helps users interpret patterns of strengths and weaknesses.

## 1. Overview of the CHC framework

The CHC model integrates influential traditions in intelligence research: Cattell's distinction between fluid and crystallized abilities, Horn's expansion to multiple broad abilities, and Carroll's evidence-based three-stratum hierarchy. Within this framework, observed test performance is explained by: (1) narrow abilities, which are proximal to specific task demands; (2) broad abilities, which summarize shared variance among related narrow abilities; and (3) a higher-order general factor capturing variance shared across a wide range of cognitive tasks.

In CHC-oriented test development, subtests are designed to load strongly on targeted narrow abilities while also contributing meaningfully to the intended broad ability (or composite) through shared variance.

## 2. Why a CHC crosswalk is technically important

A systematic mapping between ACIS subtests and CHC abilities serves three functions. First, it clarifies construct coverage: whether the battery samples the intended breadth of abilities. Second, it enables interpretable composites: indices can be defined in terms of broad abilities rather than as arbitrary subtest bundles. Third, it supports future psychometric work by making explicit the a priori model that empirical factor analyses should test.

## 3. Why CHC is commonly used in contemporary cognitive assessment

CHC is widely used because it provides a practical bridge between theory and measurement. It accommodates both general intelligence and differentiated cognitive domains, which is useful for batteries that aim to report multiple indices. Importantly, CHC offers a standardized vocabulary (e.g., *Gf*, *Gc*, *Gv*) that supports comparability across instruments and research programs. This does not imply that CHC is the only valid framework; rather, it is a common reference model for structuring test content and interpretive reports.



## 4. Method used in this manual to relate ACIS to CHC

This manual follows a construct-definition approach. For each ACIS subtest, a primary CHC narrow ability is specified based on the dominant cognitive operations required by typical item formats (e.g., lexical retrieval, inductive rule discovery, visuospatial synthesis, or short-term maintenance/manipulation). Some subtests are mapped to more than one narrow ability when the task intentionally blends processes (e.g., Similarities is treated as combining lexical knowledge with abstract induction). For indices, the mapping is made at the broad ability level (e.g., VCI to Gc).

## 5. Subtest-level CHC mapping

The following table provides the crosswalk between ACIS subtests and the CHC narrow abilities that the subtests are intended to emphasize. For blended mappings, each listed narrow ability represents a deliberate component of the task demands.

Index	Subtest	CHC narrow ability	construct description
VCI	Antonyms	Lexical Knowledge	Breadth and depth of word meanings, vocabulary, and semantic network organization; supports efficient access to verbal concepts.
VCI	Vocabulary	Lexical Knowledge	Breadth and depth of word meanings, vocabulary, and semantic network organization; supports efficient access to verbal concepts.
VCI	Information	General Information	Breadth of acquired factual knowledge and culturally mediated declarative information stored in long-term memory.
VCI	Paragraph Reading	Reading Comprehension	Extraction, integration, and inference of meaning from written passages; construction of coherent mental representations.
VCI	Similarities	Induction + Lexical Knowledge	Induction: Deriving general rules from specific instances; detecting regularities and generating hypotheses about underlying structure. Lexical Knowledge: Breadth and depth of word meanings, vocabulary, and semantic network organization; supports efficient access to verbal concepts.
FRI	Matrix Reasoning	Induction	Deriving general rules from specific instances; detecting regularities and generating hypotheses about underlying structure.
FRI	Figure Weights	Quantitative Reasoning	Reasoning with quantities, relations, and numerical constraints; mental manipulation of abstract quantitative relationships.

