The Cattell-Horn-Carroll (CHC) Model of Intelligence:

A visual tour and summary

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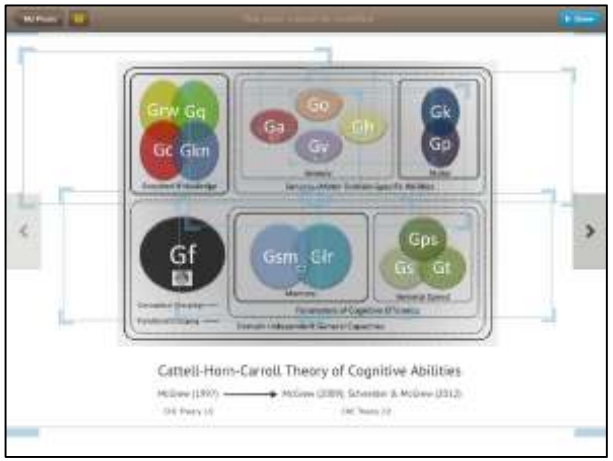
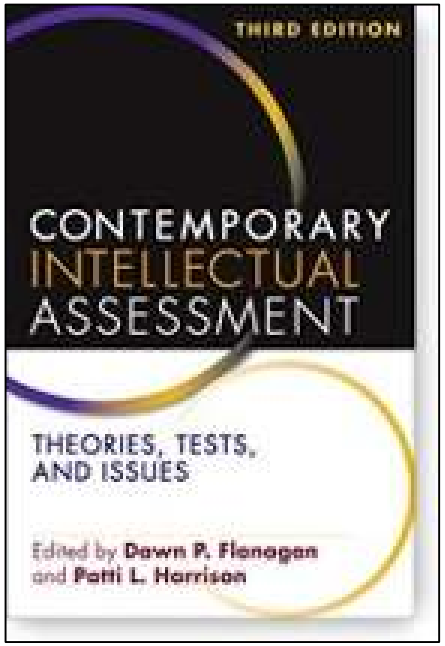
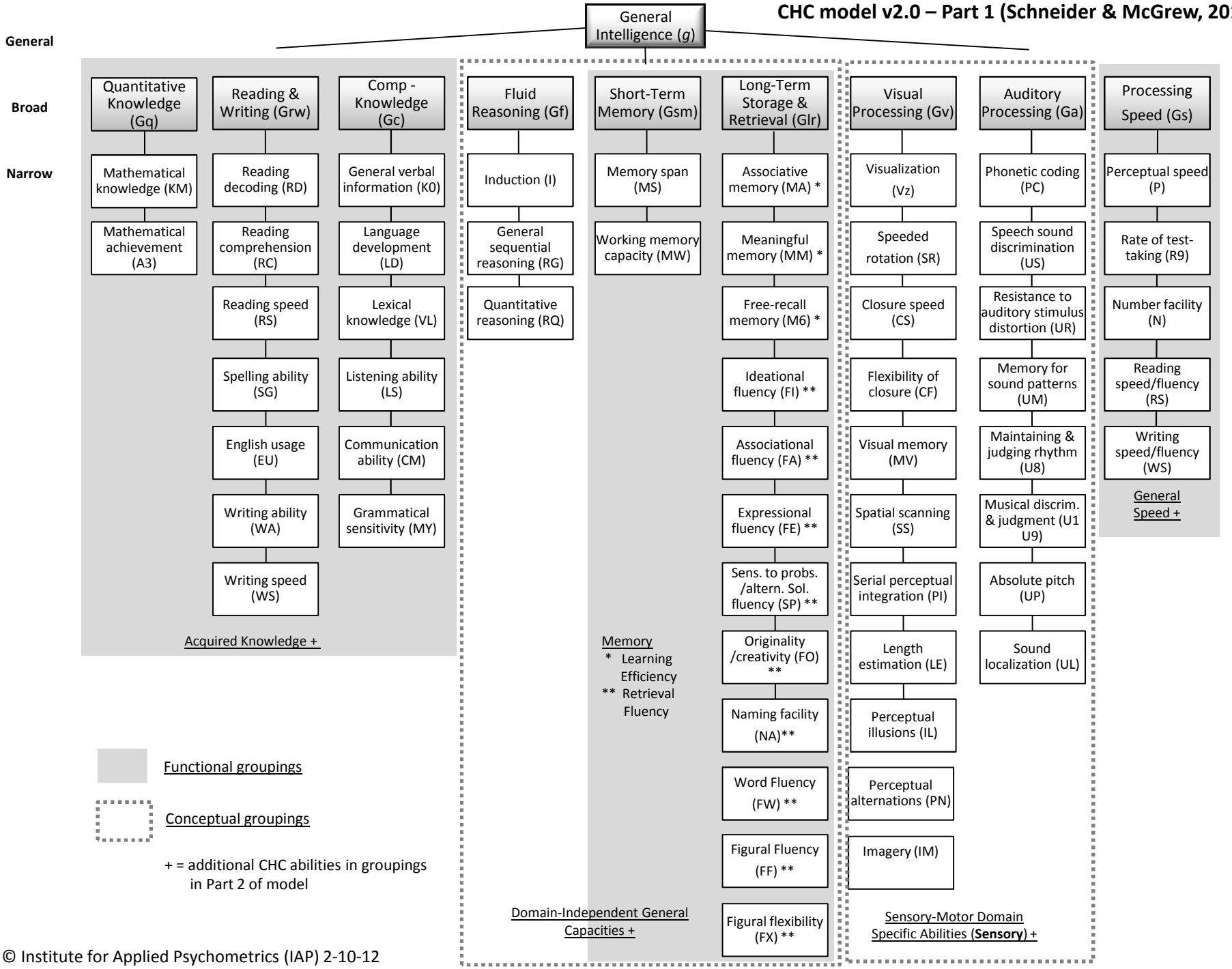


