CABPad User Guide

Palle Møller Pedersen and Lasse Willer

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Translated by: Julia Robotham

Important!

CABPad is *not* intended for use with an iPad Mini, as it has been standardized for a certain screen size. CABPad can be used with all normal sized iPads from iPad 2, with standard or retina screen resolution. iOS (operating system) must be 7.0 or newer.

CABPad is *not* meant to be interrupted during a test. However, if you accidentally press the iPad home button, you can press the CABPad icon again and CABPad will ask if you want to continue the test. It is generally not recommended to continue a test that has a time limit or that measures speed of response.

If you for some reason want to abort CABPad during a test, you can do it by touching the iPad home button and then restarting CABPad. You are then asked whether you want to continue or abort the test.

Please remember to recharge your iPad regularly in order to avoid running out of battery during a test.

Please make sure you that you do not have any alarms set from stopwatches or calendars that might interrupt during a test. Also, make sure that no app will send a push message. Use, for example, the iPad's "do not disturb" setting in the "System Preferences".

In order to avoid a few other problems, you are recommended to take the following precautions:

It is a good idea to disable the function that lets you to change apps with five fingers. Go to iPad’s "System Preferences" and disable "Multitasking Gestures".

It is also a good idea to disable the function that gives you access to the Message center by swiping down from the top of the screen. This is a little more complicated: Open "System Preferences". Go into "General" and then "Accessibility". Go into "Accessibility Shortcut" at the bottom of the window. Turn "Assistive Touch" on. Press the home button very quickly three times. A little circle will appear. Press on the circle. A square will then appear in which there is an icon that is similar to the home button. Press it quickly three times. This should solve the Message center problem!

You should also disable the function that gives you access to the Control Center by swiping up from the bottom of the screen (available in iOS 7 and later versions). Open "System Preferences" and "Control Center" and turn "Access from programs" off.

Introduction

CABPad is an iPad "app" that can help assess neuropsychological symptoms after brain damage. In the current version, it is developed specifically for assessment of stroke patients. The first version has three aims:

1. Screening neuropsychological symptoms in stroke patients prior to hospital discharge.
2. Measuring the effect of treatment of acute and subacute stroke, currently in a project using cooling.
3. Describing the remission of neuropsychological symptoms after stroke in a project that is also investigating changes in the brain's functional network using resting state fMRI.

Theses aims require of the CABPad:

1. That the entire test does not take too long.
2. That it measures the symptoms that typically appear after stroke and that are important for the client's self-help, working ability, and subjective well-being.
3. That it is sensitive to change, more specifically to increase in performance. This requires:
    1. High reliability.
    2. Avoiding basement and ceiling effects.
4. That as many patients as possible are able to cooperate to the test. This is especially challenging when it comes to stroke patients, as they suffer from such a wide range of symptoms which can influence the test, such as:
    1. Hemiparalysis of the dominant hand, which can interfere with the manual responses or lead to longer response times.
    2. Aphasia, which can make it difficult to understand instructions.
    3. Neglect, which can mean that the patient overlooks stimuli to the left side of the screen.

CABPad is *not* intended to measure all neuropsychological symptoms after stroke, just the most common and significant symptoms. CABPad is structured so that it is possible to select individual tasks if you have limited time available or if you do not need to take the whole battery. It is therefore possible to resume testing with the battery without having to take the whole test again, if you have been interrupted in the middle of a session. You can select and deselect tasks on the introduction screen or skip tasks as one proceeds with the test.

The choice of tasks in the CABPad is the result of compromises between:

1. The time that the test can take.
2. The level of symptom severity that the test can allow.
3. How sensitive the total result on the test is for recovery with treatment.
4. How detailed one can be in the assessment of neuropsychological symptoms or syndromes.
5. The level of knowledge that one can expect of the investigator in, for example, the assessment of speech in aphasia and the assessment of anosognosia.

CABPad automatically saves test results as a readable text and as a semicolon separated file that can be opened in Excel. Results are saved not only when a test is

completed but also if the program for some reason completely stops (i.e. is removed from memory when it isn't active and other programs require memory).

WARNING: CABPad cannot be used on an iPad Mini with a small screen.

Help for CABPad

Structure

There is a start screen, a series of tasks and a result screen. Each task includes an introduction screen and a task screen. There are also questionnaires, which include an introduction screen and a questionnaire. Lastly, there is a task that involves rating picture naming, which includes an introduction screen, a picture to be named and a screen with an evaluation form that the assessor fills out for each picture naming item.

On each introduction screen you have the possibility of skipping a task or aborting the test. Generally, it is not possible to abort during a task, but most tasks only last a couple of minutes (in the Verbal fluency task, you can abort between each of the five tasks, which only last one minute).

Start screen

You start the test on the first screen by allocating a patient ID and then pressing the "Start the test" button. You can also choose which tasks you would like to include in the test, as well as view, print, and delete old test results.

Create a new patient ID

This is where you can allocate a patient ID. The ID should represent a project number. The ID should not include any form of information regarding private data such as birthdate, name, or other.

Select tasks

This is where you can choose which tasks you want to include in the test. In the current version it is not possible to change the order of the tasks.