Index	Subtest	CHC narrow ability	construct description
FRI	Visual Number Series	Induction	Deriving general rules from specific instances; detecting regularities and generating hypotheses about underlying structure.
FRI	Logic Grid	General Sequential Reasoning	Stepwise application of constraints and rules to reach a logically necessary conclusion; emphasizes ordered reasoning.
FRI	Complex Relations	Induction	Deriving general rules from specific instances; detecting regularities and generating hypotheses about underlying structure.
VSI	Visual Puzzles	Visualization + Speeded Rotation	Visualization: Formation and manipulation of internal visual representations; mental synthesis and transformation of spatial relations. Speeded Rotation: Rapid mental rotation of visual forms; quick evaluation of transformed viewpoints or orientations.
VSI	Block Design	Visualization + Spatial Scanning + Speeded Rotation	Visualization: Formation and manipulation of internal visual representations; mental synthesis and transformation of spatial relations. Spatial Scanning: Efficient search and tracking of spatial relations within a visual field; supports construction and verification of spatial arrangements. Speeded Rotation: Rapid mental rotation of visual forms; quick evaluation of transformed viewpoints or orientations.
VSI	Spatial Comprehension	Imagery + Visualization + Visual Memory	Imagery: Generation of vivid internal images from partial cues; maintaining and transforming mental images for problem solving. Visualization: Formation and manipulation of internal visual representations; mental synthesis and transformation of spatial relations. Visual Memory: Encoding and retrieval of visual patterns or configurations; maintaining visual representations over short delays.
QRI	Mathematical Achievement	Mathematical Achievement	Acquired mathematical knowledge and skill in applying learned procedures to solve structured problems.
QRI	Arithmetic	Quantitative Reasoning	Reasoning with quantities, relations, and numerical constraints; mental manipulation of abstract quantitative relationships.

Index	Subtest	CHC narrow ability	construct description
WMI	Digit Span	Working Memory Capacity + Auditory Short-Term Storage	Working Memory Capacity: Capacity to maintain and manipulate information in the focus of attention while resisting interference. Auditory Short-Term Storage: Temporary storage of phonological/auditory sequences; supports serial recall and ordered manipulation.
WMI	Alphanumeric Sequencing	Working Memory Capacity + Auditory Short-Term Storage	Working Memory Capacity: Capacity to maintain and manipulate information in the focus of attention while resisting interference. Auditory Short-Term Storage: Temporary storage of phonological/auditory sequences; supports serial recall and ordered manipulation.
WMI	Visual Sequence	Visual Memory + Visual-Spatial Short-Term Storage	Visual Memory: Encoding and retrieval of visual patterns or configurations; maintaining visual representations over short delays. Visual-Spatial Short-Term Storage: Temporary storage of spatial locations or visual sequences; supports ordered recall and manipulation of visuospatial information.
PSI	Coding	Perceptual Speed-Compare + Writing Speed	Perceptual Speed-Compare: Rapid discrimination and comparison of simple visual stimuli; efficient same/different judgments under time constraints. Writing Speed: Speeded graphomotor output and symbol transcription; coordination of motor execution with cognitive demands.
PSI	Symbol Search	Perceptual Speed-Search	Rapid visual scanning to locate target features among distractors; emphasizes detection under time pressure.

Note. Subtest labels are treated as construct placeholders. The definitive mapping depends on the implemented item formats and scoring rules. The mappings shown here reflect the construct intent stated for ACIS.

## 6. Index-level CHC mapping

At the index level, ACIS indices are mapped to CHC broad abilities. This mapping describes the conceptual construct each index is intended to summarize.

ACIS index	CHC broad ability (target)	Brief
VCI	Gc (Comprehension-Knowledge)	Depth and breadth of acquired knowledge, verbal concepts, and language-based reasoning.
FRI	Gf (Fluid Reasoning)	Reasoning and problem solving in novel situations; rule discovery and flexible adaptation without relying on learned knowledge.
VSI	Gv (Visual Processing)	Perception and mental manipulation of visual-spatial information, including visualization, rotation, and spatial analysis.
QRI	Gq (Quantitative Knowledge) + Gf (Fluid Reasoning)	Gq (Quantitative Knowledge): Acquired mathematical knowledge and procedural skill, including learned numerical concepts and operations. Gf (Fluid Reasoning): Reasoning and problem solving in novel situations; rule discovery and flexible adaptation without relying on learned knowledge.
WMI	Gwm (Working Memory)	Capacity to maintain and manipulate information over short intervals under attentional control.
PSI	Gs (Processing Speed)	Speed and efficiency of performing simple cognitive operations, especially visual scanning and rapid decision making.