In our chapter in the recent Contemporary Intellectual Assessment book, we presented a revised version of CHC theory (CHC v2.0). Due to space limitations and the complexity of the model, the abilities were defined in the text but no grand figure was included. Unfortunately, the complete CHC model is now so large and complex that it is impossible to capture all critical abilities and dimensions on a single slide (at least one that is readable). This set of PowerPoint slides rectifies this situation via the presentation of a visual model for CHC v2.0. A URL to an on-line viewable Prezi presentation of the model, with a few additional embedded figures, is also included. Finally, a URL is presented where the PPT figures and an abstracted set of the can be downloaded in the form of a PDF file.

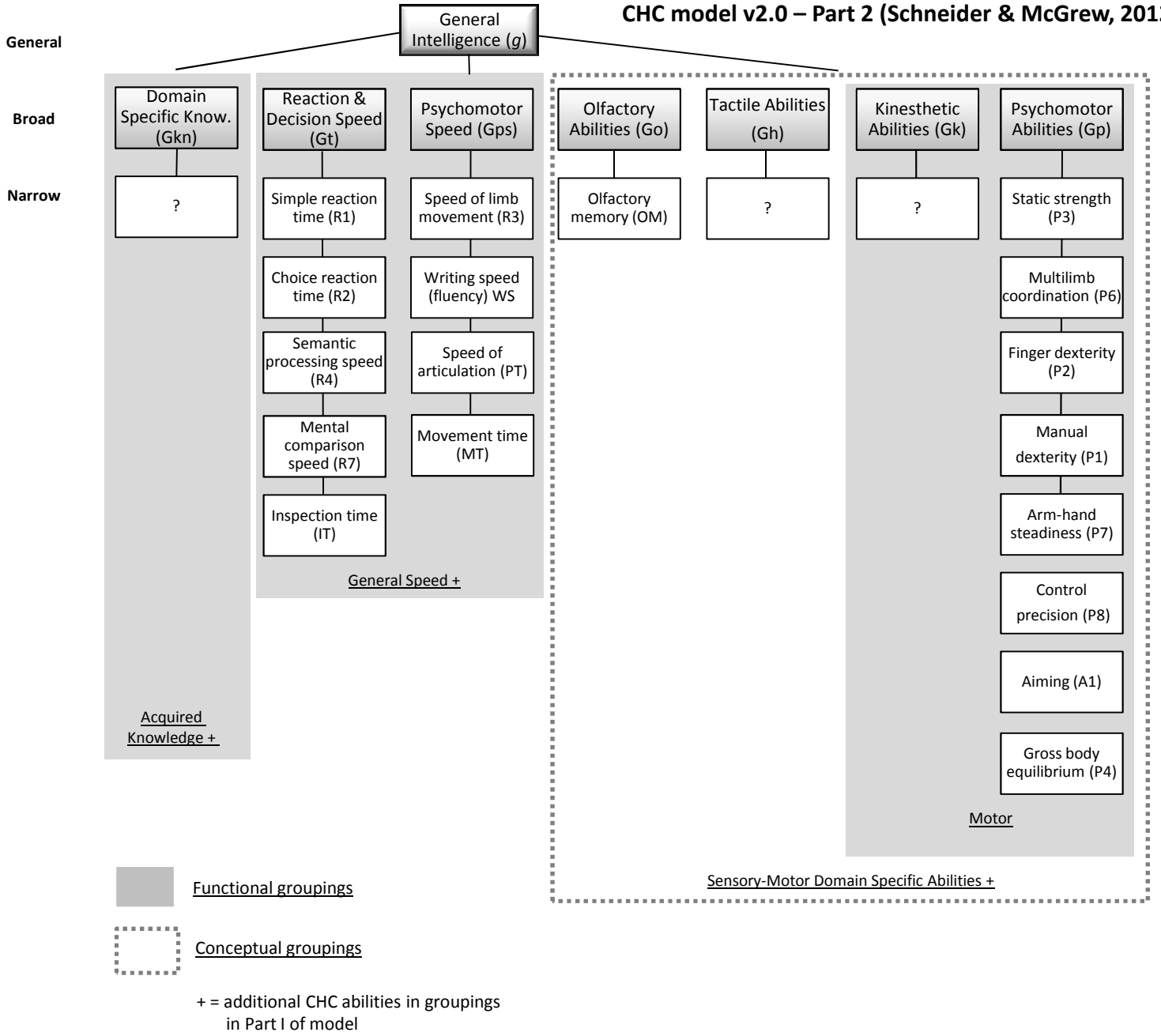
Schneider, W. J., & McGrew, K. (2012) The Cattell-Horn-Carroll model of intelligence. In D. Flanagan & P. Harrison (Eds.), *Contemporary Intellectual Assessment: Theories, Tests, and Issues (3rd ed.; pp 99-144) . New York: Guilford.*