Saved data

This is where you can view and print results of previous tests which are stored on the iPad. You can also transfer results to a computer with OSX or Windows by using iTunes, which must be installed on the computer that is being used (results are saved as a readable text and as a semicolon separated CSV datafile, which can be imported into excel). For some selected tasks, detailed data are saved in a task-specific file. This enables you to carry out more detailed analysis in a spread sheet or a statistics program. Old results can be deleted so that the iPad's memory doesn't fill with results that have already been transferred (in this case both the readable-file and CSV-datafile are deleted).

Test volume

This is where you can check and adjust how loudly the voice in the app "speaks". The volume can be changed with the buttons on the side of the iPad. Warning: The iPad's volume settings may need to be changed in order to activate the sound, as sound effects might be generally deactivated in the iPad settings.

How much help can the assessor give?

Generally, you are allowed to repeat all instructions or parts of instructions that are provided on each task's introduction screen. You are *not* allowed to repeat instructions that constitute part of any task. This means that in the language comprehension task, you are not allowed to repeat which pictures the patient must point out (the patient can have the instruction repeated once, and only once, by pressing on a button).

Generally, it is not permitted to provide the patient with any kind of help during the task itself. You may point response buttons out to the patient (for example in the Attention Span task), but you may not point out which is the correct response buttons during a task.

You should not provide feedback to the patient during testing regarding the accuracy of the answers, and you may not provide feedback to the patient regarding how the patient is performing on the tasks before the entire test is completed. You are, however, allowed to encourage the patient by, for example, acknowledging that the patient is making an effort.

Task results

The results are shown as soon as a test battery is completed. You can also access test results by pressing the "Saved data" button on the introduction screen. You can also print results from this page.

A result assessment is provided on the basis of norms collected from 43 elderly healthy controls from an age group that is relevant with regards to stroke (average 69 years). Test results that are normally distributed within the healthy group are provided as T-scores. T-scores have a mean of 50 and a standard deviation of 10. The program also suggests an interpretation as to whether the result deviates from the mean. With regards to anosognosia, aphasia, and neglect, it does not make sense to increase the task difficulties to such an extent that they lead to a normal distribution within a healthy control group. Instead, for these tasks, the program reports whether the results are under or over the cut-off point, which is set on the basis of the distribution of the healthy controls (where only few individuals may lie below cut-off). The results should always be interpreted as part of a general evaluation and taking knowledge regarding the patient into consideration (this should include an evaluation of the patient's premorbid level of functioning). This should be carried out by a professional with profound knowledge and understanding of cognitive and language dysfunctions after stroke, and who is familiar with interpreting neuropsychological test data (including possible sources of error).

Results are saved on the iPad in two formats: 1) as a readable text format that you can open in a text editing program, 2) as a semicolon separated CSV file that can be imported into an Excel spreadsheet. The CSV file's first line tells Excel that semicolons

are used in order to separate values. The next line states the names of the variables. Then there is a line stating the values of the data variables. Be aware that only data from tasks selected for the test session feature in the results. For tasks that were selected but skipped during the test session, missing data values are reported as: -999 for integer and -999,0 for decimals.

Warning: Excel must be run on a computer that has the same settings for number values as the iPad that the test has been carried out on, as decimals will otherwise be interpreted differently (in English, commas are used as thousand separators instead of decimal separators). Excel won't warn you about this and this will lead to serious errors if not taken care of. So please cross-check the values provided in Excel with the values in the text datafile.

Printing

You can print results directly from CABPad. The iPad must be connected to a wireless network and a printer, which can communicate with AirPrint, must be linked to the same network. If this is not the case, you should transfer the data via iTunes to a Windows or OSX computer, from which you can then print the results.

Assessor requirements

CABPad generally requires that the assessor understands the principles surrounding a standardized testing procedure, i.e. that conditions surrounding testing using the CABPad are the same as those in place during the collection of the normative data, in order for the norms to be applicable. It is important to understand that you cannot provide more help than is described within each task and that you need to avoid any distracting elements from the environment during testing. Some tasks have special requirements, as are described below.

There are special demands associated to the rating of anosognosia. The rating can only be carried out in a reliable way by a neurologist or a neuropsychologist who is familiar with stroke.

In order to rate picture naming and verbal fluency, you must be accustomed to speech problems that arise after aphasia. If the assessor does not have the required knowledge within this area, then the person in question should receive an introduction from or be trained by a speech therapist, a neuropsychologist, or a neurologist who is well accustomed to carrying out an aphasia examination.

Be aware that interpreting results requires in-depth knowledge regarding the neuropsychological symptoms caused by stroke.

Help for the individual tests

Rating of Anosognosia - Lack of Awareness of Symptoms

Motor Speed for Hands

Speech Comprehension

Picture Naming

Verbal Fluency

Timed Neglect Test

The Baking Tray Test (Visual Hemineglect)

Attention Span

Working Memory

Arrow Stroop (Executive Control of Attention)

Memory for Pattern Locations

Symbol Digit Coding (Mental and Visuo-Motor Speed)

Depression - GDS Short Form

You can also open this help window from each task's introduction screen.

Data formats

See a description of data formats in the result files here.

Background for the battery and contributors

CABPad is developed specially for Lasse Willers' ph.d.-project at the neurological ward at Bispebjerg Hospital in Copenhagen. Clinical associate professorHanne Christensen, Ph.d. DMSci is project supervisor. Senior neuropsychologist, Hysse Forchhammer, cand.psych., Ph.D. at the neurological ward at Glostrup Hospital is external supervisor.

CABPad is planned by Lasse Willer, MD and Palle Møller Pedersen, cand.psych., DMSci, and the program is developed by Palle Møller Pedersen.