## 7. Technical conclusion on CHC alignment

Within this framework, ACIS can be interpreted as a CHC-oriented battery that combines verbal knowledge (Gc), novel reasoning (Gf), visual processing (Gv), quantitative knowledge and reasoning (Gq + Gf), working memory (Gwm), and processing speed (Gs). The subtest mapping clarifies how each index operationalizes its target construct through specific narrow abilities. In future empirical work, this mapping can be used to evaluate whether the observed factor structure corresponds to the intended CHC structure and whether indices demonstrate adequate construct purity and discriminant validity.

## 2. What ACIS Measures

ACIS is conceptualized as a multi-domain intelligence battery whose subtests are designed to sample a wide range of cognitively demanding operations. At the construct level, ACIS targets both domain-general reasoning processes (e.g., induction and executive control) and domain-specific knowledge (e.g., verbal and quantitative knowledge), consistent with the hierarchical perspective common to CHC-oriented assessment.

### 1. Subtest design principles

Each subtest is treated as an operational definition of a cognitive construct. In a construct-driven battery, subtests are designed to maximize signal from the intended ability while minimizing construct-irrelevant variance (e.g., excessive reliance on reading speed for a reasoning task, or excessive reliance on motor speed for a verbal task). Design choices such as stimulus modality, response format, time limits, and item difficulty gradients are therefore central to the interpretability of scores.

### 2. Why subtest design quality matters in intelligence measurement

Index scores inherit their validity from the quality of their constituent subtests. Weakly designed subtests can introduce systematic bias (e.g., cultural or educational confounds), inflate measurement error, or shift the construct being measured away from the intended target. Conversely, well-aligned subtests facilitate clearer factor structure, stronger measurement precision across ability levels, and more interpretable profiles.

### 3. High-level development workflow

The development process summarized here follows a typical evidence-informed workflow: (1) large-scale review of existing subtest formats across instruments; (2) identification of what makes formats effective or ineffective for measuring the intended construct; (3) selection of high-performing formats and mitigation of known weaknesses; (4) integration planning (how subtests collectively cover constructs and avoid redundancy); (5) item specification and iterative item writing; and (6) implementation (software, scoring logic, and quality controls). In this framing, each subtest is designed with explicit standards for construct alignment and measurement integrity.

### 4. Subtest constructs

This section provides construct definitions for each ACIS subtest. Descriptions emphasize the primary cognitive operations the task is intended to elicit and measure.



Subtest	Primary construct description
Antonyms	Access and retrieval of semantic representations stored in long-term memory; rapid discrimination of lexical meaning to identify oppositional relations.
Vocabulary	Verbal concept formation and organization of semantic knowledge; precise definition of word meanings and categorical structure.
Information	Retrieval of declarative knowledge (general factual information) from long-term memory and application of that knowledge to questions.
Paragraph Reading	Integration of textual information and construction of coherent mental representations; comprehension, inference, and updating across sentences.
Similarities	Conceptual abstraction and formation of superordinate categories; identification of shared attributes across concepts and verbal reasoning about relations.

Subtest	Primary construct description
Matrix Reasoning	Inductive reasoning and rule extraction from novel stimuli; hypothesis generation and verification using abstract visual patterns.
Figure Weights	Quantitative reasoning and manipulation of abstract quantitative relations; balancing constraints and proportional reasoning.
Visual Number Series	Pattern detection and hypothesis generation about underlying rules in numerical sequences; extrapolation using inferred transformations.
Logic Grid	Step-by-step application of explicit rules to reach a logically necessary solution; constraint propagation and systematic elimination.
Complex Relations	Induction of transformation rules and relational patterns across multi-step sequences; integration of multiple constraints into a coherent rule set.

Subtest	Primary construct description
Visual Puzzles	Mental synthesis of parts into a whole and rotation of visual representations; spatial reasoning with decomposed forms.
Block Design	Perceptual analysis, visual segmentation, and spatial construction; mapping a target configuration to component placement under precision demands.
Spatial Comprehension	Generation of mental images and manipulation of internal spatial representations; transforming viewpoints and maintaining spatial relations.

Subtest	Primary construct description
Mathematical Achievement	Application of acquired mathematical knowledge and procedures to solve structured problems; retrieval of learned rules and accurate execution.
Arithmetic	Mental calculation, maintenance of numerical information, and execution of operations; combines quantitative knowledge with working memory control.