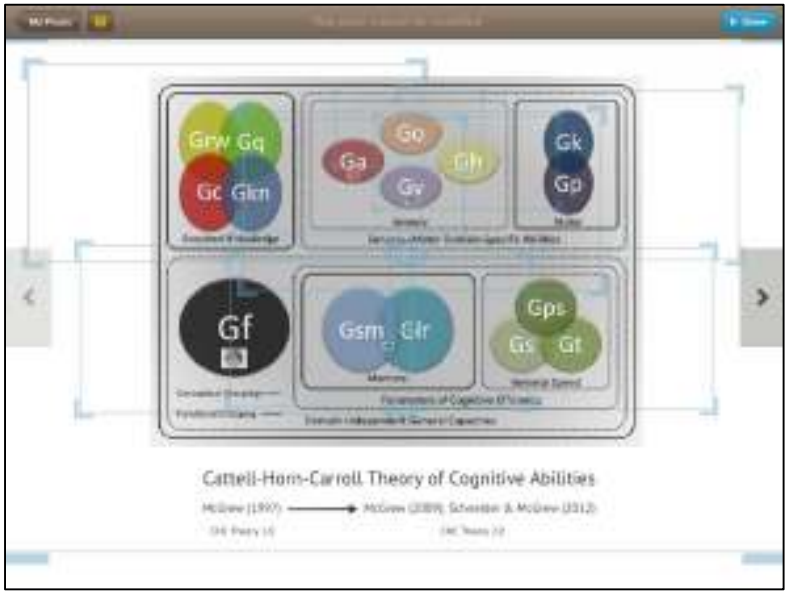


CHC model v2.0 – Part 1 (Schneider & McGrew, 2012)



CHC model v2.0 – Part 2 (Schneider & McGrew, 2012)





http://prezi.com/wkxdgwlqr_c6/chc-theory-20/

(be sure to click on “more” and then
“full screen” options to view properly)

IQ's Corner

http://www.iqscorner.com/2011/06/chc-intelligence-theory-v20-broad-and.html

(PDF copy of PPT figures and abstracted definitions can be found at link above)

Cattell-Horn-Carroll (CHC) Theory of Cognitive Abilities Definitions (CHC v2.0)

Joel Schneider & Kevin McGrew

(6-18-11; v2.0)

The following table of CHC definitions is abstracted from a lengthy narrative description of contemporary CHC theory in the forthcoming publication:

> Schneider, W. J., & McGrew, K. (in preparation) The Cattell-Horn-Carroll model of intelligence. To appear in D. Flanagan & P. Harrison (Eds.), *Contemporary Intellectual Assessment: Theories, Tests, and Issues* (3rd ed.). New York: Guilford.

The current table presents only the "bare bones" definitional information from the above mentioned book chapter. Readers are encouraged to consult the Schneider and McGrew chapter for details when published.

CHC v2.0 differs from prior **CHC v1.0** organized tables of definitions for a number of reasons. First, we conducted a detailed review of the original writings of the primary architects of CHC theory to ascertain places where CHC v1.0 may have erred (all contemporary CHC v1.0 published tables can be traced to the second authors first CHC table in the first edition of *Contemporary Intellectual Assessment*—McGrew, 1997) . Second, we reviewed contemporary intelligence research to answer unanswered issues regarding various components of CHC v1.0. Third, we attempted to define each of the constructs in CHC theory in terms that clinicians will find useful. Fourth, in the chapter, we provide guidance as to which constructs are more central to the theory or have more validity data available. Fifth, also in the chapter (but not included in this summary table) we alert readers to existing controversies and raise some questions of our own. Finally, we propose a number of additions, deletions, and rearrangements in the list of CHC theory abilities

As stated in the conclusion of our chapter:

> The end goal, however, has always been for CHC theory to undergo continual upgrades so it would evolve toward an ever-more accurate summary of human cognitive diversity. With that end in mind, we have attempted to simplify the model where it needed simplification. We have also elaborated upon aspects of the model that needed elaboration. We hope our research- and reasoning-based conclusions and hypotheses will make CHC theory more accurate, more understandable to practitioners, and ultimately more helpful to people who undergo psychoeducational assessment. We hope many readers, especially long-time CHC users and researchers, are placed into a state of thoughtful disequilibrium regarding their understanding of the prevailing CHC model. Even if such users are unconvinced by our arguments, if the schemas of CHC users are broadened and refined by considering the ideas we have presented, our chapter will have been a success. The original source theorists of CHC theory would not idly stand by and let the current consensus CHC calcify and suffer from hardening of the CHC categories. We believe Cattell, Horn, and Carroll, and all the psychometric giants upon whose shoulders they stood, would smile on our efforts, and would then promptly engage us, and others, in spirited debates and empirical- and theory-based discourse.