The programming of CABPad is financed by Cognisoft ApS, which owns the copyrights for the CABPad app.

The neuropsychologists at the Neurological ward at Glostrup Hospital contributed with feedback during beta-testing of the CABPad; cand.psych. Julia Robotham was especially active in contributing with observations and suggestions for improvements.

Patient data was collected by Lasse Willer and the neuropsychologists at Glostrup hospital at the neurological wards at Glostrup hospital and Bispebjerg Hospital.

Control data was collected by Lasse Willer and stud.med. Anders Gullach.

Rating anosognosia

Purpose

To assess symptom awareness for all common stroke symptoms.

Background

Anosognosia (missing or reduced awareness of symptoms or illness) can be important with regards to participation in rehabilitation and long term outcome. It can also lead to accidents (e.g. when a hemiplegic patient with anosognosia attempts to get out of bed). When used as an outcome measure, it is only relevant for the symptoms that the patient has. Moreover, the assessor must know about these symptoms prior to testing.

Traditionally, anosognosia has only been rated for hemianopia and hemiplegia. Anosognosia has also been described with Wernicke's aphasia and neglect, but one could expect that it exists in relation to other symptoms as well. Therefore, for experimental purposes, anosognosia is also rated here for a series of other acute stroke symptoms. If the assessment turns out to work on a practical level, it could potentially lead to the description of something novel.

It seems that there can be differences in the level of awareness of symptoms described verbally by the patient and the level of awareness demonstrated in the behavior of the patient (some patients acknowledge hemiplegia verbally, but still attempt to leave their bed, while others deny hemiplegia verbally, but stay in bed). Unfortunately, it is not possible to include this differentiation in this rating tool, as it would require extended systematic observations. This test comes first in the battery as the other tasks can reveal some of the symptoms in question to the patient.

Test description

The assessor asks the patient questions, and if necessary, asks the patient to follow commands. Anosognosia is rated according to Bisach et al.:

1. A symptom is reported spontaneously (when asked in a general way about what symptoms the patient has)
2. A symptom is reported when asked specifically about it.
3. A symptom is reported after demonstration (e.g. with hemiplegia: "Please raise your left arm")
4. A symptom is not reported at all.

One can also register if the symptom is not present (in which case an anosognosia rating of the symptom is not relevant) or if it is not possible to rate it (e.g. because of aphasia).

Introduction to CABPad

Motor Speed for Hands

Purpose

This test assesses fine motor speed for the hands.

Background

Motor function is frequently affected in stroke. With a mild impact, the degree of reduction in fine motor speed is by itself important to know. Reduction in simple fine motor speed can also have consequences regarding the interpretation of performance in other tests that measure the speed of response. It is important not to interpret reduced speed in the other tests as a reduction of higher cognitive functions when they could be a consequence of a general slowing of motor speed.

Test description

The patient must alternate between pressing two buttons with his/her index finger as quickly as possible. A star is shown in the frame that needs to be pressed. First, four practice tasks are presented, and then, there is a 30 second test for each hand. Handedness must be entered. If it is known in advance that the patient cannot use the hand at all, then one can enter this into the program. This can also be registered if it only later becomes apparent during the practice trial. The test will then not be carried out for the hand in question. The dominant hand is always tested first. If the patient is ambidextrous or if hand dominance is unknown, the right hand is tested first.

Help allowed

During the practice trials, the instructions can be repeated and elaborated as needed. They can also be accompanied by gestures.

During the test itself, the instructions can be repeated when the test starts and can be accompanied by gestures. However, no help or encouragement is allowed after this.

Introduction to CABPad

Speech Comprehension

Purpose

To assess the comprehension of spoken language: single words as well as short sentences.

Background

Language comprehension is often (but not always) affected when a patient has aphasia after left middle cerebral artery stroke.

Test description

The iPad says some words or sentences and the patient has to select the corresponding picture. When a picture has been selected, the frame around it becomes darker and the non-selected pictures disappear a bit quicker that the selected one, in order to indicate which picture has been selected. No feedback is provided regarding the accuracy of the response (as it would cause a distraction and would not have a purpose for the testing).

The spoken word or sentence may be repeated once by touching the button at the bottom of the screen.

The first set of pictures have large semantic distances with one another and depict ordinary objects. The following two sets show objects that are more closely semantically related, first vegetables and then insects, which are a bit more difficult. The next part is similar to the Token-test as it requires the comprehension of words for geometrical shapes, colors, and sizes. The last part tests sentence comprehension.

In a test like this, it is impossible to avoid any kind of ceiling effect. A comprehension test without any ceiling effect would be rather sensitive to educational background and also rather time-consuming.

Help allowed

The assessor can show and explain to the patient that he or she has to select a picture by pressing it, but may not show which picture the patient must choose.

The assessor can show and explain to the patient that the task instructions (what is said by the iPad) can be repeated (once) by pressing the button at the bottom of the screen.

The assessor *cannot* repeat the task instructions to the patient by saying the same word or sentence again (unless there has been a disturbance that has impeded the patient in hearing the task).

Introduction to CABPad

Picture Naming

Purpose

To assess naming in patients with aphasia.

Background

Naming difficulties (anomia) can be seen in all types of aphasia, and in mild aphasia, they can be the only symptom (anomic aphasia). The subtasks have different levels of difficulty because of differences in each word’s frequency in language. The test has a ceiling effect. If a larger number of pictures and more difficult pictures had been included in the test, the test would have been too time consuming and very sensitive to educational background.

