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The mental status examination in adults

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INTRODUCTION

The mental status examination includes important instruments that can assist in determining the integrity of underlying brain function. These time-tested tools have been complemented, but not replaced, by recent technological advances in neuroimaging. The mental status examination continues to play a critically important role in evaluating cognitive and behavioral disorders, contributing to diagnosis, patient care, rehabilitation, and research.

This topic will specifically review the extended mental status examination as performed at the bedside or in the clinic. Both cognitive screening tests and formal neuropsychological assessment are presented separately. Likewise, other features of the neurologic examination and other facets of the evaluation of patients with cognitive disorders are also discussed separately. (See "[The detailed neurologic examination in adults](#)" and "[Evaluation of cognitive impairment and dementia](#)".)

HIERARCHY AND SCOPE OF COGNITIVE ASSESSMENTS

Cognitive and behavioral assessments are designed to distinguish normal and abnormal performance arising across a range of different conditions. They can be divided into three levels of rigor:

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Screening tools such as the Mini-Mental State Examination (MMSE) [1] and the Montreal Cognitive Assessment (MoCA) [2] can be administered in less than 15 minutes and have cutoff scores that are designed to quickly separate patients with normal versus impaired cognition. These tests help identify individuals who may benefit from more extensive assessments, but provide relatively little insight into the brain areas affected or potential etiologies that may be contributing. These assessments are described in detail separately. (See "[Mental status scales to evaluate cognition](#)".)

- The extended mental status examination can be performed at the bedside (for hospitalized patients) or a longer clinic visit. It includes more detailed assessments of performance across a broader range of different cognitive and behavioral skills and may take 30 to 60 minutes. A patient's pattern of performance across a battery of tests helps identify which brain regions might be dysfunctional and provides important clues to the underlying pathology.
- Formal neuropsychological testing incorporates the most detailed assessments with normative values that can account for gender and a wide range of ages and educational backgrounds. Neuropsychological testing can last up to several hours, which can be divided across multiple visits. Referral to neuropsychology often occurs in clinical settings where time constraints preclude an extended mental status exam or when the results of such exams are not sufficiently conclusive to render a diagnosis.

The extended mental status exam differs from most screening tools and all formal neuropsychological assessments in that neither administration nor interpretation is consistently standardized, although some have called for greater harmonization of such assessments across practitioners [3-5]. Determination of relative deficits versus strengths often depends on extrapolated norms from standardized neuropsychological tests. Patterns of deficits in the mental status examination can sometimes allow preliminary hypotheses regarding both the nature (ie, delirium, dementia, primary psychiatric disease) and the underlying pathogenesis of presenting cognitive and behavioral symptoms. The mental status examination also provides a measure of the severity of a patient's problems that can be followed over time.

CLINICAL INTERVIEW

The evaluation of mental status, both in the clinic and at the bedside, begins during the course of obtaining an initial medical history. Many aspects of mental status, cognition, and behavior can be observed in this clinical interview: attention, response latency, ability to answer questions and provide relevant information, overall appearance, and degree of cooperation. These observations, in conjunction along with any specific complaints brought forward by the patient or family member, can help determine both the scope and the focus of the subsequent examination.

The clinical history supplements the other portions of the mental status examination. Interpretation of both cognitive performance and behavioral abnormalities is dependent on the patient's age, educational level, premorbid functioning, prior social and medical history, and current medications. Other important information that can be obtained through the interview includes the patient's ability to function in his or her daily life and whether there have been any changes in personality, behavior, and interpersonal relationships. As patients may have limited insight into their condition, more objective answers to these questions may require interviews with other individuals who know the patient well and, ideally, live with them.

The clinical interview also allows the examiner to establish rapport with the patient and make him/her comfortable. The collection of information that is relatively mundane may be less stressful than overt cognitive testing. In turn, the comfort level established during the interview may lessen the frequency and severity of any subsequent test and performance anxiety that may be engendered by explicit testing.

MENTAL STATUS EXAMINATION

Whenever possible, mental status examinations should be conducted in a quiet room, without distractions. This may be difficult in busy hospital or clinic settings. Mental status examinations can be used to evaluate the following domains:

- Level of consciousness (arousal)
- Attention and concentration
- Memory
- Language
- Visuospatial perception
- Praxis
- Calculations
- Executive functioning

- Mood and thought content

Many of these domains are preferentially affected by regional dysfunction in the brain. However, both these categorizations and the tests used to evaluate them are somewhat arbitrary and overlapping in content. The following sections outline some of the more commonly used tests in each domain, and as suggested by the Behavioral Neurology Section of the American Academy of Neurology, prioritizing those that can be administered relatively quickly, have published age- and education-based normative data, and are in the public domain [6].