Subtest	Primary construct description
Digit Span	Attentional maintenance, phonological encoding, and manipulation of information within an articulatory loop; serial recall and reordering demands.
Alphanumeric Sequencing	Executive control, updating, and active reorganization of mixed information; sequencing under rule-based constraints.
Visual Sequence	Storage in the visuospatial sketchpad and retrieval of positional sequences; ordered recall of visual locations and transformations.

Subtest	Primary construct description
Coding	Automation of symbol associations, motor response speed, and processing efficiency; rapid transcription under time constraints.
Symbol Search	Rapid perceptual discrimination, stimulus comparison, and time-pressured decision making; efficient scanning and response selection.

## 5. Index and composite index constructs

ACIS reports both primary indices and optional composite indices. The definitions below describe the intended meaning of each index, independent of any specific scoring algorithm.

Index	Intended construct (definition)
VCI	Access and application of acquired verbal knowledge; verbal concept formation, reasoning, and expression.
FRI	Novel problem solving and logical reasoning in situations that do not rely primarily on previously learned knowledge.
VSI	Analysis and manipulation of visual-spatial relationships; evaluation of visual details and spatial integration.
QRI	Quantitative reasoning and mental computation; application of quantitative knowledge to structured numerical problems.

Index	Intended construct (definition)
WMI	Registration, maintenance, and manipulation of information in conscious awareness (auditory and visual working memory).
PSI	Speed and accuracy of visual scanning, decision making, and rapid execution of simple cognitive operations.
CFI	Cultural-fair composite emphasizing reasoning, working memory, and processing efficiency with reduced reliance on acquired verbal content.
GAI	General ability composite emphasizing higher-order reasoning and knowledge (verbal, fluid, visual-spatial, and quantitative).
IRI	Inductive reasoning: detection and abstraction of underlying patterns, rules, and relationships in novel stimuli.
VRI	Verbal reasoning: identifying and explaining relations among verbal and lexical concepts, including abstraction of shared meaning.
VWMI	Visual working memory: registration, maintenance, and manipulation of visual information and ordered visual sequences.
AWMI	Auditory working memory: registration, maintenance, and manipulation of auditory-verbal information and serial sequences.
CVSI	Expanded visual-spatial composite intended to capture a broader range of visual processing operations than VSI alone.
CFRI	Expanded fluid reasoning composite intended to capture a broader range of reasoning operations than FRI alone, including quantitative components.
CQRI	Expanded quantitative reasoning composite intended to capture quantitative knowledge and quantitative pattern discovery more comprehensively than QRI.
NVI	Nonverbal composite emphasizing reasoning, visual-spatial ability, working memory, and speed with minimal reliance on verbal content.
GRI	General reasoning composite sampling multiple reasoning modalities, including fluid, quantitative, and visual-spatial reasoning.
CPI	Cognitive proficiency composite emphasizing working memory and processing speed (efficient execution and controlled attention).
SAI	Scholastic ability composite emphasizing academic performance, achievement, and knowledge-related constructs.
VKI	Verbal knowledge composite emphasizing lexical retrieval, verbal concept formation, and declarative knowledge.

## 6. Full Scale IQ (FSIQ): construct definition and relation to CHC

The Full Scale IQ (FSIQ) is a global composite intended to summarize overall cognitive ability across the breadth of the battery. In hierarchical models of intelligence, a global composite is often interpreted as an operational estimate of the variance shared across



diverse cognitive tasks. Statistically, this shared variance is commonly represented by a general factor (g) that sits above broad abilities such as Gc, Gf, Gv, Gq, Gwm, and Gs.

Conceptually, FSIQ is most interpretable when (a) the battery samples multiple broad abilities, (b) subtests demonstrate adequate reliability, and (c) the composite reflects broad, domain-general demands rather than a narrow skill. When the profile is highly uneven, users often rely more heavily on domain indices and targeted composites to describe the cognitive pattern in a scientifically precise way.

## **7. Integrated conclusion on constructs and measurement intent**

Across all measures, ACIS provides a comprehensive assessment of cognitive functioning aligned with CHC terminology. The battery distinguishes between narrow cognitive tasks at the subtest level and broad ability domains at the index level. This hierarchical approach is complemented by specialized composites designed for specific interpretive goals, such as culturally fair summaries or nonverbal testing, ensuring versatile application across different populations.



