

Sensitive Tests For Early Detection Of Mild Cognitive Impairment:

Telemedicine DigiDiaDem And In-person ALBA And PICNIR

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1 BACKGROUND

- Sensitive, simple cognitive tests can efficiently detect early memory and language impairments in older adults.
- We developed brief cognitive assessment tools for remote (telemedicine-based) and in-person (clinician-administered) cognitive evaluation.

2 METHODS

1) **Digital Diagnostics of Dementia (DigiDiaDem)** is a telemedicine-based self-assessment delivered through an automated voice dialogue comprising eight memory and language tasks (Fig. 1).

2) **The Amnesia Light and Brief Assessment (ALBA, 3 minutes)** and 3) **the door Picture Naming and Immediate Recall (door PICNIR, 4 minutes)** are brief yet cognitively demanding clinician-administered tests, freely available at www.abadecco.cz.

The ALBA includes a sentence repetition and a gesture demonstration with subsequent recall of both, summarized as the Memory ALBA Score (MAS) (Fig. 2 AB).

The door PICNIR is assessed using the number of naming errors (NE) and correctly recalled picture names (PICR) (Fig. 3).

ALPIR is a composite score combining three component scores from ALBA and PICNIR.

All three tests were administered to 188 individuals: 57 patients with mild cognitive impairment (MCI) and sociodemographically matched 131 cognitively normal participants (CN) with normal total scores on the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) (Fig. 1, Table).

Discriminative performance was evaluated using the area under the Receiver Operating Characteristic curve (AUC) (Fig. 1, Table), and convergent validity was examined by correlations with RBANS total scores.