Arousal — When starting to examine the patient, it is first important to observe whether the patient is alert, attentive, sleepy, or unresponsive. An adequate state of arousal is a prerequisite for further mental status testing, which is hierarchical in nature and built upon the assumption of normal levels of arousal. Therefore, results obtained from patients that are sleepy or unresponsive have only limited validity. The neurologic evaluation of a patient in stupor or coma is discussed separately. (See "[Stupor and coma in adults](#)".)

Attention and concentration — Attention is the ability to focus and direct cognitive processes and to resist distraction; concentration is the ability to sustain attention over a period of time.

Much like level of arousal, attention is critical to the interpretation of other parts of the neurocognitive examination. Attentional deficits will undermine performance in other cognitive domains, particularly memory and executive function, and thus confound their interpretation. Prominent deficits in attention and concentration are typical in delirious patients with toxic-metabolic encephalopathies or acute psychiatric disorders, but are less prominent in early stages of neurodegenerative disease. (See "[Diagnosis of delirium and confusional states](#)" and "[Acute toxic-metabolic encephalopathy in adults](#)".)

Abnormal attention is often evident in the clinical interview; the patient may have difficulty concentrating, be easily distracted by extraneous stimuli, lose his/her train of thought, and tend to ramble.

- **Digit span forward test** — More formal assessment of attention is most frequently accomplished through the digit span forward test [7]. The examiner recites a random sequence of digits at the rate of one number per second. The patient is asked to repeat back the number sequence in exactly the same order. With successive successful trials, the string of digits progressively increases in length. A normal

forward span is seven plus or minus two digits for adults, regardless of age or educational level [8].

A variant that is slightly more challenging and sensitive is the **digit span backwards task**, where the patient is asked to repeat the number sequence back in the reverse order. A normal reverse digit span is four or more [9].

- Other common attentional tests that assess sequential operations include serial subtraction, spelling words backward, and stating the months of the year in reverse. However, the interpretation of these other tests is limited by less extensive normative data and significant age, gender, and education effects that reduce their overall specificity [6].
- More complex tests of sustained attention also include a timed component that incorporates cognitive processing speed; time of performance is an important component in these tasks. Amongst the most commonly used [4] are Trail-Making Test part A (Trails A) (figure 1) [10-14], and symbol-copying tasks (eg, Digit Symbol Substitution test) (figure 2) [15]. While these tests can be included in the extended mental status examination, the need for a timer and specific forms means that these tests are more typically administered during formal neuropsychologic testing.

Memory — Impaired memory is perhaps the most frequent presenting complaint that prompts a more extensive mental status examination. As a clinical construct, the term "memory" encompasses multiple different dimensions.

- **Immediate and working memory** represent components of attention and concentration that are best measured with digit span forward and backwards [7]. (See '[Attention and concentration](#)' above.)
- **Recent memory** reflects the ability to learn new material. It can be informally tested by assessing a patient's orientation to time and place or his/her knowledge of current events [7,8]. The most commonly used explicit test of recent memory is to ask patients to remember three to five words, have them repeat the words to ensure normal attention/immediate memory, and then ask them to recall the words after a 5- to 10-minute delay [16]. For patients who are unable to recall the original words, category hints (eg, "animal") or multiple-choice cues ("cow, horse, or dog") can be given to further assess the severity of the deficit. Normal older adults should be able to remember three out of three words without cues [8], but formal normative data supporting this cutoff score are not readily available.

Other word-list learning tests that have more rigorous normative data include the Consortium to Establish a Registry for Alzheimer's Disease (CERAD)-Word List Memory Test [17] and the Rey Auditory Verbal Learning Test [18]. In addition to testing recall memory, these tasks also include recognition memory subtests, in which target words are interspersed with foils and patients are asked whether or not they remember previously hearing the word through a "yes-no" multiple-choice format. However, these tests are longer and more complex in their administration [6].

- **Remote memory** retrieval can be tested by asking patients to name presidents of the United States in reverse order as far back as they can remember or by asking about important historical events, famous sporting events, and popular television shows [7,8]. Patients can also be asked about details of their personal life such as their birth date, children and grandchildren, and work history (assuming independent verification is available).

Assessment of memory functions should include visual as well as verbal information. However, most bedside memory assessments are usually focused on verbal tasks due to their greater ease of administration. In settings where paper and pencil tests can be used, visual memory is tested by asking patients to either draw from memory or recognize the simple (CERAD visuospatial construction figures) and complex (eg, Rey-Osterrieth complex figure) (figure 3) line figures that they had previously copied as part of the visuospatial part of the examination [19] (see '[Visuospatial perception](#)' below). For the Rey-Osterrieth figure, patients are required to construct the figure immediately after exposure and then to reproduce the design after a delay.