Test description

Twenty pictures are shown that must be named. The patient has 20 seconds to name each picture. The picture disappears after 20 seconds and responses that are given after a picture has disappeared should not be scored as correct. As soon as the patient has provided a response, the assessor touches a button leading to a scoring page so you don't have to wait the full 20 seconds to move on. Responses are scored as follows:

1. Correct naming (no errors at all, not even dysarthria)
2. Incorrect, but can be understood as an attempt to say the correct word (responses with phonemic paraphasias, pronunciation problems and dysarthria are OK)
3. Incomprehensible or wrong word (including semantic paraphasias, stereotypical repeated utterances or grunts)
4. No response (i.e. no sound at all)

The test can be aborted after each of the 20 tasks. This can be done in cases where patients say nothing at all but should not be done if one is planning to use the data for research.

Help allowed

The only help the assessor is allowed to provide is to repeat to the patient that he/she is supposed to say what the picture depicts.

Introduction to CABPad

Verbal Fluency

Purpose

To assess verbal productivity in aphasia and mental dynamics related to executive disorders.

Background

The test can be used to assess aphasia as well as dysexecutive symptoms. However, it can only be used to assess dysexectutive symptoms if there is no sign of aphasia. Verbal fluency with semantic categories is most relevant in regards to aphasia. Verbal fluency with letters is most relevant for the executive function "mental dynamics".

Test description

The patient is asked to say as many words as possible that begin with a certain letter or that are within a certain category. The test counts the number of words that are mentioned within one minute for each task. The time is displayed (to the assessor) on a timer. The assessor registers each time a word is produced. One registers whether the word is:

1. Correct (comprehensible paraphasia and pronunciation errors are accepted)
2. Incomprehensible (totally incomprehensible: note that pronunciation errors and paraphasia are accepted as correct)
3. Rule breaking (e.g. words with the wrong first letter or not in the correct category)
4. Repetition (note that the assessor has to remember words that have already been mentioned!)

It is possible to abort the test between each of the five tasks, but not during the minute that each task lasts. The assessor should avoid aborting the test, even if there has been a task with no responses, as the following trial might be easier for the patient.

Help allowed

If the patient says nothing in a task, the instruction may be repeated once. It is only allowed to repeat it once for each of the five tasks. It is appropriate to do it after about 15 seconds (with a fourth of the time-line filled). Do not correct errors like repetitions, incorrect first letter or incorrect category.

Introduction to CABPad

Timed Neglect Test

Purpose

To measure visual hemineglect with a high level of sensitivity by measuring response times in different areas of the screen.

Background

The level of sensitivity can be limited in traditional paper-and-pencil tests for hemineglect, as they usually do not have time limits and do not measure response times. On the other hand, the iPad neglect test loses sensitivity because of the small screen size.

Test description

A butterfly is shown in various places on the screen, and the aim is to touch it as quickly as possible after it has appeared. If a response is not given within 5 seconds, the butterfly disappears and the time-score is set at 5 seconds (this is done in order for the test not to be too time consuming and in order to help patients with severe neglect move on). A total of 30 butterflies are displayed in all areas of the screen in a pseudo random order. It is easier to notice the butterfly at the top part of the screen on the blue sky background than at the bottom on green vegetation background. This graded difficulty has been added in order to reduce floor and ceiling effects. The program reports average response times for the left, middle, and right part of the screen, as well as the number of positive responses. A response-time ratio for left vs. right (middle not included) is also reported.

Help allowed

The assessor can only help by prompting during the practice session. During the practice session, the assessor can explain to the patient that he/she must look for a butterfly and touch it. If necessary, one can point out the butterfly and encourage the patient to touch it. The assessor may *not* help or prompt the patient during the test itself.

Introduction to CABPad

The Baking Tray Test (Visual Hemineglect)

Purpose

To assess hemineglect in the peripersonal space using a test that is sensitive to visuospatial as well as intentional hemineglect.

Background

Some studies have shown that the hands-on version of the baking tray test is more sensitive to hemineglect than other traditional (paper-and-pencil) neglect tests, probably because performance can be affected by intentional as well as visuospatial neglect.

Test description

The patient has to distribute twelve buns evenly on a backing tray. In order to place buns on the tray, one simply touches the intended positions on the screen. As soon as a bun has been placed on the tray, it cannot be moved (during pilot testing of the app, it proved to be confusing for some patients that buns could be removed by being touched). Before the test itself, there is a training exercise with three buns. Patients with neglect often place too many buns on the right side of the tray. Performance can also be affected by executive difficulties such as poor planning.

Help allowed

1. The assessor may prompt the patient to begin the task by saying: "Touch the baking tray to place a bun".
2. The assessor may prompt the patient to continue the task: "You haven't put all 12 buns on the backing tray yet".
3. The assessor may answer questions concerning the way the buns are placed: "You touch the baking tray in order to place a bun. Once placed, it cannot be moved".
4. The assessor is *not* allowed to comment on the distribution of the buns.
5. The assessor is *not* allowed to explain or show the entire baking tray using gestures.
6. The assessor is *not* allowed to help the patient in orienting his/her attention toward the left or right side of the screen.

Introduction to CABPad

Attention Span

Purpose

To assess simple attention span, i.e. how many items can be kept in mind at the same time with no restructuring required.