## 3. ACIS Assessment Forms and Structural Composition

ACIS is described as supporting three assessment forms. The forms differ in breadth of construct coverage and the number of subtests administered. All forms are built from the same construct map, but they prioritize different trade-offs between comprehensiveness and efficiency.

### 1. Summary of available forms

Form	Primary objective	Breadth	Reported indices
Quick	Efficient screening of core verbal knowledge, fluid reasoning, and working memory.	6 subtests	VCI, FRI, WMI
Optimized	Broad yet efficient coverage with emphasis on cultural-fair and general-ability composites.	15 subtests (as specified)	VCI, FRI, VSI, WMI, PSI, CFI, GAI
Full Scale	Comprehensive construct coverage across all primary and composite indices.	20 subtests (core) + composites derived	VCI, FRI, VSI, QRI, WMI, PSI, plus composites

### 2. Quick form: structure

The Quick form is designed as an efficient assessment targeting three core domains: verbal comprehension (VCI), fluid reasoning (FRI), and working memory (WMI). It uses two subtests per index.

Index	Subtests included
VCI	Similarities, Vocabulary
FRI	Matrix Reasoning, Figure Weights
WMI	Digit Span, Alphanumeric Sequencing

Because the Quick form samples fewer domains, it should be interpreted primarily as a focused estimate of core reasoning and memory processes rather than as a comprehensive profile.

### 3. Optimized form: structure

The Optimized form expands coverage by adding visual-spatial (VSI) and processing speed (PSI) domains and by defining two composites: a Cultural-Fair Index (CFI) and a General Ability Index (GAI). The form specifies a targeted set of subtests for each index and composite.

Index	Subtests included
VCI	Vocabulary, Antonyms, Similarities, Paragraph Reading
FRI	Matrix Reasoning, Figure Weights, Logic Grid
VSI	Spatial Comprehension, Block Design
WMI	Digit Span, Alphanumeric Sequencing
PSI	Coding, Symbol Search

Index	Subtests included
CFI	Matrix Reasoning, Figure Weights, Logic Grid, Spatial Comprehension, Block Design, Digit Span, Alphanumeric Sequencing, Coding, Symbol Search
GAI	Vocabulary, Antonyms, Similarities, Paragraph Reading, Matrix Reasoning, Figure Weights, Logic Grid, Spatial Comprehension, Block Design



## 4. Full Scale form: structure

The Full Scale form is the comprehensive ACIS configuration. It includes all core subtests across six primary indices (VCI, FRI, VSI, QRI, WMI, PSI) and supports a broad set of composite indices derived from these subtests.

Index	Subtests included
VCI	Antonyms, Vocabulary, Information, Paragraph Reading, Similarities
FRI	Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations
QRI	Mathematical Achievement, Arithmetic
VSI	Visual Puzzles, Block Design, Spatial Comprehension
WMI	Digit Span, Alphanumeric Sequencing, Visual Sequence
PSI	Symbol Search, Coding

In addition to the primary indices, the Full Scale configuration defines the composite indices listed below. Composites are defined as specific subtest sets that emphasize targeted interpretive goals (e.g., cultural-fair estimation, expanded domain coverage, or domain-specific reasoning).

Composite index	Subtests included
CFI	Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Mathematical Achievement, Arithmetic, Visual Puzzles, Block Design, Spatial Comprehension, Digit Span, Alphanumeric Sequencing, Visual Sequence, Symbol Search, Coding
GAI	Antonyms, Vocabulary, Information, Paragraph Reading, Similarities, Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Mathematical Achievement, Arithmetic, Visual Puzzles, Block Design, Spatial Comprehension
IRI	Visual Number Series, Matrix Reasoning, Complex Relations
VRI	Similarities, Complex Relations
VWMI	Visual Sequence
AWMI	Digit Span, Alphanumeric Sequencing
CVSI	Block Design, Visual Puzzles, Spatial Comprehension, Visual Sequence