I. Domain-Independent General Capacities

Fluid Reasoning (Gf): *The deliberate but flexible control of attention to solve novel "on the spot" problems that cannot be performed by relying exclusively on previously learned habits, schemas, and scripts.* Fluid reasoning is a multi-dimensional construct but its parts are unified in their purpose: solving unfamiliar problems. Fluid reasoning is most evident in abstract reasoning that depends less on prior learning. However, it is also present in day-to-day problem solving. Fluid reasoning is typically employed in concert with background knowledge and automatized responses. That is, fluid reasoning is employed, even if for the briefest of moments, whenever current habits, scripts, and schemas are insufficient to meet the demands of a new situation. Fluid reasoning is also evident in inferential reasoning, concept formation, classification of unfamiliar stimuli, generalization of old solutions to new problems and contexts, hypothesis generation and confirmation, identification of relevant similarities,differences, and relationship among diverse objects and ideas, the perception of relevant consequences of newly acquired knowledge, and extrapolation of reasonable estimates in ambiguous situations.

1. **Induction (I)**. The ability to observe a phenomenon and discover the underlying principles or rules that determine its behavior.
2. **General Sequential Reasoning (RG)**. The ability to reason logically using known premises and principles. This ability is also known as deductive reasoning or rule application.
3. **Quantitative Reasoning (RQ)**: The ability to reason, either with induction or deduction, with numbers, mathematical relations, and operators.

Memory

Short-Term Memory (Gsm): *The ability to encode, maintain, and manipulate information in one's immediate awareness*. Gsm refers to individual differences in both the capacity (size) of primary memory and to the efficiency of attentional control mechanisms that manipulate information within primary memory.

1. **Memory Span (MS).** The ability to encode information, maintain it in primary memory, and immediately reproduce the information in the same sequence in which it was represented.
2. **Working Memory Capacity (WM).**[1] The ability to direct the focus of attention to perform relatively simple manipulations, combinations, and transformations of information within *primary* memory while avoiding distracting stimuli and engaging in strategic/controlled searches for information in *secondary* memory**.**

Long-Term Storage & Retrieval (Glr): *The ability to store, consolidate, and retrieve information over periods of time measured in minutes, hours, days, and years*. Short-term memory has to do with information that has been encoded seconds ago and must be retrieved while it is being actively maintained in primary memory. Short-term memory tests often involve information that is stored in long-term memory. What distinguishes Gsm from Glr tests is that there is a continuous attempt to maintain awareness of that information. A Glr test involves information that has been put out of immediate awareness long enough for the contents of primary memory to be displaced completely. In Glr tests, continuous maintenance of information in primary memory is difficult, if not impossible.

Glr-Learning Efficiency: All tasks of learning efficiency must present more information than can be retained in Gsm

1. **Associative Memory (MA).** The ability to remember previously unrelated information as having been paired.
2. **Meaningful Memory (MM).** The ability to remember narratives and other forms of semantically related information.
3. **Free Recall Memory (M6).** The ability to recall lists in any order.

Glr-Retrieval Fluency: The rate and fluency at which individuals they can access information stored in long-term memory.

(Fluency factors they involve the production of ideas)

[1] This factor was previously named *working memory*. However, as explained in McGrew (2005), this term does not refer to an individual difference variable but instead to a set of interrelated cognitive structures. *Working memory capacity* is an individual difference variable that is a property of the working memory system as a whole.

1. **Ideational Fluency (FI)**. Ability to rapidly produce a series of ideas, words, or phrases related to a specific condition or object. Quantity, not quality or response originality, is emphasized.
2. **Associational Fluency (FA**). Ability to rapidly produce a series of original or useful ideas related to a particular concept. In contrast to Ideational Fluency (FI), quality rather quantity of production is emphasized.
3. **Expressional Fluency (FE).** Ability to rapidly think of different ways of expressing an idea.
4. **Sensitivity to Problems/Alterative Solution Fluency (SP**). Ability to rapidly think of a number of alternative solutions to a particular practical problem
5. **Originality/Creativity (FO).** Ability to rapidly produce original, clever, and insightful responses (expressions, interpretations) to a given topic, situation, or task.

(Fluency abilities that involve the recall of words)

6. **Naming Facility (NA).** Ability to rapidly call objects by their names. In contemporary reading research, this ability is called rapid automatic naming (RAN) or speed of lexical access
7. **Word Fluency (FW).** Ability to rapidly produce words that share a non-semantic feature.