Different patterns of memory deficits on bedside testing offer important clues regarding the localization of underlying neurologic disease. Amnesic disorders are characterized by normal immediate and working memory, but impaired recent memory (both recall and recognition). Such deficits imply medial temporal and hippocampal dysfunction, which can be seen early in the course of Alzheimer disease (AD). (See '[Clinical features and diagnosis of Alzheimer disease](#)'.)

Patients with Korsakoff syndrome can have even more profound loss of recent memory, which is often (though not always) accompanied by confabulation (fabricated material) as well as circumscribed deficits in remote memory, which often coincide with their periods of heaviest alcohol consumption. Individuals with damage to the frontal lobes or the underlying white matter can present with markedly impaired recall memory with largely spared recognition memory.

Language — Assessment of language functions involves both listening to the patient's spontaneous speech during the clinical interview and formal language testing, focusing on deficits in the following domains:

- **Fluency** – Spontaneous fluency is assessed by listening to the patient's speech, focusing on its rate, ease of production, and use of grammar.

Verbal fluency tasks, which are widely used in cognitive assessments, ask patients to generate as many words as possible within a specified time limit that fulfill specific rules [3,4,16]. While not specific for language function, such tests rapidly assess word knowledge and verbal executive function. Patients may perform differently on tests of category fluency (eg, animals) and letter fluency (eg, words beginning with the letter F). Cutoff scores of 12 for animals and 10 for F words are commonly employed in clinic settings. Category fluency is more sensitive to temporal lobe damage, while letter fluency is more sensitive to frontal lobe damage [20].

- **Content** – Language errors that can emerge during the examination include paraphasic errors (phonemic or semantic) and neologisms. Spontaneous speech in patients with a Wernicke aphasia (table 1) is often characterized by normal fluency but is relatively devoid of meaningful content.
- **Repetition** – Patients are asked to repeat phrases of increasing length and complexity.
- **Naming** – Patients are asked to name objects or pictures that are presented to them, beginning with words that are more frequently used and progressing to those that are less common. Within this task category, the Boston Naming Test [21] is the most commonly used [4]; an abbreviated version is included in the CERAD battery [17].
- **Comprehension** – Understanding of both written and oral language is evaluated by giving a sequence of commands, beginning with one-step, midline commands ("Close your eyes") and progressing to more complex multistep commands ("Point to ceiling, then to the door, then to the source of illumination in this room").
- **Reading** – Patients are asked to read aloud from a paragraph or a list of single words, including those with typical and atypical pronunciations.
- **Writing** – Patients are asked to spontaneously generate a written sentence.

Aphasia is the acquired inability to produce and/or understand written and spoken language. For patients, this may be an isolated finding or one feature of a larger pattern of cognitive impairment. For isolated aphasias, the language assessments described above are used to distinguish the classic language syndromes listed in the table ([table 1](#)).

Assessment of language function and categorization of aphasia are discussed in detail separately. (See "[Approach to the patient with aphasia](#)".)

Visuospatial perception — Patients with visuospatial difficulties often present with a history of losing objects, getting lost, or difficulty navigating familiar or unfamiliar terrain. They may also exhibit visuospatial neglect; family and friends may report that they ignore visual stimuli in one visual field (usually the left) when searching for objects in the refrigerator, ignore half their plate at mealtime, or only groom one side of their face or body.

Visuospatial assessments encompass both perceptual and constructional abilities, and typically include copying/drawing tasks [8]. Patients are asked to copy visual stimuli such as a diamond, overlapping pentagons, a three-dimensional cube, or more complex designs (eg, Rey-Osterrieth diagram) ([figure 3](#)) [17,19]. Line bisection and letter cancellation tests ([figure 4](#)) may be useful tools for detecting visuospatial neglect [22,23].

Clock drawing, in which the patient is asked to draw a clock and place the hands to indicate a specified time, is another sensitive and widely used tool for detecting visuospatial dysfunction [4,16], though the optimal scoring system remains uncertain [24]. Furthermore, since performance on this task incorporates a number of different domains, it may be better suited as a cognitive screening tool for dementia than a specific test of visuospatial function [25]. (See "[Mental status scales to evaluate cognition](#)".)

In addition to the formal scoring principles associated with each test, careful observation of abnormal spatial relationships, absence of detail, stimulus boundedness, loss of three-dimensional perspective, or neglect on these tests can help distinguish between perceptual failures, spatial confusion, or apraxia. Disproportionately greater deficits on visuospatial tasks relative to tests in other cognitive domains, particularly when visuospatial neglect is elicited, suggest brain dysfunction localized to the nondominant parietal lobe.

Praxis — Praxis refers to the execution of learned motor movements in the absence of primary deficits in motor and spatial abilities [8,26]. Apraxia typically presents with

difficulties dressing, feeding, and/or bathing that are not explained by clear motor deficits. These deficits should be considered independently of any concomitant difficulties with motor and/or language function.