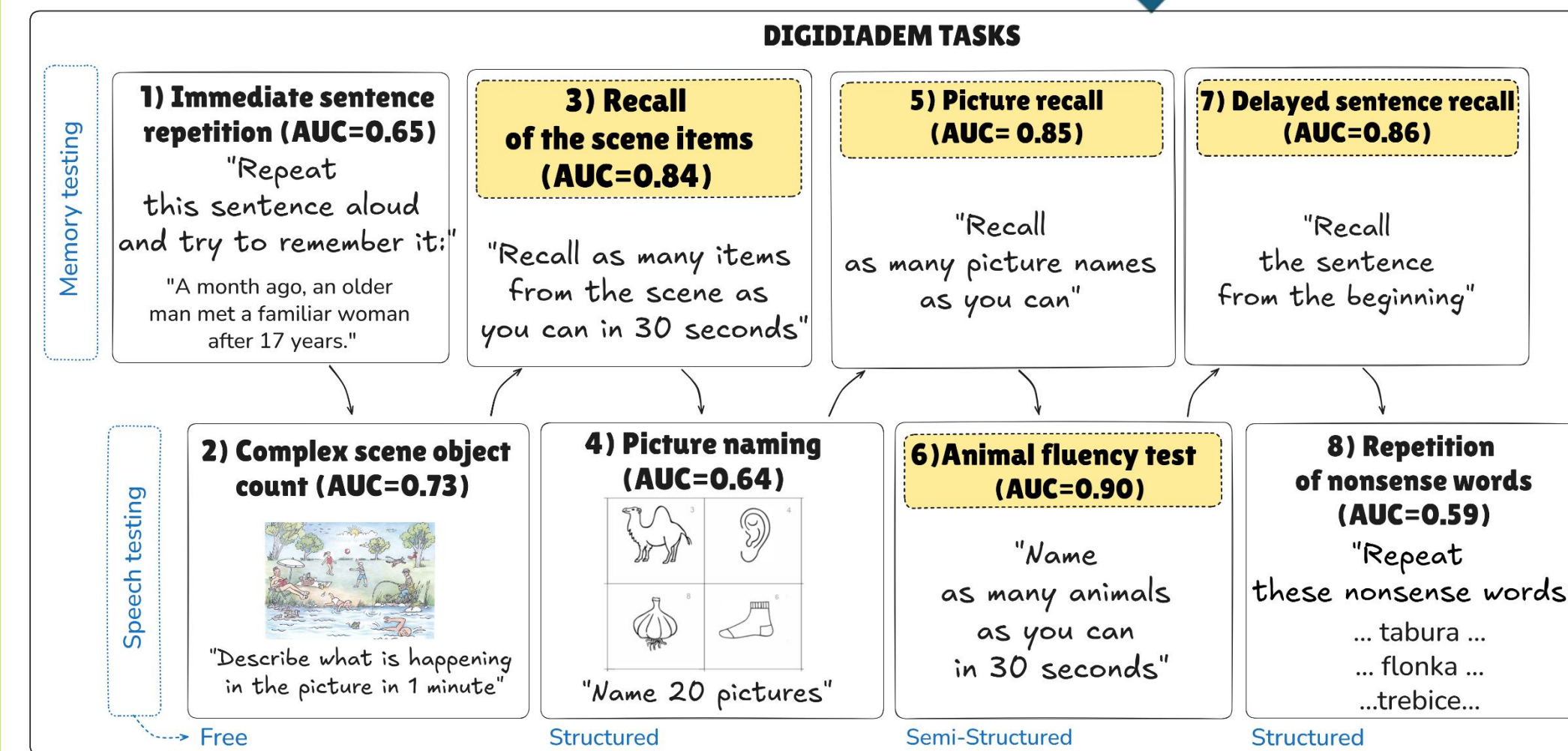
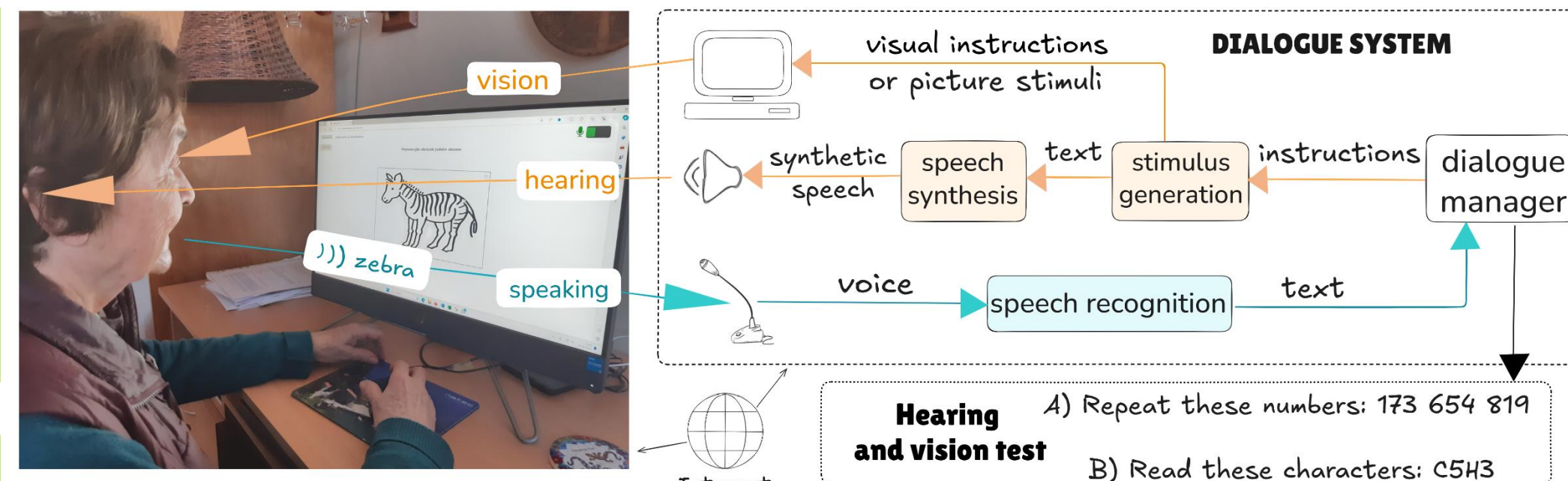
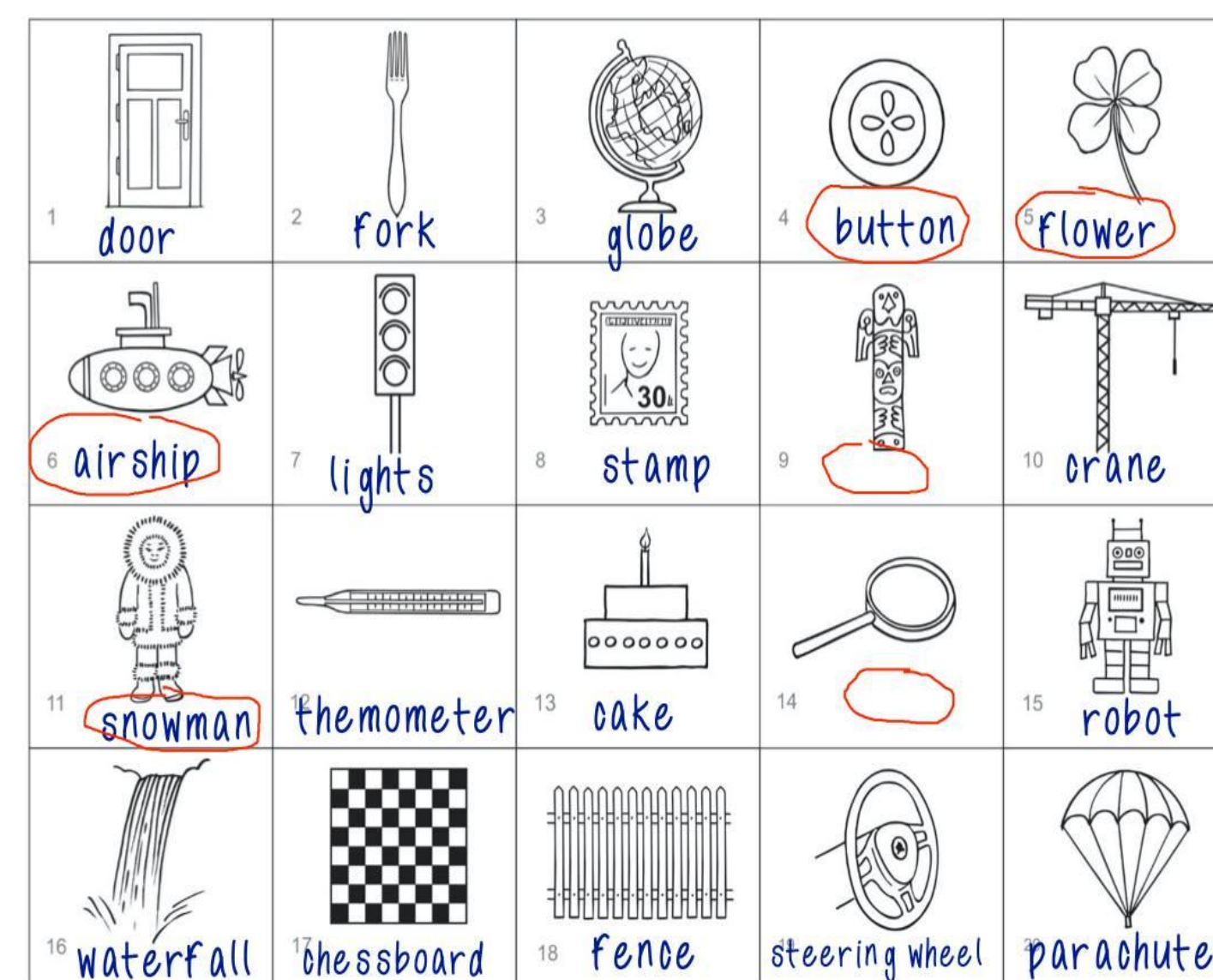