(Fluency abilities related to figures)

8. **Figural Fluency (FF).** Ability to rapidly draw or sketch as many things (or elaborations) as possible when presented with a nonmeaningful visual stimulus (e.g., set of unique visual elements). Quantity is emphasized over quality.
9. **Figural Flexibility (FX).** Ability to rapidly draw different solutions to figural problems.

General Speed

Processing Speed (Gs): *The ability to perform simple repetitive cognitive tasks quickly and* fluently. This ability is of secondary importance (compared to Gf and Gc) when predicting performance during the learning phase of skill acquisition. However, it becomes an important predictor of skilled performance once people know how to do a task. That is, once people how to perform a task, they still differ in the speed and fluency with which they perform. For example, two people may be equally accurate in their addition skills but one recalls math facts with ease and the other has to think about the answer for an extra half-second and sometimes counts on his or her fingers.

1. **Perceptual Speed (P).** Speed at which visual stimuli can be compared for similarity or difference. Much like Induction is at the core of Gf, Perceptual Speed is at the core of Gs. Recent research (Ackerman, Beier, & Boyle, 2002; Ackerman & Cianciolo, 2000; see McGrew, 2005) suggests that Perceptual Speed may be an intermediate stratum ability (between narrow and broad) defined by four narrow subabilities: (1) Pattern Recognition (Ppr)—the ability to quickly recognize simple visual patterns; (2) Scanning (Ps)—the ability to scan, compare, and look up visual stimuli; (3) Memory (Pm)—the ability to perform visual perceptual speed tasks that place significant demands on immediate Gsm, and (d) Complex (Pc)—the ability to perform visual pattern recognition tasks that impose additional cognitive demands, such as spatial visualization, estimating and interpolating, and heightened memory span loads.
2. **Rate-of-Test-Taking (R9).** Speed and fluency with which simple cognitive tests are completed. Through the lens of CHC theory, the definition of this factor has narrowed to simple tests that do not require visual comparison (so as not to overlap with Perceptual Speed) or mental arithmetic (so as not to overlap with Number Facility). The next three factors are related to the ability to perform basic academic skills rapidly.
3. **Number Facility (N).** Speed at which basic arithmetic operations are performed accurately. Although this factor includes recall of math facts, Number Facility includes speeded performance of any simple calculation (e.g., subtracting 3 from a column of 2-digit numbers). Number Facility does not involve understanding or organizing mathematical problems and is not a major component of mathematical/quantitative reasoning or higher mathematical skills.
4. **Reading Speed (fluency) (RS**). Rate of reading text with full comprehension. Also listed under Grw.
5. **Writing Speed (fluency) (WS):** Rate at which words or sentences can be generated or copied. Also listed under Grw and Gps.

Reaction and Decision Speed (Gt): *The speed of making very simple decisions or judgments when items are presented one at a time*. The primary use of Gt measures has been in research settings. Researchers are interested in Gt as it may provide some insight into the nature of *g* and some very basic properties of the brain (e.g., neural efficiency). One of the interesting aspects of Gt is that not only is faster reaction time in these very simple tasks associated with complex reasoning but so is greater consistency of reaction time (less variability).

1. **Simple Reaction Time (R1)**. Reaction time to the onset of a single stimulus (visual or auditory). R1 frequently is divided into the phases of decision time (DT; the time to decide to make a response and the finger leaves a home button) and movement time (MT; the time to move finger from the home button to another button where the response is physically made and recorded).
2. **Choice Reaction Time (R2)**. Reaction time when a very simple choice must be made. For example, examinees see two buttons and must hit the one that lights up.
3. **Semantic Processing Speed (R4)**. Reaction time when a decision requires some very simple encoding and mental manipulation of the stimulus content.
4. **Mental Comparison Speed (R7)**. Reaction time where stimuli must be compared for a particular characteristic or attribute.
6. **Inspection Time (IT)**. The speed at which differences in stimuli can be perceived.

Psychomotor Speed (Gps): *The speed and fluidity with which physical body movements can be made*. In skill acquistion, Gps is the ability that determines performance differences after a comparable population (e.g., manual laborers in the same factory) has practiced a simple skill for a very long time.

1. **Speed of Limb Movement (R3).** The speed of arm and leg movement. This speed is measured after the movement is initiated. Accuracy is not important.
2. **Writing Speed (fluency) (WS).** The speed at which written words can be copied. Also listed under Grw and Gps.
3. **Speed of Articulation (PT).** Ability to rapidly perform successive articulations with the speech musculature.
4. **Movement Time (MT).** Recent suggests that MT may be an intermediate stratum ability (between narrow and broad strata) that represents the second phase of reaction time as measured by various elementary cognitive tasks (ECTs). The time taken to physically move a body part (e.g., a finger) to make the required response is movement time (MT). MT may also measure the speed of finger, limb, or multilimb movements or vocal articulation (*diadochokinesis*; Greek for "successive movements" and is also listed under Gt.