Composite index	Subtests included
CFRI	Visual Number Series, Figure Weights, Arithmetic, Matrix Reasoning, Logic Grid, Complex Relations, Mathematical Achievement
CQRI	Mathematical Achievement, Figure Weights, Arithmetic, Visual Number Series
NVI	Matrix Reasoning, Figure Weights, Visual Puzzles, Block Design, Logic Grid, Visual Sequence, Symbol Search, Coding
GRI	Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Arithmetic, Mathematical Achievement, Visual Puzzles, Block Design, Spatial Comprehension, Similarities
CPI	Digit Span, Alphanumeric Sequencing, Visual Sequence, Coding, Symbol Search
SAI	Mathematical Achievement, Logic Grid, Figure Weights, Arithmetic, Paragraph Reading, Information, Antonyms, Vocabulary, Similarities
VKI	Antonyms, Vocabulary, Information

## 5. Interpretation notes for structural reporting

This manual specifies structural composition but does not prescribe scoring weights or transformation rules. In practice, composite scores are typically computed from standardized subtest scores (e.g., scaled scores) using sums and normative transformations. Regardless of scoring, the interpretive meaning of an index depends on:

(a) the construct coherence of its subtests, (b) the reliability of each component, and (c) the degree to which the composite reflects the intended CHC-aligned ability rather than task-specific artifacts.

## Appendix A. Abbreviations

Key abbreviations used in this manual.

Abbreviation	Meaning
ACIS	Advanced Comprehensive Intelligence Scale
CHC	Cattell-Horn-Carroll model of cognitive abilities
FSIQ	Full Scale IQ (global composite)
g	General cognitive ability factor (statistical general factor)
Gc	Comprehension-Knowledge (crystallized/knowledge-based abilities)
Gf	Fluid Reasoning
Gv	Visual Processing
Gq	Quantitative Knowledge
Gwm	Working Memory
Gs	Processing Speed
VCI	Verbal Comprehension Index
FRI	Fluid Reasoning Index
VSI	Visual Spatial Index
QRI	Quantitative Reasoning Index
WMI	Working Memory Index
PSI	Processing Speed Index
CFI	Cultural-Fair Index
GAI	General Ability Index
IRI	Inductive Reasoning Index
VRI	Verbal Reasoning Index
VWMI	Visual Working Memory Index
AWMI	Auditory Working Memory Index
CVSI	Complete Visual Spatial Index
CFRI	Complete Fluid Reasoning Index
CQRI	Complete Quantitative Reasoning Index
NVI	Nonverbal Index
GRI	General Reasoning Index

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Abbreviation	Meaning
CPI	Cognitive Proficiency Index
SAI	Scholastic Ability Index
VKI	Verbal Knowledge Index



## Appendix B. Glossary of CHC Abilities Referenced

The definitions below are functional descriptions used for construct mapping within this manual. They are intended to be practically useful for test design and interpretation.

### B.1 Broad abilities

Broad ability	Functional description
Gc (Comprehension-Knowledge)	Depth and breadth of acquired knowledge, verbal concepts, and language-based reasoning.
Gf (Fluid Reasoning)	Reasoning and problem solving in novel situations; rule discovery and flexible adaptation without relying on learned knowledge.
Gv (Visual Processing)	Perception and mental manipulation of visual-spatial information, including visualization, rotation, and spatial analysis.
Gq (Quantitative Knowledge)	Acquired mathematical knowledge and procedural skill, including learned numerical concepts and operations.
Gwm (Working Memory)	Capacity to maintain and manipulate information over short intervals under attentional control.
Gs (Processing Speed)	Speed and efficiency of performing simple cognitive operations, especially visual scanning and rapid decision making.

### B.2 Narrow abilities

Narrow ability	Functional description
Auditory Short-Term Storage	Temporary storage of phonological/auditory sequences; supports serial recall and ordered manipulation.
General Information	Breadth of acquired factual knowledge and culturally mediated declarative information stored in long-term memory.
General Sequential Reasoning	Stepwise application of constraints and rules to reach a logically necessary conclusion; emphasizes ordered reasoning.
Imagery	Generation of vivid internal images from partial cues; maintaining and transforming mental images for problem solving.
Induction	Deriving general rules from specific instances; detecting regularities and generating hypotheses about underlying structure.
Lexical Knowledge	Breadth and depth of word meanings, vocabulary, and semantic network organization; supports efficient access to verbal concepts.
Mathematical Achievement	Acquired mathematical knowledge and skill in applying learned procedures to solve structured problems.

