**S1: Neuropsychological tests**

Information about tests are provided by [Beery (1997](#_ENREF_1)), [Strauss, Sherman, and Spreen (2006](#_ENREF_2)) and [Tulsky et al. (2003](#_ENREF_3)).

**Wisconsin Card Sorting Test (WCST)**

This is a test where the subject is to sort different cards by trial and error according to a rule set by the examiner. There are several outcomes of this test, where we have looked at the following: *“total number of categories achieved”* (how many times they figure out and follow a new rule for 10 consecutive trails), *“trials to complete first category”*, *“failure to maintain set”* (not holding on to the rule before reaching 10 correct trails), *“total correct responses”*, *“perseverative responses”* (following an old rule after it has been switched), *“perseverative errors”* (if the subjects keep following a rule they know is incorrect) and *“non-perseverative errors”* (randomly responding). The WCST is independent of time. The WCST is considered a measure of executive functioning, as it assesses several aspects of problem solving behavior: the ability to form abstract concepts, switching and holding on to cognitive strategies while utilizing environmental feedback. The test requires the ability to use strategic planning, organized searching, goal-orienting and regulating impulsive reaction.

**The color-word interference test (Stroop)**

This Stroop-version is the Color-word interference test from the D-KEFS battery, and consists of four subtests*. Stroop 1* is a sheet with squares in three different colors: red, blue and green. The subject is then required to name these colors as fast as he/she can. *Stroop 2* is a sheet with color-words (red, blue, green) printed in black. The subject is required to read these words as fast as he/she can. *Stroop 3* is a sheet with the same color-names as in Stroop 2, only these are printed in color. The color on the word and the color-word is mismatching, and the task is to name the color the word is written in, and not reading the word. The *Stroop 4* is a sheet of color words, where some of the words are printed inside a black square. The task is to say the color of the words that are not in a square, and read the words that are inside a square. Score is time to complete each sheet. The Stroop test is considered a test of executive function: cognitive control, and the ability to hold a goal in mind and inhibiting an overlearned response to perform a less familiar response. Mental speed, working memory and semantic activation also seem to play a part in the performance of the Stroop. *Stroop 1 and 2* (word-reading and color-naming) are the simpler component processes of this task. *Stroop 3*: This task puts demands on inhibition of the impulse to read the color-word. *Stroop 4*: This task puts demands on inhibition and switching. Goal maintenance and inhibition of a more pre-potent response are both important aspects assessed by the *Stroop 3 and 4*.

**Design Fluency (DF)**

The DF is a test where the subject creates different figures within a time limit according to a set of rules. The test subject is not allowed to make the same figure several times. The score is number of different correct designs within the time limit. The DF is considered a measure of executive functioning. Working memory, shifting set and inhibition of reproducing designs are also parts of the test.

**Verbal Fluency (VF)**

The VF is a test where the subject produces as many words as possibly with given letters and categories, and also a task where they have to switch between two categories. Score is number of correct answers in each subtest. We have used total correct responses as outcome in this study. Verbal fluency is considered a measure of executive functioning that demands active attention, especially the suppression of a previous response and monitoring for repetitions. The test also has a verbal component, and there are some studies showing the importance of episodic verbal memory to the verbal fluency score.

**Letter-Number Sequencing**

This is also a task from the WAIS-III and the WMS-III. The examiner presents a list of mixed letters and numbers out loud and the test subject has to sort and then repeat the letters in alphabetical order, and then numbers in numerical order. Score is number of correct answers. This is a subtest considered to measure working memory.

**Spatial Span**

This task is a part of the Wechsler Memory Scale 3rd edition. The Spatial Span is a white board with 10 blue blocks. The examiner points on different blocks, and the test subject is to point on the same blocks in the same order. An increasing number of blocks are given. The second part of the task is the same, only now the subject has to point in backwards order, also here increasing the amount of blocks pointed at in a row. In our study, the outcome score is the total score. The spatial span puts demands on visual working memory.

**Mental Control**

The subject is to repeat different sequences; counting backwards from 20 to 1, saying the alphabet, stating the days of the week forward and backward, and stating months of the year forward and backward. In addition the subject is to state the days of the week and at the same time add the number 7 (Monday-7, Tuesday-14, and so on). This is an optional subtest of the WMS-III, and assesses the ability to retrieve and mentally manipulate overlearned information. It is considered to assess executive control and auditory working memory.