I. Acquired Knowledge Systems

Comprehension-Knowledge (Gc): *Depth and breadth of knowledge and skills that are valued by one's culture.* Every culture values certain skills and knowledge over others. Gc reflects the degree to which a person has learned practically useful knowledge and mastered valued skills. Thus, by definition it is impossible to measure Gc independent of culture. Gc is theoretically broader than what is measured by any existing cognitive battery.

1. **General Verbal Information (K0**). Breadth and depth of knowledge that one's culture deems essential, practical, or otherwise worthwhile for everyone to know.
2. **Language Development (LD).** General understanding of spoken language at the level of words, idioms, and sentences. In the same way that Induction is at the core of Gf, Language Development is at the core of Gc. Although listed as a distinct narrow ability in Carroll's model, his description of his analyses make it clear that he meant Language Development as an intermediate category between Gc and more specific language-related abilities such as Lexical Knowledge, Grammatical Sensitivity, and Listening Ability. Language development It appears to be a label for all language abilities working together in concert.
3. **Lexical Knowledge (VL**). Knowledge of the definitions of words and the concepts that underlie them. Whereas Language Development is more about understanding words in context, Lexical Knowledge is more about understanding the definitions of words in isolation.
4. **Listening Ability (LS**). Ability to understand speech. Tests of listening ability typically have simple vocabulary but increasingly complex syntax or increasingly long speech samples to listen to.
5. **Communication Ability (CM).** Ability to use speech to communicate one's thoughts clearly. This ability is comparable to Listening Ability except that it is productive (expressive) rather than receptive.
6. **Grammatical Sensitivity (MY).** Awareness of the formal rules of grammar and morphology of words in speech. This factor is distinguished from English Usage in that it is manifest in oral language instead of written language and that it measures more the awareness of grammar rules rather than correct usage.

Domain-Specific Knowledge (Gkn): *Depth, breadth, and mastery of specialized knowledge (knowledge not all members of a society are expected to have).* Specialized knowledge is typically acquired via one's career, hobby, or other passionate interest (e.g., religion, sports).

1. **Foreign Language Proficiency (KL).** Similar to Language Development but in another language. This ability is distinguished from Foreign Language Aptitude in that it represents achieved proficiency instead of potential proficiency. Presumably, most people with high Foreign Language Proficiency have high Foreign Language Aptitude but not all people with high Foreign Language Aptitude have yet developed proficiency in any foreign languages. This ability was previously classified as an aspect of Gc. However, since Gkn was added to CHC, it is clear that specialized knowledge of a particular language should be reclassified. Although Knowledge of English as a Second Language was previously listed as a separate ability in Gkn, it now seems clear that it is a special case of the more general ability of Foreign Language Proficiency. Note that this factor is unusual because it is not a single factor. There is a different Foreign Language Proficiency factor for every language.
2. **Knowledge of Signing (KF).** Knowledge of finger-spelling and signing (e.g., American Sign Language).
3. **Skill in Lip-Reading (LP).** Competence in the ability to understand communication from others by watching the movement of their mouths and expressions.
4. **Geography Achievement (A5).** Range of geography knowledge (e.g., capitals of countries).
5. **General Science Information (K1).** Range of scientific knowledge (e.g., biology, physics, engineering, mechanics, electronics).
6. **Mechanical Knowledge (MK).** Knowledge about the function, terminology, and operation of ordinary tools, machines, and equipment. There are many tests of mechanical knowledge and reasoning used for the purpose of personnel selection (e.g., ASVAB, Wiesen Test of Mechanical Aptitude).
7. **Knowledge of Behavioral Content (BC).** Knowledge or sensitivity to nonverbal human communication/interaction systems (e.g., facial expressions and gestures). The field of emotional intelligence (EI) research is very large but it is not yet clear which EI constructs should be included in CHC theory. CHC theory is about abilities rather than personality and thus the constructs within it are measured by tests in which there are correct answers (or speeded performance).

Reading and Writing (Grw): *Depth and breadth of knowledge and skills related to written language*. People with high Grw read with little effort and write with little difficulty. When Grw is sufficiently high, reading and writing become perfect windows for viewing a person's language development. Whatever difficulties they have understanding text or communicating clearly, it is most likely a function of Gc or Gkn. For people with low Grw, however, high language skills may not be evident in reading and writing performance. Although reading and writing are clearly distinct activities, the underlying sources of individual differences in reading and writing skills do not differentiate between the two activities cleanly. It appears that the ability that is common across all reading skills also unites all writing skills.