Narrow ability	Functional description
Perceptual Speed-Compare	Rapid discrimination and comparison of simple visual stimuli; efficient same/different judgments under time constraints.
Perceptual Speed-Search	Rapid visual scanning to locate target features among distractors; emphasizes detection under time pressure.
Quantitative Reasoning	Reasoning with quantities, relations, and numerical constraints; mental manipulation of abstract quantitative relationships.
Reading Comprehension	Extraction, integration, and inference of meaning from written passages; construction of coherent mental representations.
Spatial Scanning	Efficient search and tracking of spatial relations within a visual field; supports construction and verification of spatial arrangements.
Speeded Rotation	Rapid mental rotation of visual forms; quick evaluation of transformed viewpoints or orientations.
Visual Memory	Encoding and retrieval of visual patterns or configurations; maintaining visual representations over short delays.
Visual-Spatial Short-Term Storage	Temporary storage of spatial locations or visual sequences; supports ordered recall and manipulation of visuospatial information.
Visualization	Formation and manipulation of internal visual representations; mental synthesis and transformation of spatial relations.
Working Memory Capacity	Capacity to maintain and manipulate information in the focus of attention while resisting interference.
Writing Speed	Speeded graphomotor output and symbol transcription; coordination of motor execution with cognitive demands.

## Appendix C. Subtest Reference Sheet

This reference sheet summarizes each subtest, its primary index placement, the intended CHC narrow-ability mapping, and a concise construct definition.

Subtest	Primary index	CHC narrow ability	Construct summary
Antonyms	VCI	Lexical Knowledge	Access and retrieval of semantic representations stored in long-term memory; rapid discrimination of lexical meaning to identify oppositional relations.
Vocabulary	VCI	Lexical Knowledge	Verbal concept formation and organization of semantic knowledge; precise definition of word meanings and categorical structure.
Information	VCI	General Information	Retrieval of declarative knowledge (general factual information) from long-term memory and application of that knowledge to questions.
Paragraph Reading	VCI	Reading Comprehension	Integration of textual information and construction of coherent mental representations; comprehension, inference, and updating across sentences.
Similarities	VCI	Induction + Lexical Knowledge	Conceptual abstraction and formation of superordinate categories; identification of shared attributes across concepts and verbal reasoning about relations.
Matrix Reasoning	FRI	Induction	Inductive reasoning and rule extraction from novel stimuli; hypothesis generation and verification using abstract visual patterns.
Figure Weights	FRI	Quantitative Reasoning	Quantitative reasoning and manipulation of abstract quantitative relations; balancing constraints and proportional reasoning.
Visual Number Series	FRI	Induction	Pattern detection and hypothesis generation about underlying rules in numerical sequences; extrapolation using inferred transformations.
Logic Grid	FRI	General Sequential Reasoning	Step-by-step application of explicit rules to reach a logically necessary solution; constraint propagation and systematic elimination.
Complex Relations	FRI	Induction	Induction of transformation rules and relational patterns across multi-step sequences; integration of multiple constraints into a coherent rule set.

Subtest	Primary index	CHC narrow ability	Construct summary
Visual Puzzles	VSI	Visualization + Speeded Rotation	Mental synthesis of parts into a whole and rotation of visual representations; spatial reasoning with decomposed forms.
Block Design	VSI	Visualization + Spatial Scanning + Speeded Rotation	Perceptual analysis, visual segmentation, and spatial construction; mapping a target configuration to component placement under precision demands.
Spatial Comprehension	VSI	Imagery + Visualization + Visual Memory	Generation of mental images and manipulation of internal spatial representations; transforming viewpoints and maintaining spatial relations.
Mathematical Achievement	QRI	Mathematical Achievement	Application of acquired mathematical knowledge and procedures to solve structured problems; retrieval of learned rules and accurate execution.
Arithmetic	QRI	Quantitative Reasoning	Mental calculation, maintenance of numerical information, and execution of operations; combines quantitative knowledge with working memory control.
Digit Span	WMI	Working Memory Capacity + Auditory Short-Term Storage	Attentional maintenance, phonological encoding, and manipulation of information within an articulatory loop; serial recall and reordering demands.
Alphanumeric Sequencing	WMI	Working Memory Capacity + Auditory Short-Term Storage	Executive control, updating, and active reorganization of mixed information; sequencing under rule-based constraints.
Visual Sequence	WMI	Visual Memory + Visual-Spatial Short-Term Storage	Storage in the visuospatial sketchpad and retrieval of positional sequences; ordered recall of visual locations and transformations.
Coding	PSI	Perceptual Speed-Compare + Writing Speed	Automation of symbol associations, motor response speed, and processing efficiency; rapid transcription under time constraints.
Symbol Search	PSI	Perceptual Speed-Search	Rapid perceptual discrimination, stimulus comparison, and time-pressured decision making; efficient scanning and response selection.