**Conners’ Continuous Performance Test (CPT)**

This is a computer-based test, where the subject is required to press the space bar as fast as possible whenever a letter is presented on the screen. The subject is told not to press when the letter “X” appears. There are several outcome measures of this test; we have only chosen to include: omissions, commissions and reaction time. Omission is when the subject does not press space bar to the letters given, and reflects inattention. Commission is when the subject presses space bar when an “X” appears, and reflects inattention and lack of inhibition. Reaction time is given in milliseconds. The CPT is a widely used attention test, which tests sustained attention and response inhibition. The omission score is considered a measure of inattention, while the commission score assesses inattention and impulsivity. However, it has been discussed whether this test is mainly an attention or an executive function test, as perseveration and delayed responses can affect the outcome.

**Trail Making Test (TMT)**

This test is part of the Delis-Kaplan battery and consists of five subtests. The *TMT 1* *(visual scanning & attention)* is a page with lots of numbers on it, where the task is to mark all the number “3’s” as fast as possible. The *TMT2 (number sequencing)* is a page with numbers, where the task is to connect numbers from lowest to highest, as fast as possible. The *TMT3 (letter sequencing)* is a page with letters, where the test subject is to connect letters alphabetically as fast as possible. The *TMT4 (number-letter switching)* is a page with both letters and numbers, where the task is to connect letters and numbers interchanging. The *TMT5 (motor speed)* is a set of circles with dotted lines in between. The task is to go as fast as possible from the first circle to the last. Score is time to complete each task. The TMT is a complex test assessing several functions, including attention, speed and mental flexibility. All TMT subtests also put some demands on eye-hand coordination/fine motor functioning. The first three TMT tests are basically assessing attention and processing speed. The TMT4 requires switching and inhibition. The TMT5 puts more demands on eye-hand coordination and motor speed.

**Paced Auditory Serial Addition Test (PASAT)**

Numbers are read to the participant that is to summarize the last two numbers that were presented (1+2=3). Then the examiner gives another number (i.e. 5), and the subjects need to summarize this number with the last number given in the first round (5+2=7). There are totally 60 responses required. Scores are number of correct answers. This is a task assessing several functions, and is considered a strong measure of working memory, divided attention (switching between two tasks: adding digits and encoding the next digit) and sustained attention. Processing speed is also involved.

**Tower Test**

In this test the test subject is required to move five disks on to three pegs to build a target tower in as few moves as possible. There are several outcome measures of this task, and we have included the following in the current paper: *“time to first move”*, *“number of moves to complete the task”*, *“rule breaking”*, *“total time to complete the task”*, *“total correct on the task”*. This test puts demands on the ability to make plans, learn rules and to inhibit responses. Abstract thinking, creativity and problem solving are also aspects of this test, and the tower test is considered a measure of executive functioning.

**Vocabulary**

This is one of the Verbal Comprehension subtests of the WAIS-III. The test subject is asked to explain the meaning of different words, and the total score is number of partially correct (score 1) or correct (score 2) answers.

The vocabulary subtest is considered a measure of expressive vocabulary.

**Similarities**

This is also a Verbal Comprehension subtest from the WAIS-III. The test subject is asked to explain in what way two objects or concepts are similar (i.e. cats and dogs = animals). Score is the number of partially correct (score 1) and correct (score 2) answers. This test requires more abstraction than the Vocabulary subtest, with increasingly more abstract concepts as the test continues.

**Boston Naming Test**

In this test the subject is to name different objects visually presented on black and white drawings (60 altogether), both familiar and less familiar objects. Score is number of correct answers. The BNT is a test of visual confrontation naming.

**The Grooved Pegboard Test**

In this test the subject is to place 25 pegs into 25 holes in a metal board as fast as possible. Each peg has a ridge on it and has to be turned to fit into the hole. The holes are oriented in different directions. The task is done with both hands (dominant/non-dominant). We have provided the mean between dominant and non-dominant hand in our study, as there was no significant difference in performance between the two scores in our sample. Score is time to complete the task. The GPB is a measure of eye-hand coordination and motor speed. It requires both motor execution and adequate visual acuity. Motor dexterity, vision, speed, attention and continuous monitoring of performance are also elements of the task.