- Ideomotor praxis (ie, the ability to perform learned motor movements) can be evaluated by asking the patient to perform increasingly complex motor tasks. The patient may be asked to demonstrate the use of an object (eg, comb, hammer, fork) with and without the actual object in their hands [8,27].
- Ideational praxis (ie, the ability to carry out a sequential set of actions toward a final goal) can be evaluated by asking the patient to perform a step-wise series of coordinated tasks, such as "Take this piece of paper, fold it in half, and place it in the envelope."

Common praxis errors include using the wrong object or body part to perform a task. Many patients who cannot perform motor tasks to command can do so spontaneously or by imitation.

Patients with neurodegenerative disease may also have difficulty performing a series of coordinated tasks. More specific or isolated problems with praxis suggest involvement of the dominant parietal lobe [27,28]. Ideomotor apraxia is a relatively prominent feature of corticobasal degeneration [26]. (See "[Corticobasal degeneration](#)", [section on 'Cortical dysfunction'](#).)

Calculations — Presenting patients with simple mathematical problems is one way of assessing calculation abilities. Examples include asking them to add a series of coins or performing "serial sevens" (starting at 100 and sequentially subtracting 7; included on both the Mini-Mental State Examination [MMSE] [1] and the Montreal Cognitive Assessment [MoCA] [2]).

Acalculia is the inability to perform mathematical calculations, which can be associated with left angular gyrus lesions. However, performance on calculation is also significantly impacted by attentional deficits, anxiety, and educational level.

Acalculia also co-occurs with other cognitive deficits in neurodegenerative dementias.

Executive functioning — Executive functioning refers to a complex set of abilities, which include volition, planning, purposive action, and effective performance. These skills enable appropriate, goal-directed, socially responsible, and self-serving behavior and are supported by the prefrontal cortex and its connections with the caudate nuclei [11].

The clinical interview provides an overview of the patient's executive function, particularly if reported difficulties in the performance of everyday activities appear to greatly exceed deficits on other cognitive assessments. Impaired insight and judgment are early indicators of executive dysfunction; these can also be best assessed in the clinical history (eg, "What problems do you think you are having?"; "How would you handle a minor household emergency, such as a small plumbing leak?").

More objective evaluations of executive functions can be difficult without formal neuropsychological assessment. However, a number of executive tasks are often included in the extended mental status examination [29]:

- Working memory in its simplest form is the ability to temporarily hold information in mind and relies most heavily on attention and concentration. However, as tasks become more complex and require the manipulation of information that is attended to, they increasingly draw upon executive abilities. It is often tested with serial reversal tasks (eg, digit span backwards) or sequencing of mixed numbers and/or letters of the alphabet in ascending order.
- The ability to divide attention and change sets (ie, mental flexibility). Examples include the Trail-Making Test, part B ([figure 1](#)).
- Generative ideation through measures of verbal and design fluency [29]. Verbal fluency tasks are described above (see '[Language](#)' above). Letter fluency is more closely associated with executive function than category fluency.
- Design fluency is the visuospatial analogue for verbal fluency and draws more extensively on the nondominant frontal lobe. Patients are asked to generate as many novel designs (connecting dots within a matrix) as they can that conform to predefined rules within a specified time period. One of the more frequently used versions with available normative data is the Design Fluency test from the Delis-Kaplan Executive Function System (D-KEFS) [30], which uses a five-dot background matrix. Patients are asked to generate as many different patterns as they can in one minute that use exactly four lines to connect between dots in the matrix.
- Motor programming. Tests of motor programming include asking the patient to imitate simple rhythms (eg, clap, clap, tap, knock) or to copy a sequence of cursive m's and n's [7,8,29].

Another example is Luria's "fist-edge-palm" test, in which the patient is asked to tap that aspect of their hand to the desk in repeated sequences [29]. Impaired patients typically perseverate, getting "stuck-in-set" and continuing elements of previously instructed actions into the present task. Although the Luria hand-sequence test is frequently used to assess executive functioning in extended mental status examinations [16], performance can be affected by orthopedic or other etiologies that result in upper extremity weakness, and there are only limited normative data [6].

- Response inhibition. This can be tested by "go/no go" tests [8,29]. In one version, the examiner asks the patient to "tap when I tap once" and to "not tap when I tap twice."

Another such test that is used more frequently in formal neuropsychological assessments than bedside mental status examinations (due to the requirement for specific color stimuli) is the Stroop Color-Word Interference Test (figure 5) [8,31].