Fig. 1. DigiDiaDem: a voice-based system for self-administered cognitive assessment. The automated dialogue system delivers visual and auditory stimuli and records spoken responses to administer cognitive tasks targeting memory, language, and semantic fluency. The figure also summarizes the eight DigiDiaDem tasks and their diagnostic performance (AUC values) for detection of mild cognitive impairment

Fig. 3 A filled-in form of the PICNIR test



PICTURE NAMES RECALLED	
1. flower	
2. door	
3. dummy	confabulation
4. lights	
5. fork	
6. door	repetition

Correctly recalled picture names (PICR): 6 - 1 confabulation - 1 repetition = 4 correctly recalled picture names

Table Participant characteristics, test results and their comparisons of socio-demographically matched groups

3 PARTICIPANTS	Patients with mild cognitive impairment	Cognitively normal elderly	p	AUC
Number of participants	57	131		
Age	73 ± 9	73 ± 7	n.s.	–
Education (years of schooling)	14 ± 4	15 ± 2	n.s.	–
RBANS (40-160 points)	83 ± 6	110 ± 11	n.a.	n.a.
DigiDiaDem (0-124 points)	28 ± 9	48 ± 9	<0.001	0.95
ALBA- MAS (0-12 points)	7 ± 2	9 ± 2	<0.001	0.78
PICNIR-NE (0-10 points)	2 ± 3	1 ± 1	<0.001	0.72
PICNIR-PICR (0-15 points)	5 ± 2	9 ± 2	<0.001	0.86
ALPIR (-10 – 25 points)	10 ± 5	17 ± 4	<0.001	0.89

AUC - area under the receiver operating characteristic curve (ROC), RBANS – the Repeatable Battery for the Assessment of Neuropsychological Status, ALBA-MAS – memory Amnesia Light and Brief Assessment score, PICNIR - the door PICTURE Naming and Immediate Recall: NE – naming errors, PICR – picture name recall, DigiDiaDem – Digital Diagnostics of Dementia, n.a. – not applicable, n.s. – not significant

4 RESULTS

- From 31 candidate variables, the optimal feature set for DigiDiaDem included animal fluency, picture recall, and sentence recall scores. These variables were summed to create a single composite score.
- All tests successfully differentiated CN individuals from MCI patients, demonstrating satisfactory accuracy (AUCs of 0.95 for DigiDiaDem, 0.89 for ALPIR, 0.86 for PICR, 0.78 for MAS, and 0.72 for NE) (Fig. 1, Table).
- RBANS total scores correlated significantly with all DigiDiaDem, ALBA, and PICNIR measures ($r = 0.50-0.81$) across all participants.

