



# Researchers Assessment Batteries

Reliability and Validity description of CogniFit Assessment Batteries.

## Science, reliability and validity

CogniFit has extensive and robust high-quality **scientific validation** by independent researchers from **universities around the world**.

The “**Matrix**”, which is the **conceptual model, design, calculation and norming of the cognitive skills** measured by the CogniFit cognitive assessment batteries was statistically validated four times (in 2010, 2012, 2015 and 2022). Each validation was initiated because of unavoidable **transitions to more advanced technology**, which required renewed data collection using different programming tools, languages or data management methods. To validate the conceptual division proposed in the Matrix it was used data from a reference group of 17,362 individuals (9,722 females and 7,640 males). In 2015, the matrix was validated again using data from 65,377 test-takers (27,202 females and 38,175 males) and the normative data were updated. More recently, in 2022 a new validation of the matrix was carried out with data from 1,282,242 unique test-takers (711,262 females and 570,980 males) with ages between 7 and 85 years, and the current reference normative dataset was created.

Reference normative sample of the Matrix	
Type of users	Number of users
Females	711,262
Males	570,980
Total	1,282,242

Regarding the reliability, **Test-retest reliability** for the cognitive abilities was tested in a population of 500 men and women, and the obtained correlation coefficients ranged from 0.70 to 0.92, reflecting highly acceptable levels of stability from one measurement to the next. **The internal consistency** obtained with the values extracted from the 2015 sample described above showed a mean **Chronbach's alpha** of 0.78. Complete results are shown in the table on the next page.

The CogniFit cognitive assessment batteries have been validated using construct and convergent validity. **Construct validity:** In a conceptual phase, using a task by ability Matrix, latent cognitive abilities were assigned to tasks and conceptually appropriate variables in the tasks were assigned to the general abilities. These latent abilities were then statistically validated using factor analysis. **Convergent validity:** In 2009, the CogniFit cognitive assessment batteries validated in 40 young adults vis-à-vis several major standard neuropsychological tests. Results are shown in the table on page 4.

**Internal consistency and test-retest reliability by cognitive skill**

Cognitive Ability	Internal Consistency 2015 (Chronbach's Alpha)	Internal Consistency PC 2022 (Chronbach's Alpha)	Internal Consistency Mobile 2022 (Chronbach's Alpha)	Test-retest Reliability
Shifting	0.73	0.72	0.50	0.84
Divided Attention	0.87	0.73	0.69	0.85
Hand-Eye Coordination	0.78	0.86	0.96	0.88
Naming	0.69	0.76	0.64	0.78
Focus Attention *	-	-	-	0.91
Visual Scanning	0.86	0.81	0.71	0.92
Estimation	0.76	0.65	0.62	-
Inhibition	0.66	0.43	0.74	0.70
Phonological Short-Term Memory	0.92	0.73	0.76	0.70
Contextual Memory	0.88	0.91	0.86	0.78
Visual Short-Term Memory	0.87	0.84	0.91	0.74
Short-Term Memory	0.85	0.81	0.84	0.72
Working Memory	0.85	0.89	0.81	0.70
Non-Verbal Memory	0.79	0.83	0.78	0.73
Spatial Perception	0.61	0.33	0.82	0.91
Visual Perception	0.75	0.78	0.69	0.89
Auditory Perception	0.65	0.77	0.65	0.90
Planning	0.77	0.61	0.77	0.83
Updating	0.57	0.79	0.50	0.88
Recognition	0.86	0.88	0.86	0.77
Response Time	0.87	0.90	0.81	0.82
Processing Speed	0.89	0.87	0.77	0.76

\* Focus Attention is a cognitive skill computed from a single variable, and consequently certain stats are not available.

**Convergent Validity - Main correlations between CogniFit Cognitive Assessment Battery (CAB)™ and both CANTAB and other traditional tests**

CogniFit CAB	CANTAB	STROOP Test	WCST & RSPM	Reading Tests
Naming & Memory span, including digit and spatial span	<p>Rapid visual information processing (sustained attention). r = 0.75 (p &gt; 0.01)</p> <p>Stockings (frontal/executive task): Mean subsequent thinking time. r = -0.85 (p &lt; 0.001)</p> <p>Stockings (frontal/executive task): Problems solved in minimal moves. r = 0.62 (p &lt; 0.001)</p> <p>Delayed matching to sample (attention and memory). r = 0.50 (p &lt; 0.01)</p>	<p>Stroop (words) time r = -0.59 (p &lt; 0.001)</p>	N.A.	<p>Reading test. Silent reading time r = 0.51 (p &lt; 0.01)</p> <p>Reading test: Naming speed of letters (time) r = 0.60 (p &lt; 0.001)</p>
Integration of two dimensions-visual and semantic & Psychomotor skills (i.e., tracking) & Time estimation, both auditory and visual	<p>Internal/External dimensional shift (frontal/executive task). r = 0.60 (p &lt; 0.01)</p> <p>Rapid visual information processing (sustained attention task). r = 0.86 (p &lt; 0.001)</p> <p>Stockings of Cambridge (planning) (frontal/executive task). r = 0.76 (p &lt; 0.001)</p>	<p>Stroop (words) r = 0.63 (p &lt; 0.001)</p>	<p>(WCST) Internal/External dimensional shift (frontal/executive task) r = 0.60 (p &lt; 0.01)</p> <p>(WCST) Rapid visual information processing (sustained attention task) r = 0.86 (p &lt; 0.001)</p>	<p>Reading test: Oral reading time r = 0.73 (p &lt; 0.001)</p> <p>Reading test: Silent reading time r = 0.61 (p &lt; 0.001)</p>
Sustained attention in tasks involving allocated attention to a target - with and without distractor & Executive functioning - planning and working memory, tested in a maze task	<p>Stockings of Cambridge (planning) Thinking time (frontal/executive task). r = 0.72 (p &lt; 0.001)</p> <p>Rapid visual information processing (frontal/executive task). r = 0.68 (p &lt; 0.01)</p> <p>Spatial working memory (frontal/executive task). r = 0.57 (p &lt; 0.001)</p> <p>Spatial working memory (frontal/executive task). r = 0.52 (p &lt; 0.001)</p>	<p>Stroop (words) r = 0.58 (p &lt; 0.001)</p> <p>Stroop (words) r = 0.58 (p &lt; 0.001)</p> <p>Stroop (words) r = .52 (p &lt; 0.001)</p>	<p>(RSPM) Raven number of error r = 0.57 (p &lt; 0.001)</p>	<p>Reading test: Oral reading time r = 0.71 (p &lt; 0.001)</p> <p>Reading test: Oral reading errors r = 0.65 (p &lt; 0.001)</p>

Only the most powerful and relevant correlations of the comparisons are shown in this table.

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