- Abstract reasoning. Abstraction is usually assessed by asking the patient to interpret similarities and differences (eg, between word pairs such as watch-ruler, child-midget), idioms (eg, warm-hearted), and proverbs (eg, "a rolling stone gathers no moss") [7,29]. However, given the association between educational attainment and performance on such tasks, results amongst patients with a high school education or less should be interpreted with caution [29].

Mood and thought content — Mood and emotional state have a strong impact on mental status and cognitive functioning. Patients and their friends and family should be questioned about mood and behavior. The patient's affect (ie, the outward expression of their mood) should be noted. Depression can present with cognitive impairment and is suggested by a withdrawn affect that can include poor eye contact, tearfulness, and/or emotional blunting. Apathy or amotivational states can be difficult to distinguish from depression. Mood and affect can be incongruent in the case of pseudobulbar palsy, where tearfulness/laughing is disproportionate or inappropriate to the underlying feeling, and in other conditions, such as traumatic brain injury or multiple sclerosis, where euphoria may mask clinical depression [8].

Thought content can be assessed through the patient's spontaneous speech during the clinical interview and examination. Any abnormal intrusions, preoccupations, perseverations, delusions, or hallucinations that emerge during the visit or are reported by the patient should be noted, as these can provide vital clues for the understanding of

the underlying etiology and localization of brain dysfunction. If the patient is poorly communicative, collateral information regarding such abnormal thoughts from friends and/or family members may be particularly valuable.

Mood and behavior can also be assessed in a more quantitative fashion, particularly in the setting of formal neuropsychological testing, through the use of symptom checklists or survey instruments. Amongst the most commonly used are the Beck Depression Inventory, the Geriatric Depression Scale, and the Neuropsychiatric Inventory [3,4].

Other domains — In the appropriate situation, an examiner may opt to test for right-left orientation and finger agnosia. Both are features of the Gerstmann syndrome, which also includes dysgraphia and acalculia and localizes to posterior left hemisphere dysfunction. Right-left orientation may be tested by asking the patient to point to or move body parts on the right or left side. Finger agnosia is tested by asking the patient to point to or manipulate named fingers.

COGNITIVE SCREENING TESTS

While initial assessments often incorporate both clinical interviews and mental status testing, subsequent briefer follow-up visits are more reliant on cognitive screening tests to screen for new onset or interval progression of cognitive decline and dementia. The most frequently used screening tests are introduced below.

- The Mini-Mental State Examination (MMSE) [1] is the most popular and well known of such screening tests [4]. Scores range from 0 to 30, with higher scores denoting better performance. It assesses multiple cognitive domains, particularly memory and language, which may be most relevant to dementia due to Alzheimer disease (AD). The MMSE can be performed in a relatively short time interval (5 to 10 minutes) and is most sensitive to patients at the mild to moderate stages of AD dementia.
- The Montreal Cognitive Assessment (MoCA) [2] is more sensitive to earlier stages of cognitive decline, including mild cognitive impairment. Relative to the MMSE, the MoCA surveys a broader range of cognitive function (with a greater emphasis on executive function) and has more difficult items. As such, it takes slightly longer to administer (approximately 15 minutes) and may be less useful in patients with more advanced disease.
- Clock drawing has also become popular as a screening tool for cognitive problems as a single task that covers multiple cognitive domains [25].

SUMMARY

A thorough mental status assessment is a critical tool for the diagnosis and management of central nervous system syndromes, particularly dementing disorders.

- It can be performed at the bedside or in an outpatient office and provides an initial assessment of cognition and mental status. The depth and breadth of such assessments can be adapted to the setting and level of concern. (See ['Hierarchy and scope of cognitive assessments'](#) above.)
- It can generally distinguish normal versus abnormal cognition and dementia from delirium or primary psychiatric disease. Evaluation of the severity of deficits and relative cognitive strengths requires extrapolated age- and education-based norms from standardized neuropsychological testing. Overall patterns of deficits on the mental status examination provide important insight into the underlying pathogenesis of a dementing process. The interval change in a patient's cognitive performance can be monitored over time through longitudinal assessments. (See ['Hierarchy and scope of cognitive assessments'](#) above.)
- A thorough mental status examination evaluates the following cognitive spheres:
 - Attention and concentration
 - Memory
 - Language
 - Visuospatial perception
 - Praxis
 - Calculations
 - Executive functioning
 - Mood and thought content

Mental status testing is hierarchical. For example, difficulties with arousal affect attention, which in turn influences performance on language and memory testing. Furthermore, performance on many tests draws upon abilities in multiple cognitive domains. Therefore, individual test scores should not be interpreted in isolation but in conjunction with other assessments of the same underlying cognitive ability. (See ['Mental status examination'](#) above.)

- An initial assessment of mental status can be obtained through the clinical interview.
-

For patient settings in which an extended mental status examination is not performed, brief cognitive assessments can be used to screen for cognitive decline and dementia.