## Appendix D. Composite Index Reference Sheet

Composite indices are derived from predefined subtest sets. This appendix lists the intended construct definition and the subtests included for each composite index described in this manual.

Composite	Intended construct	Subtests included
CFI	Cultural-fair composite emphasizing reasoning, working memory, and processing efficiency with reduced reliance on acquired verbal content.	Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Mathematical Achievement, Arithmetic, Visual Puzzles, Block Design, Spatial Comprehension, Digit Span, Alphanumeric Sequencing, Visual Sequence, Symbol Search, Coding
GAI	General ability composite emphasizing higher-order reasoning and knowledge (verbal, fluid, visual-spatial, and quantitative).	Antonyms, Vocabulary, Information, Paragraph Reading, Similarities, Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Mathematical Achievement, Arithmetic, Visual Puzzles, Block Design, Spatial Comprehension
IRI	Inductive reasoning: detection and abstraction of underlying patterns, rules, and relationships in novel stimuli.	Visual Number Series, Matrix Reasoning, Complex Relations
VRI	Verbal reasoning: identifying and explaining relations among verbal and lexical concepts, including abstraction of shared meaning.	Similarities, Complex Relations
VWMI	Visual working memory: registration, maintenance, and manipulation of visual information and ordered visual sequences.	Visual Sequence
AWMI	Auditory working memory: registration, maintenance, and manipulation of auditory-verbal information and serial sequences.	Digit Span, Alphanumeric Sequencing
CVSI	Expanded visual-spatial composite intended to capture a broader range of visual processing operations than VSI alone.	Block Design, Visual Puzzles, Spatial Comprehension, Visual Sequence
CFRI	Expanded fluid reasoning composite intended to capture a broader range of reasoning operations than FRI alone, including quantitative components.	Visual Number Series, Figure Weights, Arithmetic, Matrix Reasoning, Logic Grid, Complex Relations, Mathematical Achievement

Composite	Intended construct	Subtests included
CQRI	Expanded quantitative reasoning composite intended to capture quantitative knowledge and quantitative pattern discovery more comprehensively than QRI.	Mathematical Achievement, Figure Weights, Arithmetic, Visual Number Series
NVI	Nonverbal composite emphasizing reasoning, visual-spatial ability, working memory, and speed with minimal reliance on verbal content.	Matrix Reasoning, Figure Weights, Visual Puzzles, Block Design, Logic Grid, Visual Sequence, Symbol Search, Coding
GRI	General reasoning composite sampling multiple reasoning modalities, including fluid, quantitative, and visual-spatial reasoning.	Matrix Reasoning, Figure Weights, Visual Number Series, Logic Grid, Complex Relations, Arithmetic, Mathematical Achievement, Visual Puzzles, Block Design, Spatial Comprehension, Similarities
CPI	Cognitive proficiency composite emphasizing working memory and processing speed (efficient execution and controlled attention).	Digit Span, Alphanumeric Sequencing, Visual Sequence, Coding, Symbol Search
SAI	Scholastic ability composite emphasizing academic performance, achievement, and knowledge-related constructs.	Mathematical Achievement, Logic Grid, Figure Weights, Arithmetic, Paragraph Reading, Information, Antonyms, Vocabulary, Similarities
VKI	Verbal knowledge composite emphasizing lexical retrieval, verbal concept formation, and declarative knowledge.	Antonyms, Vocabulary, Information

End of manual.