**Rey Complex Figure Test**

This is a test where the subject is given a picture of a figure consisting of different geometrical shapes. First, the subject is to copy the picture as accurate as possible while looking at the picture. The model is thereafter removed. After three minutes the subject is asked to draw the figure again, now without looking at the picture. Thirty minutes after completing the last task, the subject is asked to draw the figure one last time. Lastly, a recognition test is given, where the subject is to mark of shapes he/she recognizes from the original picture. Scores are time spent drawing and quality of the drawings (how similar they are to the original picture). On the recognition task, the subject gets one point for every correct shape. This test is considered a measure of visual-spatial constructional abilities, and also visual memory. Performance requires visual perception, visual-spatial organization, motor functioning and memory (on the recall conditions). Working memory and executive functioning (inhibition/self-monitoring) are also involved in the task, at least in the copy subtest.

**Beery-Buktenica Developmental Test of Visual-Motor Integration, 6th Edition (VMI)**

This test has three subtasks. The first test is the VMI *Copy*, where the subject is to copy different geometric figures. There is no time limit in this subtask. The second task is called *Visual Matching*. Here the subject is to look at a figure, and then find one out of several other figures, that is identical to the target figure. This task has a time limit of three minutes. The last task is *Motor Coordination*, where the subject is to draw lines between double lines, without crossing the lines. This task has a time limit of five minutes. All tasks have increasing difficulty. Scores are total number of correct performance on each subtest. The visual-motor integration test assesses the ability to combine visual perceptual and motor skills. Performance can be affected by either visual or motor performance, or the integration of the two skills.

**Auditory memory (immediate, delayed and recognition)**

These are index scores from the WMS-III. Indices consist of the following subtests:

*Logical memory*

The examiner reads two stories aloud, in which the test subject is to recall and recite the same story. Both stories are presented twice. Recall is tested both immediately, and after a 30 minute delay. A recognition test is conducted after the recall. Scores are based on number of correctly remembered information.

*Verbal paired associates*

The examiner reads a list of word-pairs. The test subject is then given one word of each word-pair, and is to remember the word that belongs to the given word. Each list is repeated four times. Recall is tested both immediately and after a 30 minute delay. A recognition test is also conducted, where word-pairs are presented along with distracter word-pairs. Scores are based on number of correctly remembered words during all four trials, as well as total words associated correctly after the delay.

*Word lists*

The word list is presented orally four times to the subject, who is asked to recall as many words as possible after each trial, as well as after a 30 minute delay. The task also includes an interference list that is only presented once, after which the subject is asked to recall it and then to recall the first list (rehearsed four times). Free recall and recognition of initial lists are assessed after a delay. Scores are the total number of correctly recited words after the rehearsal of the first list, as well as number of words remembered after the delay.

The subtests that make up the auditory immediate and delayed score involve the auditory presentations of verbal information. The auditory immediate, delayed and recognition indices all give a measure of verbal/auditory memory.

**Visual memory immediately and delayed**

These two are index scores from the WMS-III. The indices consist of the following subtests:

*Faces*

The subject is presented with photographs of faces, each for 5 seconds, and is to recognize them immediately after the presentation, as well as after 30 minutes delay. The score is the number of faces correctly recognized in each trial.

*Family pictures*

This task requires the subject to look at four different pictures of a family in four different social situations. After the presentation and after a 30 minute delay, they are asked to remember details from the picture. The scores are based on the number of correctly remembered participants, placements and activities.

The visual immediate and delayed memory indices both assess visual-spatial memory.

**References**

Beery, K. (1997). *Administration, Scoring and Teaching Manual for the Beery-Buktenica Developmental Test of Visual Perception and Motor Coordination*. New Jersey: Modern Curriculum Press.

Strauss, E., Sherman, E., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms and Commentary* (Vol. 3rd). New York: Oxford University Press.

Tulsky, D. S., Saklofske, D. H., Heaton, R. K., Bornstein, R., Ledbetter, M., Chelene, G. J., . . . Prifitera, A. (2003). *Clinical interpretation of the WAIS-III and WMS-III*. San Diego, USA: Academic Press.