- Neuropsychological testing can complement the mental status examination by providing a more precise measure of a patient's cognitive strengths and weaknesses and assisting in differential diagnosis. (See ["Mental status scales to evaluate cognition"](#) and ["Evaluation of cognitive impairment and dementia", section on 'Neuropsychological testing'](#).)

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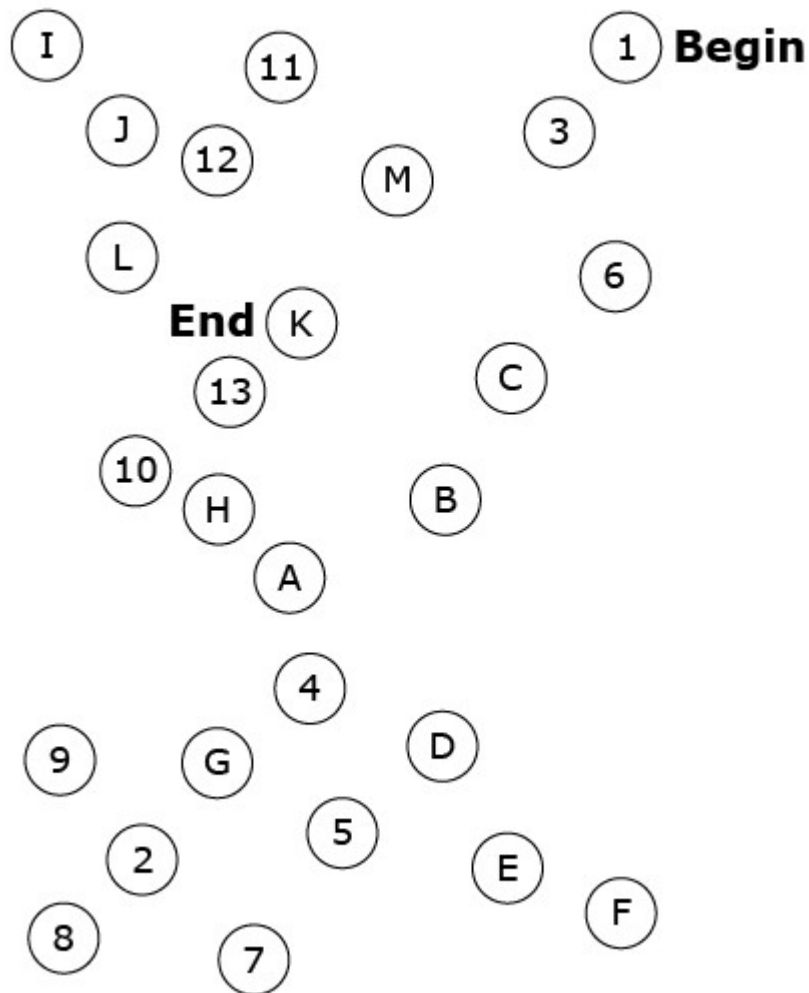
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Topic 14067 Version 7.0

GRAPHICS

Trails test (B version)



Trail-making tests assess visual attention.

In the "A version" of the test, the subject connects 25 consecutive targets, each numbered (1, 2, 3, etc).

In the "B version" of the test, shown here, the subject alternates between numbers and letters (1, A, 2, B, 3, C, etc).

The test is scored in speed and accuracy.