1. **Reading Decoding (RD)**. Ability to identify words from text. Typically this ability is assessed by oral reading tests with words arranged in ascending order of difficulty. Tests can consist of phonetically regular words (words that are spelled how they sound such as bathtub or hanger), phonetically irregular words (words that do not sound how they are spelled such as sugar or colonel), or phonetically regular pseudowords (fake words that conform to regular spelling rules such as gobbish or choggy).
2. **Reading Comprehension (RC)**. Ability to understand written discourse. Reading comprehension is measured in a variety of ways..
3. **Reading Speed (RS)**. Rate at which a person can read connected discourse with full comprehension. Reading Speed is classified as a mixed measure of Gs (Broad cognitive Speed) and Grw in a hierarchical speed model.
4. **Spelling Ability (SG)**. Ability to spell words. This factor is typically measured with traditional written spelling tests. However, just as with Reading Decoding, it can also be measured via spelling tests consisting of phonetically regular nonsense words (e.g., "grodding"). It is worth noting that Carroll (1993) considered this factor to be weakly defined and in need of additional research.
5. **English Usage (EU)**. Knowledge of the mechanics of writing (e.g., capitalization, punctuation, and word usage).
6. **Writing Ability (WA)**. Ability to use text to communicate ideas clearly.
7. **Writing Speed (WS)**. Ability to copy or generate text quickly. Writing Speed tasks are considered to measure both Grw and Gps (Broad Psycho-Motor Speed) as per a hierarchical speed hierarchy.

Quantitative Knowledge (Gq): *Depth and breadth of knowledge related to mathematics.* Gq is distinct from Quantitative Reasoning (a facet of Gf) in the same way that Gc is distinct from the non-quantitative aspects of Gf. It consists of acquired knowledge about mathematics such as knowledge of mathematical symbols (e.g., $\int$, π, Σ, ∞, $\neq$, $\leq$, $+$, $-$, $\times$, $\div$, $\sqrt{}$, and many others), operations (e.g., addition/subtraction, multiplication/division, exponentiation/n^{th} rooting, factorials, negation, and many others), computational procedures (e.g., long division,

reducing fractions, quadratic formula, and many others), and other math-related skills (e.g., using a calculator, math software, and other math aids).

1. **Mathematical Knowledge (KM)**. Range of general knowledge about mathematics. Not the performance of mathematical operations or the solving of math problems. This factor is about "what" rather than "how" knowledge (e.g., What does π mean? What is the Pythagorean theorem?)
2. **Mathematical Achievement (A3).** Measured (tested) mathematics achievement.

II. Sensory/Motor-Linked Abilities

Sensory

Visual Processing (Gv): *The ability to make use of simulated mental imagery (often in conjunction with currently perceived images) to solve problems*. Once the eyes have transmitted visual information, the visual system of the brain automatically performs a large number of low-level computations (e.g., edge detection, light/dark perception, color-differentiation, motion-detection, and so forth). The results of these low-level computations are used by various higher-order processors to infer more complex aspects of the visual image (e.g., object recognition, constructing models of spatial configuration, motion prediction, and so forth).

1. **Visualization (Vz).** The ability to perceive complex patterns and mentally simulate how they might look when transformed (e.g., rotated, changed in size, partially obscured, and so forth). In the same way that Induction is central to Gf and Language Development is central to Gc, this is the core ability of Gv.
2. **Speeded Rotation (Spatial Relations; SR).** The ability to solve problems quickly using mental rotation of simple images. This ability is similar to visualization because it involves rotating mental images but it is distinct because has more to do with the *speed* at which mental rotation tasks can be completed. Speeded Rotation tasks typically involve fairly simple images.
3. **Closure Speed (CS).** Ability to quickly identify a familiar meaningful visual object from incomplete (e.g., vague, partially obscured, disconnected) visual stimuli, without knowing in advance what the object is. This ability is sometimes called Gestalt Perception because it requires people to "fill in" unseen or missing parts of an image to visualize a single percept.
4. **Flexibility of Closure (CF)**. Ability to identify a visual figure or pattern embedded in a complex distracting or disguised visual pattern or array, when knowing in advance what the pattern is.
5. **Visual Memory (MV).** Ability to remember complex images over short periods of time (less than 30 seconds). The tasks that define this factor involve being shown complex images and then identifying them soon after then stimulus is removed.
6. **Spatial Scanning (SS).** Ability to visualize a path out of a maze or a field with many obstacles. This factor is defined by performance on paper and pencil maze tasks. It is not clear whether this ability is related to complex large-scale real-world navigation skills.
7. **Serial Perceptual Integration (PI)**. Ability to recognize an object after only parts of it are shown in rapid succession.
8. **Length Estimation (LE).** The ability to visually estimate the length of objects.
9. **Perceptual Illusions (IL)**. The ability to not be fooled by visual illusions
10. **Perceptual Alternations (PN)**. Consistency in the rate of alternating between different visual perceptions..
11. **Imagery (IM)**. Ability to mentally imagine very vivid images. Small scale brain imaging studies have suggested that visual spatial imagery may not be a single faculty, rather, visualizing spatial location and mentally transforming locating rely on distinct neural networks. This research suggests a transformational process versus memory for location substructure. An objective versus spatial imagery dichotomy has also been suggested as well as the possibility of quality and speed of imagery abilities.

Auditory Processing (Ga):. *The ability to detect and process meaningful nonverbal information in sound*. This definition may cause confusion because we do not have a well developed vocabulary for talking about sound unless we are talking about speech sounds or music. Ga encompasses both of these domains but also much more. There are two common misperceptions about Ga. First, although Ga depends on sensory input, it is not sensory input itself. Ga is what the brain does with sensory information from the ear, sometimes long after a sound has been heard.. The second extremely common misconception is that Ga is oral language comprehension. It is true that one aspect of Ga (parsing speech sounds or Phonetic Coding) is related to oral language comprehension but this is simply a precursor to comprehension, not comprehension itself.