Background

The test measures attention span, which is an aspect of working memory (with little demand on the executive component, which is challenged more in the next test: Working Memory). The test is not sensitive to a reduction of episodic memory (which has to do with what can be remembered after a distraction). There is a test in the CABPad that is specially designed to test episodic memory: Memory for Pattern Locations.

In order to increase the chance that aphasia patients can manage the test, symbols (pictures of objects) are used instead of digits. The response buttons are grouped in the shape of a square in the middle of the screen in order to increase the chance that neglect patients can perform the test.

Test description

The task involves remembering symbols and the order in which they are presented. First, the symbols are shown on the screen and then, the patient has to select them from a larger selection of symbols, in the correct order. In the first trial, two symbols must be reported in the correct order, then three, then four, etc. There are two trials for each amount of symbols. The test stops when two errors have been made on the same level (e.g. if both trials with three symbols are incorrect). A single trial proceeds as follows:

1. Each symbol is shown for 1.5 seconds.
2. The patient enters his/her response by pressing the symbols in the order they were shown.
3. The test moves on to the next trial when the patient has entered the amount of symbols that were included in the trial.
4. If the patient cannot remember all of the symbols, he/she can press the button: "Cannot remember any more symbols".
5. The test begins with a practice session.

Help allowed

Instructions can be repeated and elaborated upon (also using gestures) during the practice session but not during the test itself. During the test itself, the assessor can draw the patient’s attention to the "Cannot remember any more symbols" button, if the patient cannot remember all symbols or if the patient freezes.

Introduction to CABPad

Working Memory

Purpose

To assess working memory, i.e. the ability to keep and process several items simultaneously in the mind.

Background

Working Memory is an important executive function. The prefrontal areas of the brain are important when it comes to maintaining and processing several items simultaneously in the mind. The elements themselves are held in the posterior brain areas (towards the back), which are involved in the perception of the type of information in question. The prefrontal component contributes by fending off distractors and manipulating elements, e.g. when inverting the order of the elements.

Two tests measuring working memory have been included in the battery. In the Attention Span test, the order of the elements does not have to inversed, so the contribution of the prefrontal/executive component is far weaker.

The test cannot be used to measure episodic memory (in other words, it cannot be used to measure whether a patient is able to create new memories after brain damage). There is another test included in the battery which is specifically aimed at measuring episodic memory: Memory for Pattern Locations.

Test description

This test is similar to the "Attention Span" test, but here, the symbols must be entered in reverse order. The test starts with two symbols, then three, and so on. There are two trials for each amount of symbols. The test stops when two errors have been made on the same level (e.g. if both trials with three symbols are incorrect). A single trial proceeds as follows:

1. Each symbol is shown for 1.5 seconds.
2. The patient enters his/her response by pressing the symbols in the reverse order than that, which they were shown in.
3. The test moves on to the next trial when the patient has entered the amount of symbols that were included in the trial.
4. If the patient cannot remember all of the symbols, he/she can press the button: "Cannot remember any more symbols".

The test begins with a practice session.

Help allowed

The assessor may repeat and elaborate instructions (also using gestures) during the practice session but not during the test itself. During the test itself, the assessor can draw the patient’s attention to the "Cannot remember any more symbols" button if the patient cannot remember all symbols or if the patient freezes.

Introduction to CABPad

Arrow Stroop (Executive Control of Attention)

Purpose

To investigate executive control of attention, more specifically cognitive impulse control.

Background

Selective dysexecutive syndromes are rarely seen after stroke, but after severe stroke, mild executive difficulties are commonly seen together with other symptoms. These symptoms can be expected to have implications for the patient's outcome. In CABPad, only one aspect of executive symptoms has been included, as the battery would be too time consuming if it had to cover all aspects (e.g. cognitive flexibility and planning ability). The task measures the added reaction time that results from response conflict. Other tasks that can reflect dysexecutive disorders are Working Memory and Verbal Fluency (but performance on these tasks can also be affected by more basic cognitive disorders, such as aphasia).

Test description

Two buttons are placed above one another. Arrows are shown (one on each side in order to support neglect patients) pointing upwards or downwards. In the test, one must press the top button as quickly as possible if the arrow is pointing upwards and the bottom button if the arrow is pointing downwards. Nine out of ten arrows are placed in a position that is congruent with the direction that the arrow is pointing towards, i.e. beside the top button (that is to be pressed), if the arrow is pointing upwards. One out of ten trials is incongruent. The test stops after two minutes.

If the wrong button is pressed, a red cross appears, and an unpleasant sound is produced.

Before the test begins, there is a practice session.

Results are measured as the difference in reaction times between the congruent and incongruent trials. The number of errors is also indicated, but it is not a good measure of performance, as patients do not all reach the same amount of trials within the two minute limit. This would require that all patients were given the same amount of trials regardless of their reaction times, in which case the test could take a very long time for the slowest patients.

Help allowed

The assessor can help the patient understand the test by repeating and elaborating explanations, as well as by using gestures during the practice trials, but not during the test itself.

Introduction to CABPad

Memory for Pattern Locations

Purpose

To evaluate episodic memory using a test that can be carried out by patients with aphasia.