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Graphic 66230 Version 9.0

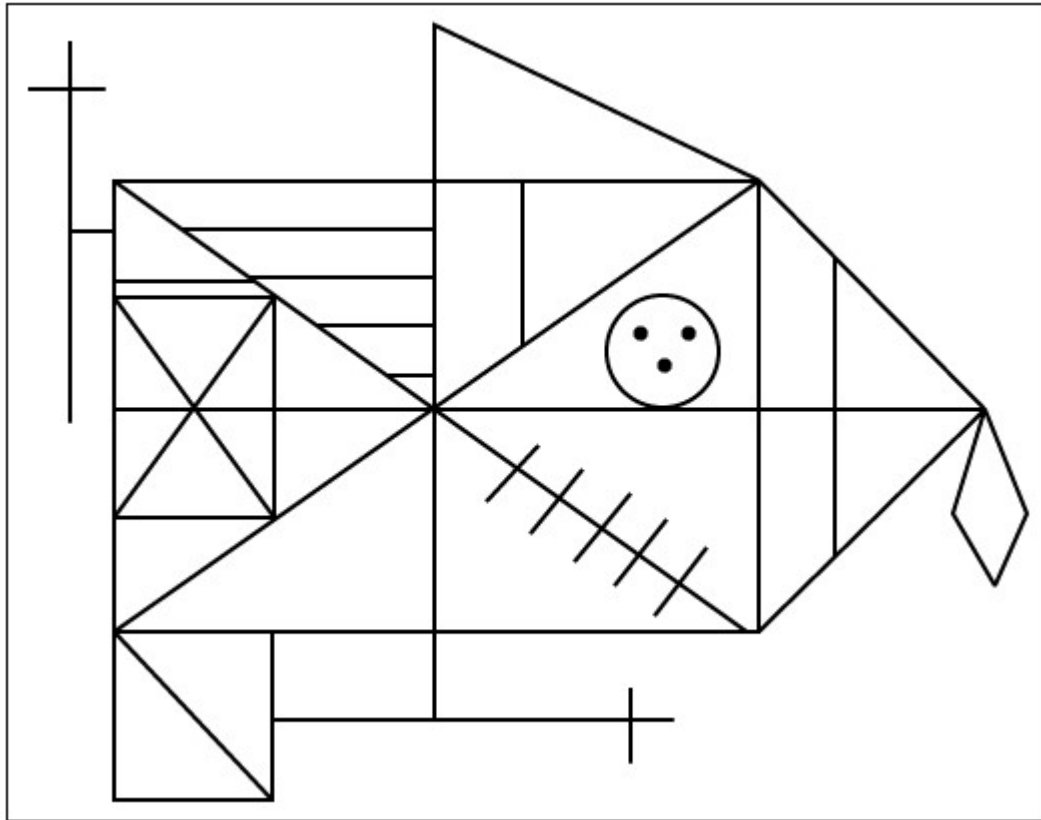
Digit symbol test

1	2	3	4	5	6	7	8	9
△	=	○	×	□	⌌	⊥	+	∣

3	6	1	9	5	4	8	3	9	7	2	5	6	3	4	1	9
○	⌌	△	∣													

In digit symbol tests, subjects are provided nine digit symbol pairs (top) and are then asked to write the correct symbol for a series of digits (below). The test is scored based on speed and accuracy.

Graphic 74553 Version 1.0

Rey-Osterrieth complex figure

Subjects are asked to draw this diagram, first as a copy, then from memory.

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Graphic 53426 Version 8.0

Aphasia syndromes

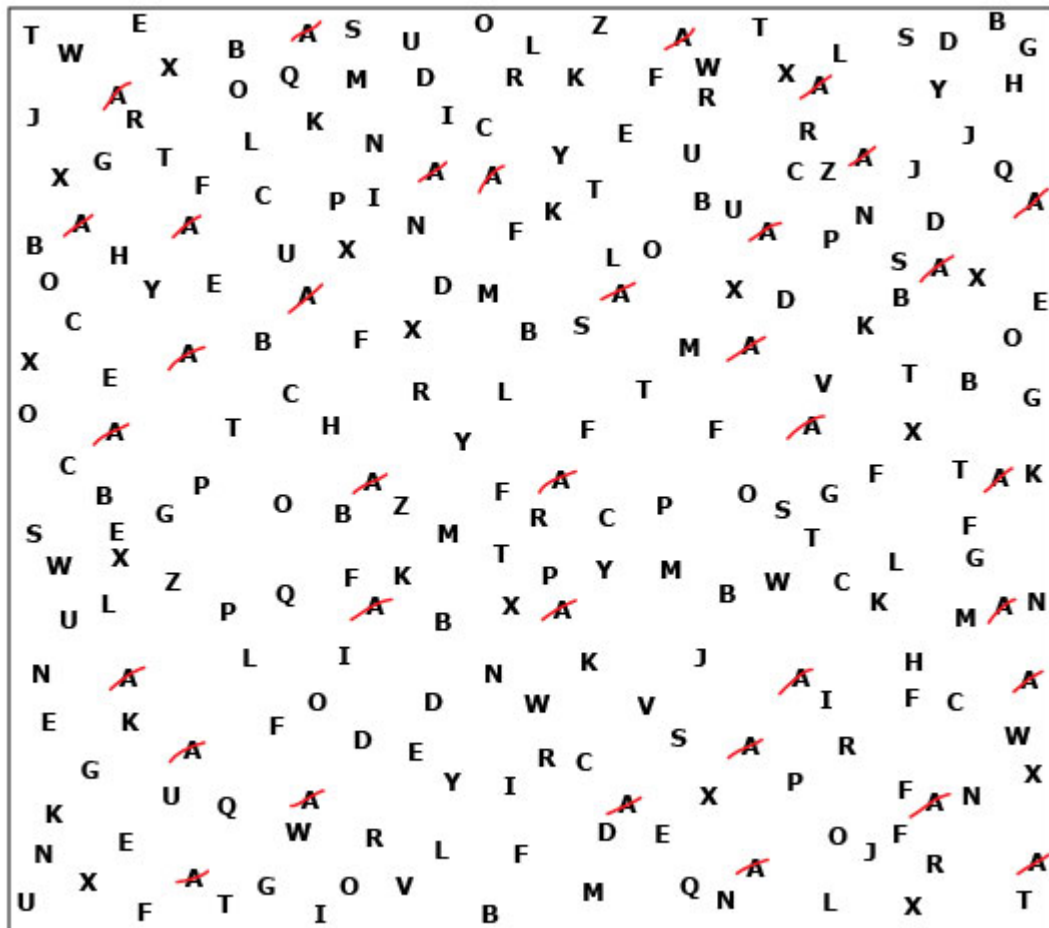
Syndrome	Flu	Rep	Comp	Read	Write	Localization
Broca	-	-	+	+	-	"Broca" area: left inferior frontal, often anterior MCA branch occlusion
Wernicke	+	-	-	-	-	"Wernicke" area: left superior temporal and inferior parietal region, often posterior MCA branch occlusion
Anomic	+	+	+	±	±	Temporal, parietal, and occipital regions of cortex outside of classical language areas
Conduction	+	-	+	+	±	Superior temporal gyrus, inferior parietal region adjacent to temporal lobe; classically in arcuate fasciculus
Transcortical motor	-	+	+	+	-	Left mesial frontal, especially supplementary motor area; anterior cerebral artery occlusion
Transcortical sensory	+	+	-	-	-	Left posterior watershed zone between MCA and PCA territories
Transcortical mixed	-	+	-	-	-	Anterior and posterior watershed zones, effectively disconnecting perisylvian cortex from other cortical regions
Global	-	-	-	-	-	Large MCA or left carotid inclusions infarcting a vast region of the left hemisphere
Pure word deafness	+	+	-	+	+	Left or bilateral superior temporal gyrus lesions
Pure alexia	+	+	+	-	+	Left occipital lobe with involvement of splenium of corpus callosum
Aphemia	-	+	+	+	+	Motor cortex outflow to articulators
Pure agraphia	+	+	+	+	-	Left inferior frontal region