5 CONCLUSIONS

- ❖ DigiDiaDem (telemedicine-based) and the brief clinician-administered ALBA and door PICNIR are sensitive and efficient tests with high discriminative potential and convergent validity for detecting mild cognitive impairment.
- ❖ They are suitable for large-scale screening and routine use in busy clinical practice.
- ❖ Moreover, DigiDiaDem can be fully automated, eliminating the need for direct human administration.
- ❖ Together, these tools provide an efficient and user-friendly approach for the early detection of mild cognitive impairment across diverse clinical and remote settings.

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Fig. 2 A Procedure for administering the Amnesia Light and Brief Assessment (ALBA) test and the demonstration of the 6 gestures symbolic of the 5 human senses

Fig. 2 B A filled-in form of the ALBA test with detailed instructions and scoring

Ultra-brief AMNESIA LIGHT AND BRIEF ASSESSMENT (ALBA)

Name and surname: _____ Year of birth: _____ Date: _____

Focus on the patient's behavior and verbal comments during testing.

A brief hearing examination before cognitive testing may be useful. If necessary, ask a person to repeat the numbers 941-726-583 after you. Good hearing? yes/no

1A. SENTENCE TEST – REPETITION AND ENCODING

Administration: Say the sentence smoothly with a distinct separation of words. Then the tested person will repeat it after you. If asked, do not repeat any words; simply ask them to repeat what they can. Record words and score correct words as 1 point in the Repetition line of Table 1 (row 2).

INSTRUCTION: "Now I am going to say one short sentence, but only once. Please repeat it loud and try to remember it. I will ask you to recall it in a moment. Now listen carefully and repeat this sentence after me exactly as I say it..." (short pause). "And now you."

Table 1

Sentence:	Indian	summer	brings	first	morning	frost	Number of correct words
REpetition (0 or 1)	Indian	summer	brings		spring	first	4 / 6 POINTS
RECALL (0 or 1) without time limit	1	1	0	0	0	0	2 / 6

The repetition and recall are not time-limited. Optionally, an incorrectly recalled sentence can be recorded below:

Scoring: The sentence must be recalled using the exact words in the exact order. Score 1 point for each correct word. The maximum score for 6 correct words is 6 points.

2. TEST OF GESTURES (TEGEST)

INSTRUCTION: "Now, I would like you to show me some gestures. I will give you six instructions related to your hands or head – a kind of pantomime. "Show me how you would..."

Table 2

Gestures:	eat with a spoon	stroke your cheek	make a telephone call	put on your glasses	smell a flower	look through a pair of binoculars	Number of correct gestures
DEMONSTRATION (N or X)	✓	✓	✗	✓	✓	✓	5 / 6 POINTS

There are a total of six gestures. Now perform and give me a verbatim description of all 6 gestures without regard to order.

RECALL (0 or 1) without time limit

1. eat with a spoon	2. stroke your cheek	3. make a telephone call	4. put on your glasses	5. smell a flower	6. look through a pair of binoculars	other gestures name	total
0	0	3	0	0	1		3 / 6

The recall is not time-limited. Additionally, you can write down the position number of the recalled gesture, even though gestures can be recalled in any order.

Scoring: Score 1 point for each correctly recalled gesture. The correctly recalled gesture is scored 1 point if the gesture is EITHER correctly demonstrated OR correctly described or BOTH. The maximum number of points for 6 correctly recalled gestures is 6 points.

1B. SENTENCE TEST – RECALL

INSTRUCTION: "Now please tell me what was the sentence that I told you to remember a while ago."

Administration: Sentence recall is not time-limited.

Record the results in the Recall line of Table 1 (row 3).

TOTAL ALBA SCORE 5 / 12

Abadecco Prof. Ales Bartos, MD, PhD ©, test form of the ALBA test, 2022 free for clinical, educational and research use, licensed for commercial use

Memory ALBA score - MAS is equal to correctly recalled sentence words plus correctly recalled gestures, i.e., 2+3= 5 in this example