1. **Phonetic Coding (PC)**. Ability to hear phonemes distinctly. This ability is also referred to as phonological processing and phonological awareness. People with poor phonetic coding have difficulty hearing the internal structure of sound in words.
2. **Speech Sound Discrimination (US):** Ability to detect and discriminate differences in speech sounds (other than phonemes) under conditions of little or no distraction or distortion**.** Poor speech sound discrimination can produce difficulty in the ability to distinguish variations in tone, timbre, and pitch in speech.
3. **Resistance to Auditory Stimulus Distortion (UR)**. Ability to hear words correctly even under conditions of distortion or loud background noise.
4. **Memory for Sound Patterns (UM).** Ability to retain (on a short-term basis) auditory events such as tones, tonal patterns, and voices.
5. **Maintaining and Judging Rhythm (U8)**. Ability to recognize and maintain a musical beat. This may be an aspect of Memory for Sound Patterns as short-term memory is clearly involved. However, it is likely that there is something distinct about rhythm that warrants a distinction.
6. **Musical Discrimination and Judgment (U1 U9)**. Ability to discriminate and judge tonal patterns in music with respect to melodic, harmonic, and expressive aspects (phrasing, tempo, harmonic complexity, intensity variations).
7. **Absolute Pitch (UP)**. Ability to perfectly identify the pitch of tones. As a historical tidbit, John Carroll had perfect pitch.
8. **Sound Localization (UL)**. Ability to localize heard sounds in space.

Olfactory Abilities (Go): *The ability to detect and process meaningful information in odors*. Go refers not to sensitivity of the olfactory system but to the cognition one does with whatever information the nose is able to send. The Go domain is likely to contain many more narrow abilities than currently listed in the CHC model as a cursory skim of Go-related research reveals reference to such abilities as olfactory memory, episodic odor memory, olfactory sensitivity, odor specific abilities, odor identification and detection, odor naming, olfactory imagery, to name but a few.

1. ***Olfactory Memory (OM).*** *Ability to recognize previously encountered distinctive odors*. OM is involved in the oft-noted experience of smelling a distinctive smell and being flooded with vivid memories of the last time that odor was encountered. Memory for distinctive odors has a much flatter forgetting curve than many other kinds of memory.

Tactile Abilities (Gh): *The ability to detect and process meaningful information in haptic (touch) sensations*. Gh refers not to sensitivity of touch but to the cognition one does with tactile sensations. Because this ability is not yet well defined and understood, it is hard to describe it authoritatively. The domain may include such abilities as tactile visualization (object identification via palpation), tactile localization (i.e., where has one been touched), tactile memory (i.e., remembering where one has been touched), texture knowledge (naming surfaces and fabrics by touch), and many others. There are no well-supported narrow cognitive ability factors within Gh yet. *Tactile Sensitivity* (TS), a sensory acuity ability, refers to the ability to make fine discriminations in haptic sensations (e.g., if two caliper points are placed on the skin simultaneously, we perceive them as a single point if they are close together. Some people are able to make finer discriminations than others).

Motor

Kinesthetic Abilities (Gk): *The ability to detect and process meaningful information in proprioceptive sensations*. Proprioception refers to the ability to detect limb position and movement via *proprioreceptors* (sensory organs in muscles and ligaments that detect stretching). Gk refers not to the sensitivity of proprioception but to the cognition one does with proprioceptive sensations. There are no well-supported narrow cognitive ability factors within Gk yet. *Kinesthetic Sensitivity* (KS), a sensory acuity ability, refers to the ability to make fine discriminations in proprioceptive sensations (e.g., whether and how much a limb has been moved).

Psychomotor Abilities (Gp): *The ability to perform physical body motor movements (e.g., movement of fingers, hands, legs) with precision, coordination, or strength.*

1. **Static Strength (P3)**. The ability to exert muscular force to move (push, lift, pull) a relatively heavy or immobile object.
2. **Multilimb Coordination (P6**). The ability to make quick specific or discrete motor movements of the arms or legs.

3. **Finger Dexterity (P2)**. The ability to make precisely coordinated movements of the fingers (with or without the manipulation of objects).
4. **Manual Dexterity (P1)**. Ability to make precisely coordinated movements of a hand or a hand and the attached arm.
5. **Arm-Hand Steadiness (P7)**. The ability to precisely and skillfully coordinate arm–hand positioning in space.
6. **Control Precision (P8)**. The ability to exert precise control over muscle movements, typically in response to environmental feedback (e.g., changes in speed or position of object being manipulated).
7. **Aiming (AI).** The ability to precisely and fluently execute a sequence of eye–hand coordination movements for positioning purposes.
8. **Gross Body Equilibrium (P4).** The ability to maintain the body in an upright position in space or regain balance after balance has been disturbed.