Background

Severe memory deficits (amnestic syndrome) are rarely seen in patients with aphasia but can occur, specially if the posterior cerebral arteries are affected. Patients do, however, often describe more discrete memory problems. It can be difficult to differentiate language problems and memory problems in patients with aphasia. This test is designed to evaluate episodic memory, i.e. what one can remember after a disturbance has occurred after learning (information that one can keep in mind as long as no disturbance occurs is called working memory; working memory can be measured using other tests in the CABPad). The test requires memory for spatial locations and for abstract patterns, which are difficult to verbalize. In the first version of the test, drawings of real objects were used, but there was an evident ceiling effect among healthy controls. There should not be a floor effect as one should be able to remember the location of at least one pattern within ten attempts. The fact that some patterns look very much alike means that a ceiling effect is unlikely.

Test description

The patient has to remember where the abstract patterns are shown. There are 10 positions and their 10 associated patterns, and 10 attempts are given. In the first trial, a pattern is shown. When the pattern has been hidden, one has to point at the frame where the pattern was shown. If a mistake is made, the pattern is shown again. If one answers correctly, the next trial includes two patterns. If a mistake is made, both patterns are shown again. A point is given for each correct answer, with 55 as the maximum score.

Each time a pattern is shown, an arrow appears in the middle of the screen pointing towards it. This is intended to help neglect and hemianopia patients in seeing the patterns.

Help allowed

1. The assessor may remind the patients that they are being shown patterns that they must remember.
2. The assessor may prompt the patients to answer by pressing the field with the question mark, but may not show the patient which frame they need to choose.

Introduction to CABPad

Symbol Digit Coding (Mental and Visuo-Motor Speed)

Purpose

To measure mental and visuo-motor speed in a complex task that requires good communication between different parts of the brain and that also requires a high level of concentration.

Background

This test is included in the battery because it is highly sensitive to cognitive disturbances. It is, however, not very specific, as it challenges a number of cognitive functions including visual search, working memory, concentration, and learning. The high sensitivity and good level of reliability make it very well-suited for research regarding outcome, and since it lasts only a few minutes, a lot of important information can be gained in a short timespan.

Test description

A coding system is displayed at the top of the screen, showing digits and their associated symbols. At the bottom of the screen, there is a "symbol keyboard", which the patient uses to provide responses. Single digits are shown, one at a time, in the middle of the screen, and one has to press the associated symbols as quickly as possible. If a mistake is made, a red frame appears instead of a grey frame around the digit in the middle of the screen. The test starts with five practice trials. The test itself takes two minutes.

Help allowed

The assessor may repeat and elaborate explanations (also using gestures) during the practice session.

During the test itself, the patient can be prompted to start at the beginning of the test, but no other explanations or help may be given.

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Depression - GDS Short Form

Purpose

To assess depression using a scale that can be used with elderly and hospitalized patients.

Background

Depression is common after stroke. It should probably be treated as early as possible, in part because it can affect the amount of energy the patient has for rehabilitation. Depression can also affect a patient's performance on cognitive tests. There is also an overlap between depression and stroke symptoms (e.g. loss of energy or concentration difficulties). The scale that has been included in this test battery was chosen because it was considered to be least affected by stroke symptoms.

Test description

The test is simply a computerized form of the short version of the Geriatric Depression Scale:

Brink TL, Yesavage JA, Lum O, Heersema P, Adey M, Rose TL (1982). Screening tests for geriatric depression. Clinical Gerontologist, 1, 37-44.
Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M et al. (1982). Development and validation of a geriatric depression screening scale: a preliminary report. J.Psychiatr.Res., 17, 37-49.
Sheikh JI, Yesavage JA: Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. Clinical Gerontology: A Guide to Assessment and Intervention 165-173, NY: The Haworth Press, 1986.

The assessor reads the questions aloud and enters the patient's yes-no answers. The questions can also be read aloud by the app. It is also possible to register whether the patient is able to understand the questions and respond to them. Any form of yes-no answers are accepted.

Help allowed

All 15 questions may be repeated as many times as needed, but they may not be rephrased.

Any type of support that can help the patient provide a positive or negative answer is allowed. The assessor must be sure, however, that what is typed in the form is a true expression of the patient's answer.

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Data formats

Different types result files

The data is saved as semicolon separated data files with .csv extensions and as files with .txt extensions that can be printed and read. The *CSV-files* are intended for statistical use in research, while the *txt-files* are intended for everyday clinical use.

Data file with results from all tests combined

Format of the file

The file includes two rows. The first row includes the names of the variables and the second row includes the data fields. The fields are separated by semicolons. It's only the data from the tests that were selected for the session that are reported in the data file. If a test was selected but skipped during testing, then it is reported in the file as missing data.

Data heading

PT_ID: patient-identification, text-string.
SESSION: session-number (the same patient can be tested more than once, integers).
DATO: The date upon which the test session was started (see format below).
TIME: The time at which the test session was started (see format below).

Format of the date and time

The date has the following format: dd-MM-yyyy (day in two digits, month in two digits, year in four digits; separated by a dash).
The time has the following format: HH:mm:ss (time in two digits, minutes in two digits, seconds in two digits; separated by colons).

Missing data

Missing data is reported with the value: -999.

Yes/no data (boolean)

-999: missing data.
0: no/false.
1: yes/true.