Flu: fluency; Rep: repetition; Comp: comprehension; Read: reading; Write: writing; +: relatively spared; -: impaired; MCA: middle cerebral artery; PCA: posterior cerebral artery.

Data from: Mendez MF, Clark DG. Neuropsychiatric aspects of aphasia and related disorders. In: The American Psychiatric Publishing Textbook of Neuropsychiatry and Behavioral Neurosciences, 5th ed, Yudofsky SC, Hales RH (Eds), American Psychiatric Publishing, Washington, DC 2007. p.522.

Graphic 72780 Version 2.0

Letter cancellation test

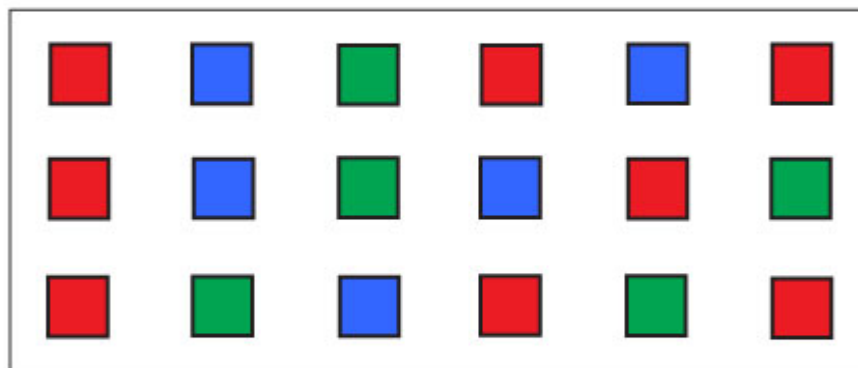


The letter cancellation test is used to evaluate the presence, pattern, and severity of visual scanning deficits. In this example, the patient correctly crossed out all instances of the letter A.

Graphic 63183 Version 2.0

Stroop test

RED	BLUE	GREEN	RED	BLUE	RED
RED	BLUE	GREEN	BLUE	RED	GREEN
RED	GREEN	BLUE	RED	GREEN	RED



RED	BLUE	GREEN	RED	BLUE	RED
RED	BLUE	GREEN	BLUE	RED	GREEN
RED	GREEN	BLUE	RED	GREEN	RED

The Stroop Color-Word Interference Test examines the ability to direct attention. After first confirming that the subject can appropriately read the color names and name the colors (top two panels), he/she is asked to name the color of the ink that the word is printed in (third panel). As an example, the patient should say for the first row of the third panel "Blue, Green, Blue, Blue, Red, Green." The test is scored based on speed and accuracy.

Graphic 72016 Version 2.0

Contributor Disclosures

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