# Guide to cognitive assessments for children

As part of the cognitive evaluation process, it is sometimes useful to look at the individual's functioning in different cognitive domains. This may be helpful when the general ability score is not entirely representative, when there is a need to establish the severity level, to plan interventions, or when assessing very young children. In this guide you will find information about assessments for evaluating visuospatial ability, processing speed and executive function in children and adolescents. These areas represent three of the six key domains of cognitive function defined in DSM-5 (Ganguli et al., 2011) and have been found to be particularly important in cognitive development of children (Zelazo et al., 2021).



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Visuospatial ability is the process that helps us understand how objects in our environment relate to each other in space – about their distance, direction and rotation. It is important for a range of behaviours, such as reading a map, coordinating movements, and making sense of letters and numbers. Common measures of visuospatial processing are puzzles, mental rotation, or reproduction of two- or three-dimensional constructions from models. For example, in Block design in the Wechsler Scales the child is asked to re-create the design of a model, by using one- and two-colour blocks.

	Test	Subtest	Age span
	Bayley-4	Cognitive scale	16 days to 42 months
	KABC-II NU	Block counting Triangles	3–18 years
	NEPSY-II	Arrow Block construction Design copying Geometric Puzzles Picture Puzzles Route Finding	5–16 years 3–16 years 3–16 years 3–16 years 7–16 years 5–12 years
-	WISC-V	Block design Visual Puzzles Matrices	6–16 years
	WPPSI-IV	Block design Object assembly Matrices Picture concepts	2–7 years 2–7 years 4–7 years 4–7 years
	WNV	Matrices Object assembly	4–21 years 4–7 years

#### Visuospatial ability

## Processing speed

Processing speed is often referred to as the time it takes to respond to or process information. It has a great impact on all other cognitive abilities, since it determines how well and how quickly other cognitive skills can be used. Measures of processing speed typically involve timed tasks. For example, it may ask the examinee to solve a task as quickly and with as few errors as possible (e.g. Coding in the Wechsler scales). Sometimes, the measure involves conditions of different complexity, enabling the examiner to compare the time taken to process information with different cognitive loads (e.g. Trail Making Test in D-KEFS).



Speed processing

Test	Subtest	Age span
Bayley-4	Timed subtests and items	16 days to 42 months
Brown EF/A	Rating scale	3 through adult
D-KEFS	Timed subtests and items	8–89 years
NEPSY-II	Timed subtests and items	3–16 years
WISC-V	Coding Symbol search Cancellation	6–16 years
WPPSI-IV	Bug search Cancellation	4–7 years
WNV	Coding	4–21 years

## Executive functions

Executive functions are a set of cognitive processes, including areas such as cognitive flexibility, inhibitory control, working memory, and reasoning. These skills help us to learn new information, control our attention, refrain from acting on impulses, use creativity to solve problems, among other things.

Assessments of executive functions often involve quite different test constructions, depending on which process that is measured. For example, measures of cognitive flexibility may ask the examinee to sort cards into different categories (e.g. 'Animal sorting' in NEPSY-II), while measures of inhibition may ask the examinee to refrain from reading the names of different colours (e.g. 'Colour-Word interference' in <u>D-KEFS</u>).

In working memory paradigms, it is common to ask the examinee to remember digits, letters, words or pictures (e.g. 'Visual working memory' in <u>WRAML-3</u>). To assess reasoning, the examinee may be asked to compare weights (e.g. 'Compares masses' in <u>Bayley-4 UK</u> or 'Figure weights' in <u>WISC-V UK</u>) or find patterns in visual matrices and select the missing piece (e.g. <u>Raven's 2 Progressive Matrices</u>). In some instances, rating scales are used to get a better understanding of behaviours of executive function that is expressed in everyday life situations (e.g. <u>Brown EF/A</u>).



Cognitive flexibility

Test	Subtest	Age span
BADS-C	Playing cards	8–16 years
Brown EF/A	Rating scale	3 through adult
D-KEFS	Trail making test Verbal fluency Design fluency Colour-Word interference Sorting Word context	8–89 years
NEPSY-II	Inhibition Animal sorting	5–16 years

#### Inhibitory control

Test	Subtest	Age span
Brown EF/A	Rating scale	3 through adult
Conner's 4	Rating scale	6–18 years
D-KEFS	Verbal fluency Design fluency Colour-Word interference Tower	8–89 years
NEPSY-II	Inhibition Statue	5–16 years 3–6 years

#### Initiating action

Test	Subtest	Age span
Brown EF/A	Rating scale	3 through adult
D-KEFS	Verbal fluency Design fluency Sorting Tower	8–89 years
NEPSY-II	Design fluency Animal sorting	5–12 years 7–16 years



Problem solving & Reasoning

Test	Test Subtest	
BADS-C	Water test	8–16 years
Bayley-4	Cognitive	16 days to 42 months
D-KEFS	Tower Sorting 20 questions Word context Design fluency	8–89 years
KABC-II NU	Pattern reasoning Story completion Triangles	5–18 years 5–18 years 3–18 years
KBIT-2 revised	Matrices	4–90 years
Raven's 2	Not applicable	4–69 years
WISC-V	Matrix reasoning Figure weight Picture concepts Arithmetic Block design Visual puzzles	6–16 years
WPPSI-IV	Matrix reasoning Picture concepts Block design Object assembly	4–7 years 4–7 years 2–7 years 2–7 years
WNV	Matrices Object assembly	4–21 years 4–7 years

#### Planning & Organising

Test	Subtest	Age span
BADS-C	Key Search Zoo map Six parts	8–16 years
Bayley-4	Cognitive	16 days to 42 months
Brown EF/A	Rating scale	3 through adult
D-KEFS	Tower Clocks Animal sorting	8–89 years 7–16 years 7–16 years
WNV	Picture arrangement	8–21 years



Working	memory
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Test	Subtest	Age span
Bayley-4	Cognitive	16 days to 42 months
Brown EF/A	Rating scale	3 through adult
KABC-II NU	Word Order Number recall	3–18 years
NEPSY-II	Word list interference	7–16 years
WISC-V	Digit span Picture span Letter-number sequencing	6–16 years
WPPSI-IV	Picture memory Zoo locations	2–7 years
WNV	Spatial span	8–21 years
WRAML-3	Visual working memory Verbal working memory	5–90 years

### References

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Zelazo, P. D., Lourenco, S. F., Frank, M. C., Elison, J. T., Heaton, R. K., Wellman, H. M., ... & Reznick, J. S. (2021). Measurement of cognition for the National Children's study. *Frontiers in pediatrics*, *9*, 603126.