Rating of Anosognosia - Lack of Awareness of Symptoms

All anosognosia-scores can have the following values (integers):
-999: missing data.
0: not relevant (doesn't have the symptom)
1: The symptom is reported spontaneously

2: The symptom is reported when asked specifically about it
3: The symptom is reported after demonstration
4: The symptom is not at all reported.
5: It is not possible to rate anosognosia (e.g. because the patient has aphasia)

ANOSO_START_TIME: time at which the test started.
ANOSO_END_TIME: time at which the test ended.
ANOSO_HEMIPAR: anosognosia for hemiparesis.
ANOSO_SENSIBIL: anosognosia for sensory disorders.
ANOSO_HEMIANOP: anosognosia for hemianopia.
ANOSO_NEGLECT: anosognosia for hemineglect.
ANOSO_DYSART: anosognosia for dysarthria.
ANOSO_SPEECH: anosognosia for aphasic speech disorders.
ANOSO_COMPREHEN: anosognosia for aphasic comprehension disorders.

Manual Motor Speed

Handedness can have the following values (integers):
-999: missing data.
0: right
1: left
2: ambidextrous
3: unknown

MOTOR_START_TIME: time at which the test started.
MOTOR_END_TIME: time at which the test ended.
MOTOR_HANDEDNESS: handedness (see above).
MOTOR_RIGHT_USABLE: can use the right hand, yes/no data (see above).
MOTOR_LEFT_USABLE: can use the left hand, yes/no data (see above).
MOTOR_R_RESPONS: amount of responses with the right hand in 30 seconds.
MOTOR_L_RESPONS: amount of responses with the left hand in 30 seconds.

Speech Comprehension

COMPREHEN_START_TIME: time at which the test started.
COMPREHEN_END_TIME: time at which the test ended.
COMPREHEN_CORRECT: amount of correct responses (integer).
COMPREHEN_ERROR: amount of wrong answers (integer).
COMPREHEN_REPETIT: amount of tasks that were repeated (integer).
COMPREHEN_MEAN_TIME: average reaction time in seconds (decimal number) from the first time the task is spoken.

Picture Naming

NAMING_START_TIME: time at which the test started.
NAMING_END_TIME: time at which the test ended.
NAMING_CORRECT: amount of pictures that were named correct.
NAMING_UNDERSTAND: amount of wrong but words that were recognizable.
NAMING_INCOMPREHEN: amount of incomprehensible or wrong words.
NAMING_NO_ANSWER: amount of tasks with no response within the time limit.

Verbal Fluency

VERBALFLU_START_TIME: time at which the test started.
VERBAL_FLU_END_TIME: time at which the test ended.
VERBALFLU_F_CORRECT: phonemic fluency F-words, amount of correct words (integer).
VERBALFLU_F_REPETIT: phonemic fluency F-words, amount of words that were repeated (integer).
VERBALFLU_F_RULEBREAK: phonemic fluency F-words, amount of times the rules were broken (integer).
VERBALFLU_F_INCOMPREH: phonemic fluency F-words, amount of incomprehensible words (integer).
VERBALFLU_A_CORR: phonemic fluency A-words, amount of correct words (integer).
VERBALFLU_A_REPETIT: phonemic fluency A-words, amount of words that were repeated (integer).
VERBALFLU_A_RULEBREAK: phonemic fluency A-words, amount of times the rules were broken (integer).
VERBALFLU_A_INCOMPREH: phonemic fluency A-words, amount of incomprehensible words (integer).
VERBALFLU_S_CORRECT: phonemic fluency S-words, amount of correct words (integer).
VERBALFLU_S_REPETIT: phonemic fluency S-words, amount of words that were repeated (integer).
VERBALFLU_S_RULE_BREAK: phonemic fluency S-words, amount of times the rules were broken (integer).
VERBALFLU_S_INCOMPREH: phonemic fluency S-words, amount of incomprehensible words (integer).
VERBALFLU_ANIMAL_CORRECT: semantic fluency animals, amount of correct words (integer).
VERBALFLU_ANIMAL_REPETIT: semantic fluency animals, amount of words that were repeated (integer).
VERBALFLU_ANIMAL_RULEBREAK: semantic fluency animals, amount of times the rules were broken (integer).
VERBALFLU_ANIMAL_INCOMPREH: semantic fluency animals, amount of incomprehensible words (integer).
VERBALFLU_CLOTH_CORRECT: semantic fluency clothes, amount of correct words (integer).
VERBALFLU_CLOTH_REPETIT: semantic fluency clothes, amount of words that were repeated (integer).
VERBALFLU_CLOTH_RULEBREAK: semantic fluency clothes, amount of times the rules were broken (integer).
VERBALFLU_CLOTH_INCOMPREH: semantic fluency clothes, amount of incomprehensible words (integer).

Timed Neglect Test

TNEGLECT_START_TIME: time at which the test started.
TNEGLECT_END_TIME: time at which the test ended.
TNEGLECT_LEFT_HIT: amount of targets touched on the left side.
TNEGELCT_MIDDLE_HIT: amount of targets touched in the middle.
TNEGLECT_RIGHT_HIT: amount of targets touched on the right side.

TNEGLECT_LEFT_TIME: average reaction time in seconds on the left side (decimal numbers).
TNEGLECT_MIDDLE_TIME: average reaction time in seconds in the middle (decimal numbers).
TNEGLECT_RIGHT_TIME: average reaction time in seconds on the right side (decimal numbers).
TNEGLECT_INDEX: difference in reaction time in seconds between the right and the left side (decimal numbers).

The Baking Tray Test (Visual Hemineglect)

BAKINGTRAY_START_TIME: time at which the test started.
BAKINGTRAY_END_TIME: time at which the test ended.
- This pair of variables comes 12 times (_01_X to _12_X and _01_Y to _12_Y):
BAKINGTRAY_BUN_01_X til BAKINGTRAY_BUN_12_X: x-position (horizontal) in pixels (decimal number)
BAKINGTRAY_BUN_01_Y til BAKINGTRAY_BUN_12_Y: y-position (vertical) in pixels (decimal number)
- And finally the overall results:
BAKINGTRAY_BUNS_RIGHT: amount of buns for which the centers are to the right of the screen (integer)
BAKRINGTRAY_BUNS_LEFT: amount of buns for which the centers are to the left of the screen (integer)
BAKINGTRAY_MEAN_DEVIANCE: the average distance to the middle in pixels for the 12 buns (decimal number)

Attention Span

ATTENTSPAN_START_TIME: time at which the test started.
ATTENTSPAN_END_TIME: time at which the test ended.
ATTENTSPAN_TOT_COR: total amount of correct trials (integer).
ATTENTSPAN_MAX_LEN: the highest amount of symbols reported in the correct order (integer).

Working Memory

WORKMEM_START_TIME: time at which the test started.
WORKMEM_END_TIME: time at which the test ended.
WORKMEM_TOT_COR: total amount of correct trials (integer).
WORKMEM_MAX_LEN: the highest amount of symbols reported in the correct order (integer).

Arrow Stroop (Executive Control of Attention)

ASTROOP_START_TIME: time at which the test started.
ASTROOP_END_TIME: time at which the test ended.
ASTROOP_TOT_RESPONS: total amount of responses in 120 seconds.
ASTROOP_TOT_ERRORS: total amount of mistakes.
ASTROOP_RTIME_CORREC: average reaction time in the congruent tasks (careful: misleading name of variable) (decimal number).

ASTROOP_RTIME_INCORRECT: average reaction time in the incongruent tasks (careful: misleading name of variable) (decimal number).
ASTROOP_RTIME_DIFF: difference in reaction times between the congruent and incongruent tasks.

Memory for Pattern Locations

MEMORY_START_TIME: time at which the test started.
MEMORY_END_TIME: time at which the test ended.
MEMORY_TOT_CORRECT: total amount of patterns remembered correctly in all 10 trials (max. 55, integer).
MEMORY_MAX_POSITIONS: the highest amount of patterns remembered in a single trial (max. 10, integer).

Symbol Digit Coding (Mental and Visuo-Motor Speed)

CODING_START_TIME: time at which the test started.
CODING_END_TIME: time at which the test ended.
CODING_TOTAL_CORRECT: amount of correct responses in 120 seconds (integer).
CODING_TOTAL_ERRORS: amount of mistakes (integer).

Depression - GDS Short Form

GDS_START_TIME: time at which the test started.
GDS_END_TIME: time at which the test ended.
GDS_COOPERAT: is able to give some kind of valid verbal or non-verbal yes/no answer (yes/no variable, see above).
GDS_TOTAL: total score (0-15; integer)
- Then the answers for the 15 questions are listed (GDS_01 to GDS_15):
GDS_01 to GDS_15: answers to questions, 0 = no, 1 = yes, -999 = missing data

Extra data from various tests

These data are intended for additional analysis and are saved in a different file. They can for example be used to analyze test reliability. The data is organized in a column instead of a row. Extra data is only available for tasks that can provide particularly valuable information.

Manual motor speed

You will find the following fields in each row (the amount of rows varies according to the amount of responses the patient managed to give):

PT_ID: patient-identification (text-string)
SESSION: session-number (the same patient can be tested more than once, integer).
HAND: right or left hand (integer, see the code above).
RESPONSE_TIME: response time in seconds (decimal number).

Speech Comprehension (Aphasia)

You will find the following fields in each row (1 row for each trial, 20 rows in all):

PT_ID: patient-identification (text-string)
SESSION: session-number (the same patient can be tested more than once, integer).
TARGET_PICTURE: the correct picture (name as a text string).
CHOSEN_PICTURE: the chosen picture (name as a text string).
IS_CORRECT: whether the correct picture was chosen (yes-no variable, see above).
WAS_REPEATED: whether the instruction was repeated (yes-no variable, see above).
RESPONSE_TIME: response time in seconds from when the word was spoken (decimal number).

Timed Neglect Test

You will find the following fields in each row (1 row for each trial, 30 rows in all):

PT_ID: patient-identification (text-string)
SESSION: session-number (the same patient can be tested more than once, integer).
POSITION: position on the screen in 5 rows from top left, 6 positions in each row.
SIDE: 0 = right side of the screen, 1 = middle, 2 = left.
MISSED: the target was not touched within the 5 second limit.
RESPONSE_TIME: response time in seconds (max. 5 seconds).

Arrow Stroop (Executive Control of Attention)

You will find the following fields in each row (the amount of rows varies according to the amount of responses the patient managed to give):

PT_ID: patient-identification (text-string)
SESSION: session-number (the same patient can be tested more than once, integer).
TARGET_TYPE: Type of target (0 = congruent arrow pointing upwards, 1 = congruent arrow pointing downwards, 2 = incongruent arrow pointing upwards, 3 = incongruent arrow pointing downwards).
IS_CORRECT: whether the response was correct (yes/no variable, see above).
RESPONSE_TIME: response time in seconds (decimal number).

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